

# Cardiovascular and Diabetes & Endocrine Health Networks

## Model of Care for the High Risk Foot

'If crocodiles had taken 34 legs and 14 lives in 3 years and had cost the taxpayer \$3.5 Million dollars, every person in Australia would know about it, and there would be an outcry for action'

O'Rourke I, Heard S, Treacy J et al. ANZ Journal of Surgery 2002; 72 (4): 286



Government of **Western Australia**  
Department of **Health**



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## Executive Summary

For the purposes of this Model of Care, a high risk foot is a foot with progressive deformity, ulceration, infection and/or amputation and is most commonly associated with diabetes.

The Diabetes and the Amputee Services and Rehabilitation Models of Care identified the need to develop the High Risk Foot Model of Care given the probable increase in the incidence of the high risk foot secondary to the increased prevalence of diabetes, obesity and in the context of an ageing population.<sup>1-2</sup> The data presented in the High Risk Foot Model of Care show an increase in the incidence of lower limb amputation (a marker of severe high risk foot) in Western Australian patients with diabetes. The amputation rate is particularly high in Aboriginal people. High risk foot complications such as ulceration, infection and amputation are responsible for significant direct and indirect health care costs in both the inpatient and outpatient setting.

The recommendations from the Diabetes and the Amputee Services and Rehabilitation Models of Care (Appendix 1) have been taken into account. Particular attention has been paid to those that highlight the need for foot education programs to prevent foot complications and lower limb amputation, the need for improvements in co-ordination, capacity, complication screening and effectiveness of general and specialist podiatry services and the provision of outreach high risk foot services to regional centres.

There is evidence that an efficient high risk foot service would improve patient outcomes in a cost-effective manner but currently there are significant barriers to achieving this goal. These are identified as: an emphasis on reactive rather than preventative services across the state; a lack of service coordination across the metropolitan area; geographic and workforce inequalities; unclear referral mechanisms with multiple barriers to access; a lack of awareness of the need for foot screening by non specialist clinicians; and a lack of culturally appropriate and easily accessible high risk foot services for Aboriginal patients in both the metro and rural areas.

The main objectives of this Model of Care are to prevent and/or delay complications of the high risk foot at all stages, especially amputations and to deliver equitable and cost-effective high risk foot services particularly to rural and remote Aboriginal communities.

The key recommendations of the Model are to:

1. Raise awareness of the high risk foot.
2. Prevent complications of the high risk foot through early detection.
3. Establish evidence-based guidelines and protocols to manage the high risk foot.
4. Address access inequities to services (due to geographic and resource allocation disparities) for the high risk foot.
5. Improve care co-ordination and strengthen the multi-disciplinary approach to management of the high risk foot.
6. Improve access to health services for Aboriginal patients with a high risk foot.
7. Conduct research and address ongoing professional development and training in management of the high risk foot.
8. Address workforce capacity and capability issues.

The recommendations are intended to improve patients' outcomes, provide more coordinated and efficient care and to reduce health care costs in the long term.



## Methodology

The Working Group to develop the Model of Care for the High Risk Foot was established in early 2008, as a joint collaboration between the Cardiovascular Health Network and the Diabetes and Endocrine Health Network. Health professionals from a variety of specialties including podiatry, nursing, endocrinology, vascular surgery and orthopaedic surgery were invited to participate and contribute to the Model.

The aim of the project was to develop a state wide service model for the prevention, assessment and management of the high risk foot across the continuum of care. This included examining pertinent literature, current service provision and barriers to service delivery and proposing an optimal multi-disciplinary management model for the high risk foot in WA.

The High Risk Foot Model of Care is informed by and builds on the recommendations of the following models of care:

- Diabetes Model of Care<sup>3</sup>
- Amputee Services and Rehabilitation Model of Care<sup>4</sup>

The High Risk Foot Model of Care is informed by and builds on the following national and international evidence based and best practice guidelines for the assessment and management of the high risk foot.

- Evidence based guidelines for the inpatient management of acute diabetes related foot complications, 2004. Department of Clinical Epidemiology and Health Service Evaluation, Melbourne<sup>5</sup>.
- National Institute for Clinical Excellence. Type 2 diabetes: prevention and management of foot problems. Clinical guideline, 2004.<sup>6</sup>
- National evidence based guidelines for the management of Type 2 diabetes mellitus: Detection and prevention of foot problems in Type 2 diabetes, Australian Centre for Diabetes Strategies, Prince of Wales Hospital.<sup>7</sup>
- Diabetic Foot Disorders: A clinical practice guideline (2006).<sup>8</sup>
- International Consensus on the Diabetic Foot, 2007, International Working Group of the Diabetic Foot.<sup>9</sup>

The draft model of care was distributed to relevant WA Health Networks Clinical Leads, clinical staff, health service providers, consumers, stakeholder groups and the Statewide Aboriginal Health Forum. The Diabetes and Endocrine and Cardiovascular Health Networks Executive Advisory Groups endorse the Model of Care for High Risk Foot.





## 1. Definitions and risk factors

### 1.1 Definition of the high risk foot

For the purposes of this model the High Risk Foot is defined as a foot with progressive deformity, ulceration, infection and/or amputation as a result of a patient's underlying medical condition. Consideration is given to those "at risk" of complications, so the full spectrum of high risk foot management can be analysed. In Australia and internationally the high risk foot is generally associated with diabetes. Other less common underlying diagnoses include neurological disorders, vascular disease, inflammatory conditions (e.g. Rheumatoid arthritis) and renal disease. While this model of care will focus on the diabetic high risk foot, it is also relevant to patients with high risk foot secondary to other systemic conditions.

### 1.2 Key risk factors

Diabetes is the key risk factor for the high risk foot. The causes of foot ulceration – the leading precursor to infection and amputation in the high risk foot – are multifactoral.<sup>10-</sup>

<sup>12</sup> Particularly in those with diabetes, the three primary predisposing risk factors are:

- Peripheral neuropathy
- Peripheral arterial disease
- Structural foot deformity

#### 1.2.1 Peripheral neuropathy

Diabetes is the most common cause of peripheral neuropathy but alcoholism, renal failure, autoimmune disease, nutritional deficiencies, nerve injuries and adverse drug reactions account for a small proportion of cases. The most common type is distal symmetrical polyneuropathy ('glove and stocking' neuropathy), which has three manifestations.<sup>12</sup>

- Sensory peripheral neuropathy resulting in numbness and loss of protective sensation
- Motor peripheral neuropathy resulting in foot deformity, gait changes and abnormal pressure zones.
- Autonomic peripheral neuropathy resulting in foot oedema and dry skin prone to break down.

Sensory neuropathy is the most common form but may also co-exist with motor and/or autonomic neuropathy. Peripheral neuropathy is implicated in the development of a foot ulcer where chronic trauma (e.g. ill fitting footwear) or acute injury goes unrecognised in the insensate foot leading to skin breakdown. The resultant wound is prone to soft tissue sepsis, secondary osteomyelitis, and ultimately amputation.<sup>1</sup>



### 1.2.2 Peripheral arterial disease

Peripheral arterial disease (PAD) is usually due to atherosclerosis and is a known complication of diabetes. It results in tissue ischemia and impaired wound healing. Peripheral arterial disease is a causal factor in approximately one-third of all diabetic foot ulcers and an established risk factor for recurrent wounds. The presence of peripheral arterial disease is a crucial indicator in foot ulcer outcomes, with its presence linked with a significantly increased risk of amputation.<sup>1</sup> Smoking further increases the risk of PAD.

### 1.2.3 Structural foot deformity

Structural foot deformity of the bones and/or joints (e.g. hammer and claw toes, hallux valgus, prominent metatarsal heads) as well as limited joint mobility, can lead to increased or abnormal mechanical pressures on the foot leading to chronic skin trauma and breakdown. On its own, foot deformity is not usually considered predictive of ulceration. It becomes significant, however, in the presence of peripheral neuropathy and/or peripheral arterial disease and/or inflammatory arthritis.

### 1.2.4 Other risk factors

Other factors may increase the likelihood of complications in patients with a high risk foot. Impaired vision (most commonly diabetic retinopathy) results in an individual's inability to inspect their feet, perform basic wound care and identify hazards in the external environment. Poor glycaemic control, renal failure and a current or past foot ulcer (or amputations) lead to significant risk of future ulceration.<sup>13</sup>

**Table 1** Risk factors for future ulceration in the high risk foot.<sup>14</sup>

	Relative risk (RR)	Confidence interval 95%
Current foot ulcer	5.32	3.71 – 7.64
Past history of foot ulcer or amputation	3.05	2.16 – 4.31
Peripheral Neuropathy	2.32	1.61 – 3.35
Peripheral Arterial Disease	1.80	1.40 – 2.32
Structural foot deformity	1.57	1.22 – 2.02

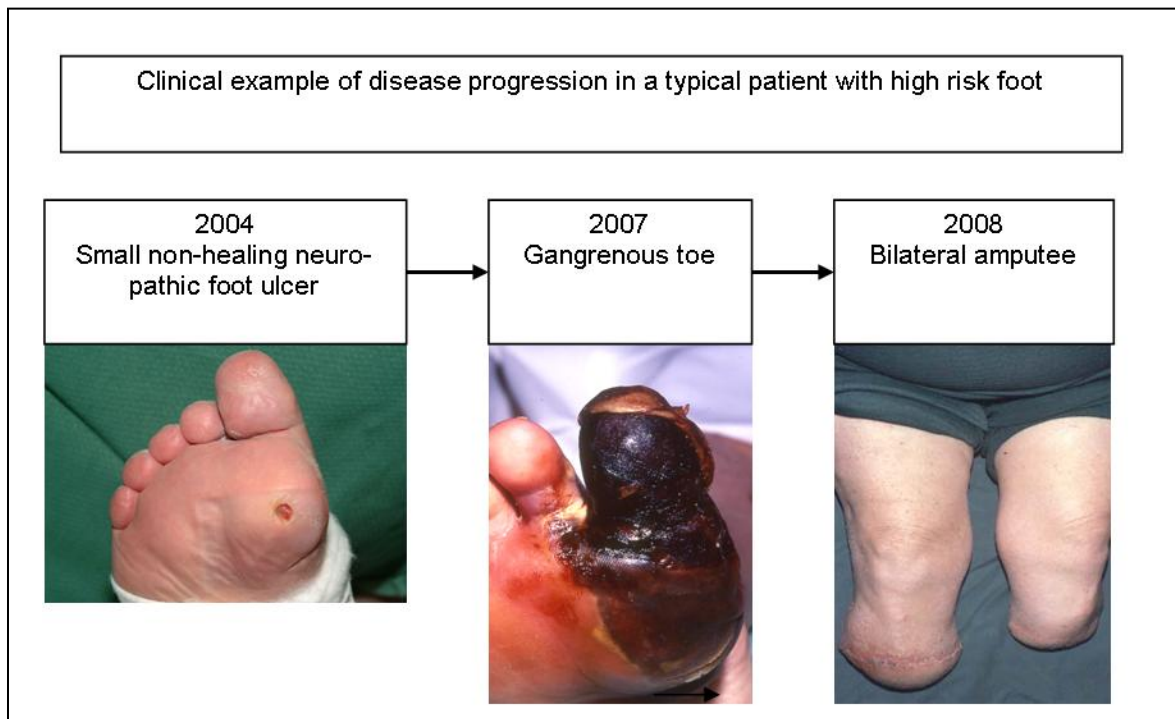


### 1.3 Causal Pathway to ulceration and amputation in the high risk foot

The causal pathway to foot ulceration and its potential progression towards amputation are multifactorial.<sup>13, 15</sup> An example of the natural history of diabetic high risk foot is shown in Figure 1. The typical pathway to amputation is shown in Figure 2.

This common scenario occurs when a foot ulcer arises as a result of trauma in a person with diabetes with peripheral neuropathy, with or without peripheral arterial disease and structural deformity. The trauma may be an acute event (stepping on a penetrating object, insect bite, thermal injury) or chronic in nature (localised pressure, friction). The absence of the pain sensation allows the injury to be neglected. This contributes to wound progression. Foot ulcers in patients with diabetes have a 50% chance of developing a soft tissue infection, and 20% of these will progress to osteomyelitis (bone infection). The development of foot osteomyelitis significantly increases the risk of lower extremity amputation.<sup>10</sup>

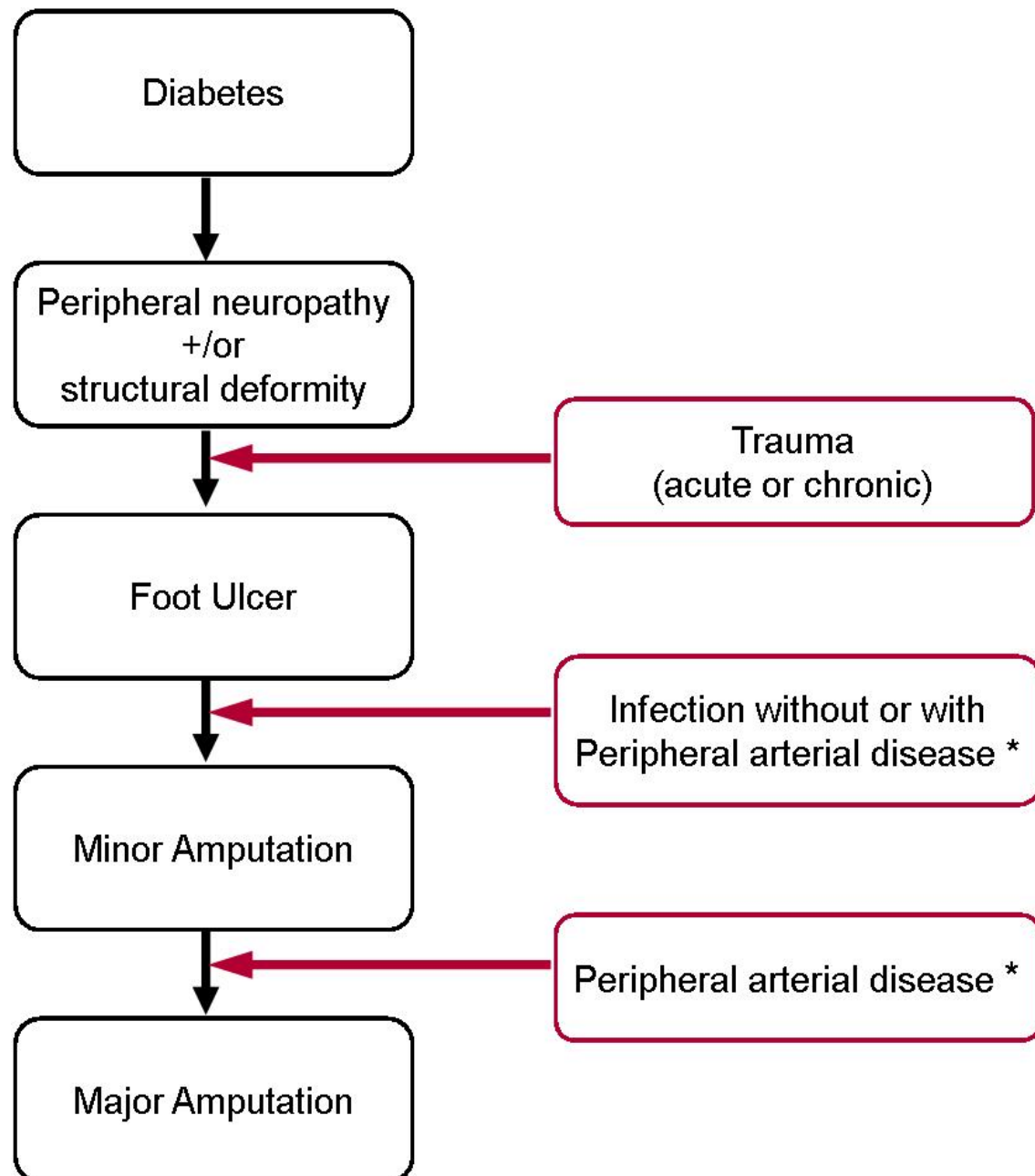
**Figure 1 Clinical example of disease progression in a typical patient with a high risk foot.**





In studies of causal pathways leading to lower extremity amputations in patients with diabetes, foot ulcers preceded 84% of the amputations.<sup>16</sup> Following the development of an ulcer, the added association with infection and ischaemia due to peripheral arterial disease, completed the causal pathway for limb amputation in 73% of cases.<sup>15, 17</sup>

**Figure 2 Factors involved in a causal pathway for amputation in a person with diabetes with a high risk foot.**



\* Alternative entry point for patients without diabetes

Figure 2 was developed by the working group, based on the available best evidence.



## 2. The high risk foot: contribution to the burden of disease

### 2.1 Global Data

“Every 30 seconds a lower limb is lost somewhere in the world as a consequence of diabetes”<sup>16</sup>

The incidence of foot ulceration in the diabetic population is estimated to be in the region of 2% per annum, while approximately 15% of all patients with diabetes will develop an ulcer during their lifetime.<sup>18</sup> This is significant given the exponential increase in the incidence of diabetes in recent decades. There are an estimated 246 million people with diabetes internationally. This figure is predicted to increase to 380 million by the year 2025.<sup>19</sup>

Diabetic foot disorders are the leading cause of non-traumatic lower extremity amputation. It is estimated that patients with diabetes have 10-40 fold higher prevalence of amputation than people without the disease.<sup>20</sup> 70-85% of these amputations are precipitated by a foot ulcer.<sup>15, 21-24</sup> Lower limb amputation is associated with significant morbidity and mortality, as approximately 50% experience foot ulceration or amputation of the contralateral limb within 2 to 5 years. A 5-year survival rate is estimated in those having an amputation aged between 50 and 80 years.<sup>20</sup>

Diabetic foot disorders account for substantial direct and indirect costs to both the patient and health care system. A 2004 study in the United States estimated the inpatient and outpatient costs per foot ulcer episode as between US\$1, 892 to \$27, 721, depending on the severity of the wound.

Numerous studies have calculated the direct costs of diabetic foot ulcers dependent on outcome, with primary healing leading to the lowest associated costs (between US\$1, 929 to \$6, 664) and amputation the highest (between US\$15, 792 to \$44, 790).<sup>25-28</sup>

### 2.2 Australian Data

A national study showed an average of 2,673 amputations per year as a result of diabetes in the mid 1990's.<sup>29</sup> The Australian Institute of Health & Welfare<sup>22</sup> estimated that this had increased to 3,400 lower limb amputations in the 2004/2005 period. Their data suggest the average length stay (LOS) for lower limb ulcerations was 12-13 days, while an amputation increased the LOS to 26 days.

The Fremantle Diabetes Study carried out in WA in 2006 found a diabetes-related incidence of lower extremity amputation of 3.8 per 1,000 patient years.<sup>30</sup>

#### 2.2.1 Western Australian Data: trends in hospital separations (1999-2008)

Due to the lack of data from primary care sources, the trends in amputations in patients with diabetes have been used as a marker of recent disease burden.<sup>31</sup> All amputations due to peripheral arterial disease and/or complications of diabetes (the diagnoses of interest) were identified. The data were extracted and analysed by the Department of Health's Epidemiology Branch (see Appendix 6 for further detail of the methods used). These trends have been compared with trends in patients without diabetes in order to estimate the contribution of diabetes rather than peripheral arterial disease.

#### Relationship between diabetes and amputation rates

There were 3,455 amputations performed in Western Australia in the financial years 1999-2008 on those individuals coded with the diagnoses of interest (Appendix 5, Table 1). Of these 71.5% (2,470) of cases had diabetes and 28.5% (985) did not.

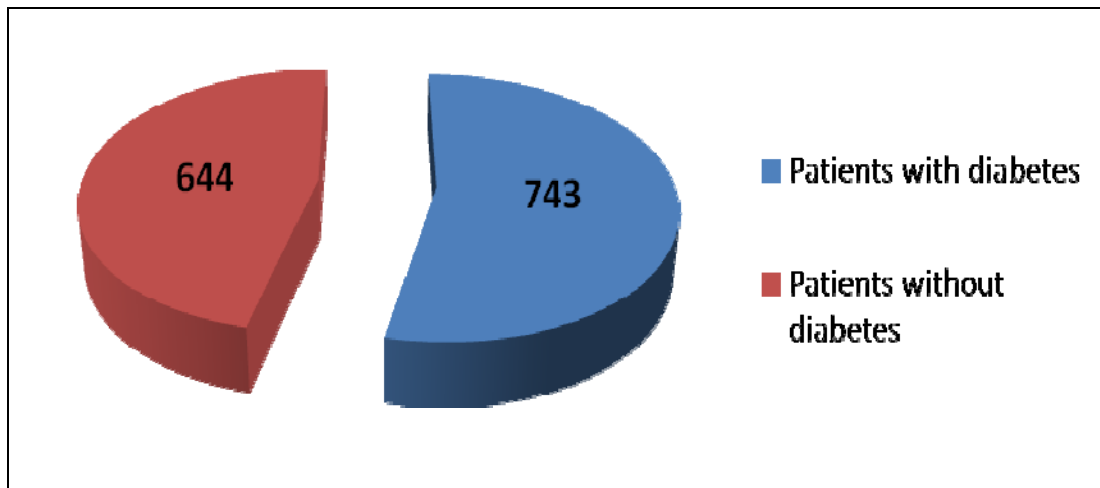


Of the 3,455 patients undergoing amputation:

- 80% had vascular disease as either a principal or extra diagnosis
- 60% had a minor (toe/foot) amputation and 40% of the cases had a major (above, at, or below knee) amputation (3:2 ratio).

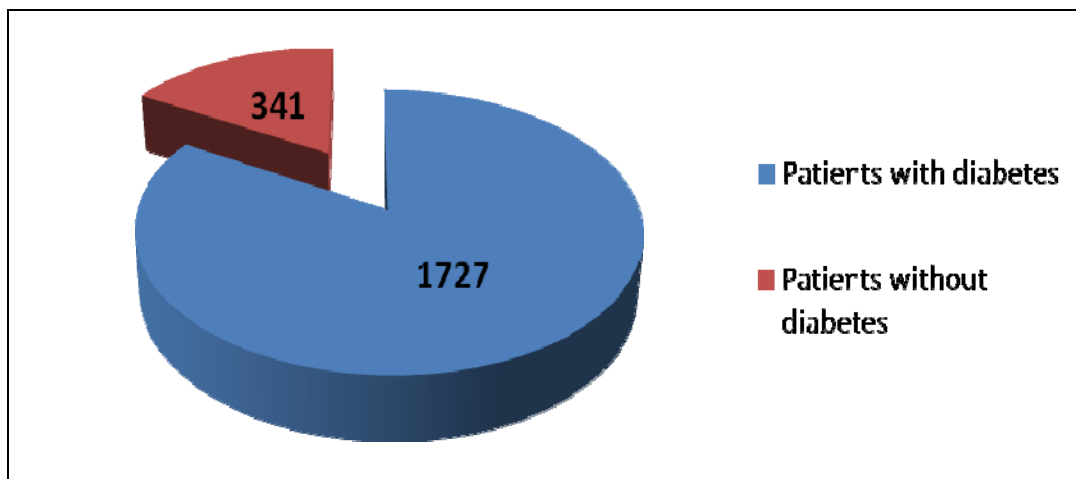
Major amputations were more common in persons with diabetes compared to those without diabetes (743 vs. 644) (Figure 3).

**Figure 3** Number of major amputations (above, at or below knee), Western Australia, 1999-2008.<sup>32</sup>



Minor amputations were 5 times more common in persons with diabetes compared to those without diabetes (1,727 vs. 341) (Figure 4). The ratio of minor to major amputations in persons with diabetes was approximately 2.3:1.

**Figure 4** Number of minor amputations (toe or foot), Western Australia, 1999-2008.<sup>32</sup>

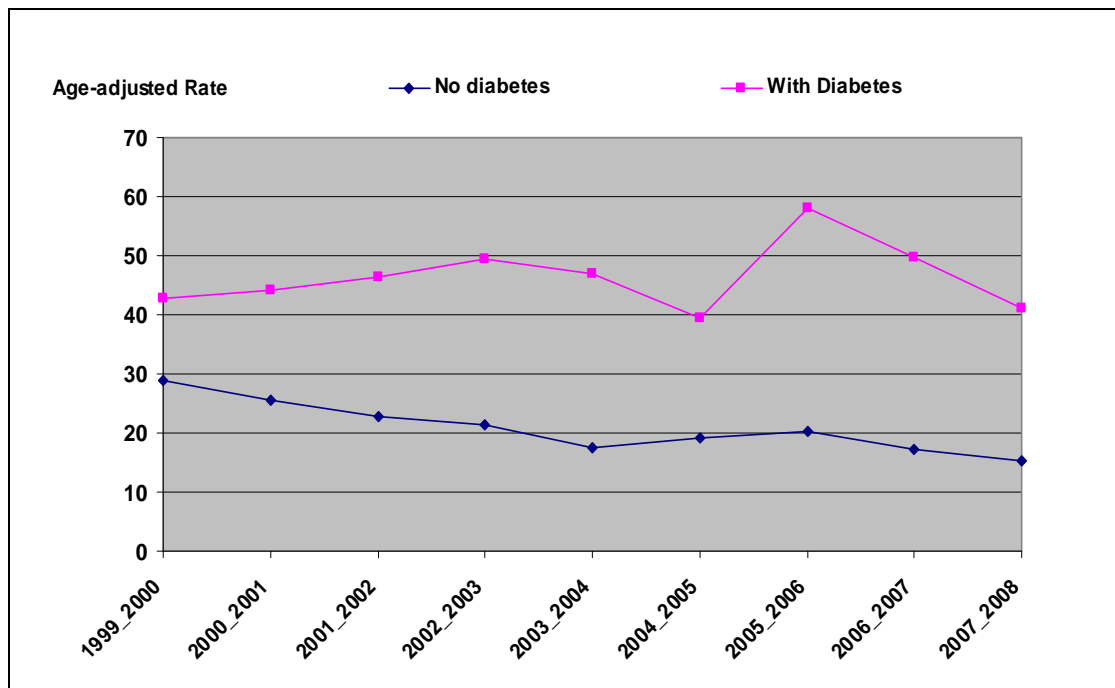




## Trends in amputations over time.

In order to examine trends in amputations in those with and without diabetes, age-adjusted rates were calculated for each year and significant trends noted (Figure 5). For both non-diabetic and diabetic patients, the denominator for these rates is the population for that gender and age strata (i.e. irrespective of diabetes status).

**Figure 5 Age adjusted rates (per 100.000 persons) for amputation in patients with/ without diabetes, aged 50 years and over, Western Australia, 1999-2008.<sup>32</sup>**



The age-adjusted rate for amputation in patients without diabetes (cases aged 50 years and over) decreased from 1999-2008, with trend analysis showing a significant average yearly rate of -6.62% ( $p < 0.0001$ ). The age-adjusted rate for amputation in patients with diabetes (cases aged 50 years and over) increased from 1999-2008, but the trend in the average yearly rate of 0.78% was not significant ( $p = 0.105$ ). Trends in the age-adjusted rates for major and minor amputations in men and women are shown in Appendix 5, Table 2.

This highlights the importance of improving the primary and secondary prevention of high risk foot amongst people with diabetes.

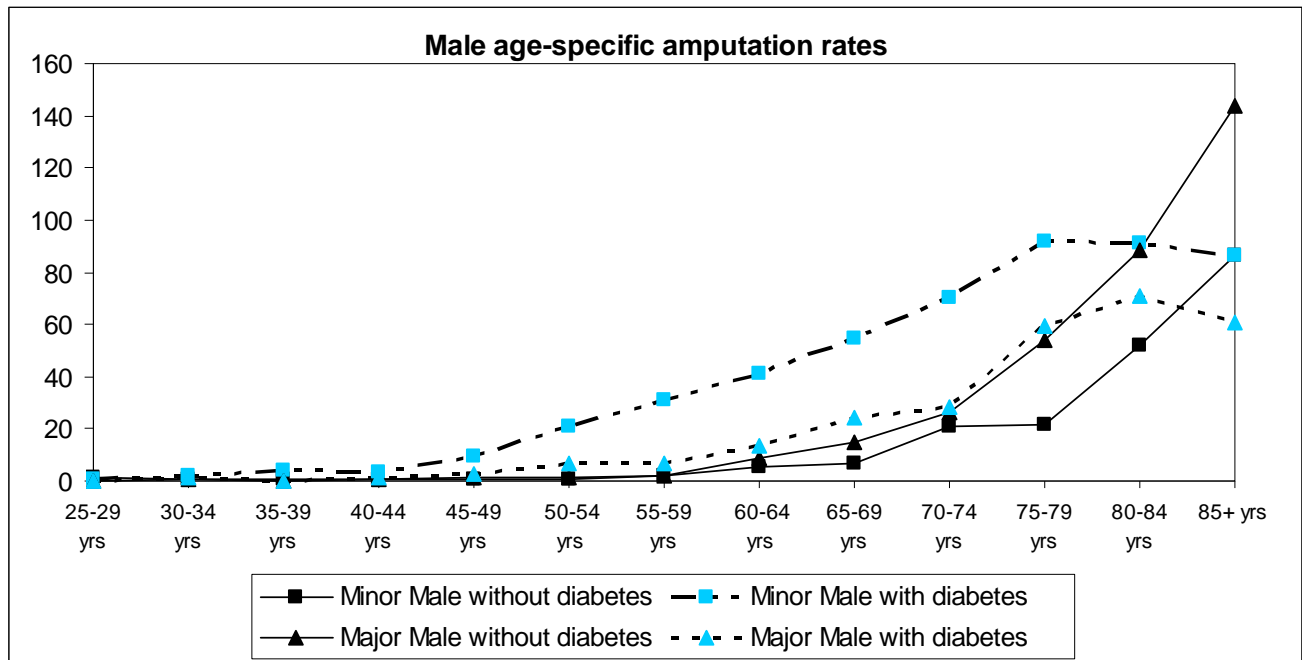
## Effect of age and gender on amputation rates

Age specific amputation rates in WA by amputation type, diabetes status and gender are presented in Figure 6 and 7. They show that the incidence of all amputations rises with age and is greater in men. The plateau/fall in rates for people with diabetes over 75 years probably reflects a survival bias (fewer diabetic individuals of this age).

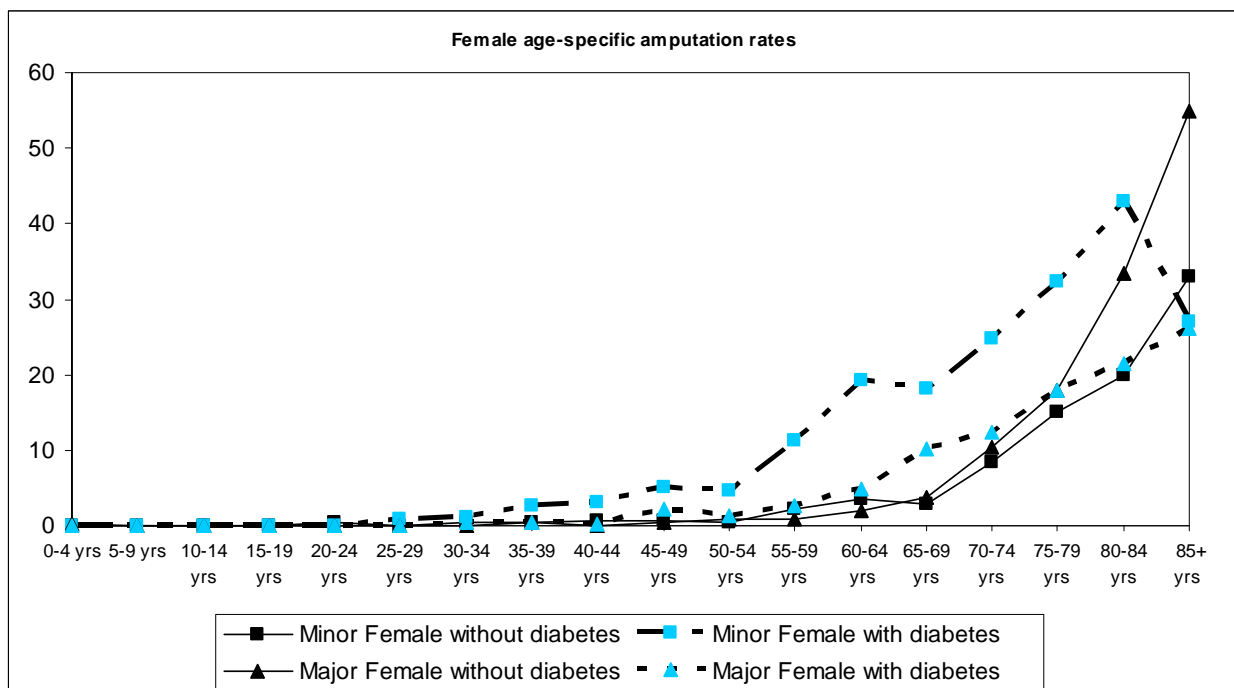


Patients with diabetes begin needing amputations (particularly minor ones) from the age of ~40 years, compared to ~60 years for those without diabetes.

**Figure 6** Age specific amputation rates (per 100,000 persons) by amputation type diabetes status in males, Western Australia, 1999-2008.<sup>32</sup>



**Figure 7** Age specific amputation rates (per 100,000 persons) by amputation type and diabetes status in females, Western Australia, 1999-2008.<sup>32</sup>







## Effect of Aboriginal status on amputation rates.

Amputation rates for Aboriginal people with and without diabetes were analysed separately (Table 2).

**Table 2** Crude amputation separation rates per 100,000 persons, by diabetic and Aboriginal status, WA, 1999-2008.<sup>32</sup>

	MINOR AMPUTATION (Toe/Foot)				MAJOR AMPUTATION (Below/at/above Knee)			
	25-49 years		50+ years		25-49 years		50+ years	
	Rate	No.	Rate	No.	Rate	No.	Rate	No.
Aboriginal with diabetes	46.4	(93)	185	(118)	15.0	(30)	76.8	(49)
Non Aboriginal with diabetes	1.7	(108)	28.9	(1408)	0.4	(26)	13.1	(638)
Aboriginal without diabetes	0.0	(0)	4.7	(3)	1.0	(2)	3.1	(2)
Non-Aboriginal without diabetes	0.3	(21)	6.5	(317)	0.3	(17)	12.8	(628)

Amongst those aged 25-49 years with diabetes, minor amputations were 27 times, and major amputations 38 times more likely in Aboriginal people. The data has not been validated by chart review but there is no reason to suspect systematic bias.

The vast majority (98%) of the amputations in Aboriginal people were associated with diabetes. Although it is difficult to estimate the role of macrovascular arterial disease using administrative data, the literature suggests that peripheral neuropathy, ulceration and sepsis are important causal factors in these amputations.<sup>1</sup> These differences are even greater than the difference for hospitalisation for renal failure (~24x more common in Aboriginal people).

The cause for the high rates in Aboriginal people is likely to be due to multiple factors including:

- High prevalence of diabetes and other risk factors
- Late presentation due to geographic isolation and lack of awareness at individual and community level
- Various gaps in current services

## Length of stay

It is well recognised that the length of stay for amputation for any type of vascular disease is amongst the longest of all conditions. The most recent data are summarised in the table below.



**Table 3      Length of stay for patients undergoing amputation in 2007/8\*.<sup>32</sup>**

<b>Amputation type With and without diabetes</b>	<b>Median length of stay – days (interquartile range)</b>
<b><i>Minor Amputation</i></b>	
- With diabetes	15.00 (7.50-30.00)
- Without diabetes	16.00 ( 11.75-32.25)
<b><i>Major Amputation</i></b>	
- With diabetes	20.50 (12.25-30.75)
- Without diabetes	16.00 (9.50-30.00)

\*See Appendix 5 for expanded dataset

### **Summary**

- The incidence of all amputations rises with age and is greater in men,
- Patients with diabetes begin needing amputations (particularly minor ones) at the age of ~40 years, compared to ~60 years for those without diabetes,
- The rate of amputation in patients with diabetes is increasing and those without diabetes decreasing. This highlights the need to improve the primary and secondary prevention of high risk foot amongst people with diabetes.
- The rates are extremely high in Aboriginal people.
- The length of stay for all amputations, particularly major amputations in people with diabetes is high.



### 3. Best practice management of the high risk foot

There are existing national and international guidelines for the management of the high risk foot in the area of diabetes<sup>5-9 33-34</sup>. These are generally a combination of evidence based medicine, and where this does not exist, expert consensus is adopted. Unfortunately implementation of these guidelines can be variable.

Best practice management for the high risk foot is prescribed by patient needs and is directly related to their level of risk. The level of risk is determined by a number of factors, namely presence of neuropathy, peripheral arterial disease, foot deformity, infection, active Charcot neuro-arthropathy and either history of, or current ulceration. Appendix 2 outlines a commonly used and validated risk classification system. As the degree of risk and complexity rises, so does the need for resources and interdisciplinary support. Essentially the acuity of the high risk foot dictates the level of service required (Figure 8)

**Figure 8 Target patient group and most common providers for each level of care.**

<p><b>Primary Services</b> No current pathology Outpatient management.</p>	<ul style="list-style-type: none"> <li>aim: prevent progression of underlying disease and foot complications in those at risk</li> <li>target diabetics without peripheral vascular disease or history of foot complications, or non-diabetics considered at elevated risk</li> <li>Provide routine care, regular foot screening/ assessment, medical review and education to monitor and reduce risk factors.</li> </ul>	<p>Podiatrist at community health centre</p> <p>Podiatrist at private practice or senior citizen centre</p> <p>GPs and Practice nurses</p> <p>Diabetes educators / nurses</p> <p>Any health professional trained in foot screening including Aboriginal Health Workers</p> <p>NGO's (eg. Diabetes WA)</p>
<p><b>Secondary Services</b> History of ulceration / amputation or active early stage ulceration against background of peripheral neuropathy +/- foot deformity Primarily outpatient with some inpatient management.</p>	<ul style="list-style-type: none"> <li>aim: prevent deterioration, maintain the healed high risk foot</li> <li>target patients with ability to heal post foot ulceration and injury through early intervention. Includes those whose psycho-social factors elevate risk level</li> <li>Provide frequent monitoring, intensive footcare education and access to specialised services e.g. customised accommodative orthotics/ footwear, medical support for underlying condition.</li> </ul>	<p>Podiatrist at community health centre, secondary or general hospital or Aboriginal Medical Service</p> <p>Nurse practitioners, diabetes and wound care nurses e.g. via WoundsWest services</p> <p>GPs and Practice nurses</p> <p>Public and private medical and surgical specialists</p>
<p><b>Tertiary Services</b> Active chronic or complex wound (eg. osteomyelitis) Amputation +/- revascularisation Inpatient and outpatient management.</p>	<ul style="list-style-type: none"> <li>aim: prevent admission and amputation, facilitate wound healing</li> <li>target patients with complex ulceration, infection and amputation as a result of their underlying medical conditions</li> <li>Provide frequent monitoring and access to specialist multidisciplinary medical, surgical allied health and nursing services.</li> </ul>	<p>Podiatrist at tertiary hospital</p> <p>Public and private medical and surgical specialists</p> <p>Specialist nurse practitioners and wound care nurses</p> <p>Wound clinics eg. Silverchain, Hospital in the Home (HITH), Home Hospital (SilverChain and Home Link), Wounds West</p>



### 3.1 Multidisciplinary care

Internationally, it is widely acknowledged that people with high risk foot, particularly when complex foot disorders develop, should be managed within a multidisciplinary environment.<sup>21, 35-41</sup> Integrated teams consisting of medical, surgical, nursing, podiatry and allied health professionals have been shown to:

- Reduce wound healing times
- Increase the percentage of healed ulcers
- Diminish the incidence of amputation
- Improve the prognosis for limb salvage.

Multidisciplinary teams are therefore considered to be a best practice strategy in the management of multifaceted foot conditions that require expert and coordinated care.<sup>36</sup> This integrated approach acknowledges that no one specialist possesses all the expertise and knowledge to manage the patient.<sup>42</sup>

An excellent example of the integrated approach is a prospective intervention undertaken in a population of US Native Americans.<sup>43</sup> This is a population with a relatively high level of diabetes prevalence and, therefore, similar to Indigenous Australians. Through the introduction of simple measures, the rate of amputation was reduced (see Table 4)

**Table 4      The integrated approach - a prospective intervention in a population of US Native Americans.**<sup>43</sup>

Year	Intervention	Amputation rate/ person years
1986-9	Baseline	29/1000
1990-3	Changes included: patient education plus self-management support with prophylactic foot care and footwear for high risk cases.	21/1000
1994-6	Introduction of primary care-based multidisciplinary foot care team.	15/1000
1997-9	Outreach wound care clinic and foot care services to dialysis patients.	7/1000

This model of care delivery has also been adopted in the high risk foot for underlying diseases other than diabetes. For example, best practice guidelines recommend an integrated multi-disciplinary team be accessible for those with inflammatory arthritis<sup>44</sup>

The composition of a multidisciplinary team will vary significantly depending on local factors such as expertise and resources available, as well as the setting e.g. tertiary hospital versus community health centre. As such, there is no universal definition of what comprises a multidisciplinary team to manage the high-risk foot. Importantly, the teams should be of sufficient size to afford the required expertise to achieve their goals, but small enough to preserve efficient management and meaningful participation of each team member.<sup>45</sup>



## 3.2 High risk foot across the continuum of care

Management of the high risk foot across the continuum of care can be grouped into four distinct categories.

- Prevention and health promotion
- Screening assessment and education
- Management of acute high risk foot
- Management of the high risk foot with a history of ulceration and/or amputation

### 3.2.1 Prevention and health promotion

It has become clear that, while lifestyle factors contribute greatly to the development of Type 2 diabetes, and hence are 'largely preventable', there are also important genetic, biochemical and other factors affecting insulin secretion and responsiveness. The susceptibility to specific complications which may be manageable but are often not 'preventable' may also be a factor.

Healthy eating, moderate weight loss and regular physical activity can reduce an individual's risk of developing Type 2 diabetes by up to 60%.<sup>3</sup> Once the disease is present, measures must be taken to control the disease systemically and to manage those with high risk foot.

Similarly, it is acknowledged that a significant proportion of high risk foot complications are preventable. Interventions undertaken around the world demonstrate how substantial reductions in the rates of amputations can be made using innovative prevention strategies in diabetes foot care education programs at tertiary, secondary and primary levels (see insert).

The World Diabetes Day 2005 campaign focused on raising awareness of amputation and promoting appropriate care and self care. With the slogan 'Put Feet First: Prevent Amputations'. The World Health Organisation provided leadership for all nations to tackle diabetic foot complications and highlighted the importance of foot care for people with diabetes.<sup>19</sup>

### 3.2.2 Screening, assessment and education

The strategies outlined in the National Health and Medical Research Council guidelines<sup>47</sup> in relation to regular screening, assessment and education integrate well with those of the International Working Group on the Diabetic Foot.<sup>16</sup>

Foot *screening* generally refers to a cursory assessment to identify any problems relating to the foot such as loss of sensation, vascular insufficiency, deformity and active foot problems. This can be performed by any appropriately trained health professional. If concerns are raised, the patient requires a more comprehensive foot *assessment* by an advanced practitioner regarding appropriate further investigations and management.

#### RAISING AWARENESS

##### Using Celebrities

USA Football League stars promoted the need for people with diabetes to "Check Your Feet".<sup>46</sup>

##### Culturally specific education

In Nauru the "Love Your Feet" Campaign led to 50% reduction in lower limb amputations. It used posters, car bumper stickers and leaflets in health clinics, retail stores and schools. In addition, a 5 minute video screened on national television for 2 weeks out of every 10 for 6 months.<sup>16</sup>

##### Include ALL health professionals

A Brazilian project used the STOP sign with pictures of tools, products and behaviors not to use on feet. They encouraged all health professions to remove the shoes of people with diabetes and check or screen their feet. This led to 90% reduction in major lower limb amputations.<sup>16</sup>



Based on a thorough review and analysis of the available evidence, the key foot related elements of a program for people with a high risk foot were found to be:<sup>44, 48</sup>

- Identification of individuals with a high risk foot through annual screening by health care professionals including podiatrists,<sup>49-50</sup> nurses, diabetes educators, medical practitioners and other allied health professionals.
- Referral of those who need foot care, but who suffer no current diabetes foot complications. to community based foot care services for annual screening, basic foot care education and general foot care.
- Direction of those with identified high risk foot factors to a level of foot care service that provides regular and thorough foot assessment, and provides specific and targeted foot care, footwear and intensive diabetes foot care education.
- Education is carried out opportunistically at most encounters but should accompany screening and assessment as the practitioner explains the implications of the risk factors they have identified.

The patient needs to be acutely aware of the risks associated with certain behaviours and, in line with self-management principles, has a responsibility to follow basic principles to minimise those risks e.g. not walking bare foot, checking their feet on a daily basis and seeking help urgently if a problem is detected.

The health professional has a responsibility to ensure education messages are culturally appropriate and to reinforce them regularly.<sup>51</sup> Fear of amputation and cultural or religious factors can play an important role in delayed presentation in some patients. These can be significant for some Aboriginal Australian people.<sup>52</sup>

There is Level 1 evidence that specific foot care education for people with diabetes improves knowledge and may improve self care behaviour, preventing serious foot complications including amputation.<sup>43, 53-54</sup> Low incidence of new ulceration was seen in an observational study in which all subjects and their families received foot care education.<sup>48</sup>

### **3.2.3 Management of the acute high risk foot**

The management of acute high risk foot primarily spans two distinct conditions which may overlap: foot ulceration and Charcot neuro-osteoarthropathy.

#### ***Foot Ulceration***

The cohort of patients who have previously had a foot ulcer or amputation are at significant risk of developing high risk foot complications in the future. Peters and Lavery<sup>55</sup> report that within a 3 year follow-up period, patients with diabetes and a history of foot ulceration are 17.8 times more likely to develop ulceration; 52.2 times more likely to receive a lower-extremity amputation; and 13.2 times more likely to undergo a peripheral arterial bypass than patients without a background of foot ulceration.

The management of the high risk foot with established ulceration requires addressing numerous interdependent factors to ensure the best possible outcome. Early and aggressive management of foot ulceration significantly improves the prognosis. Frequent podiatry review is aimed at preventing re-ulceration and managing risk factors. The recommended check up frequency for patients with a history of ulceration is every 1-3 months<sup>16</sup>. Regular neurovascular assessment (minimum 3-6 monthly) allows for any changes to be detected early and appropriate management to be implemented in a timely manner.



The presence of high plantar pressure and plantar callus is highly predictive of subsequent ulceration, especially if there has been a previous ulcer at the same site.<sup>49</sup> Offloading pressure areas (especially in the case of minor amputations) and reducing mechanical stress has been shown to greatly reduce the risk of re-ulceration.<sup>10-11</sup> Redistributing plantar pressures and reducing mechanical stress is usually achieved by a combination of regular debridement of callous, provision of appropriate foot wear and/or orthoses and orthopaedic surgery.

Table 5 reflects the key factors which need to be considered in the management of foot ulceration. The table was compiled by the working group based on a combination of best practice guidelines and evidence.





**Table 5 Management of the high risk foot with ulceration**

	General Management	Surgical Management	Pressure Offloading	Infections
Assessment	<ul style="list-style-type: none"> <li>Review of success and adherence to current medical management</li> <li>Review of modifiable risk factors including smoking status and exercise</li> <li>Psychosocial factors</li> <li>Cultural safety context</li> </ul>	<ul style="list-style-type: none"> <li>Peripheral pulses</li> <li>Intermittent claudication</li> <li>Rest pain / acute pain</li> <li>Temperature</li> <li>Femoral bruits</li> <li>Presence of gangrene</li> </ul>	<ul style="list-style-type: none"> <li>Location of wound +/- callous</li> <li>Footwear</li> <li>Biomechanical deformity</li> <li>Neuro assessment including vibration, monofilament and reflexes</li> </ul>	<ul style="list-style-type: none"> <li>Symptoms and signs of infection (local and systemic)</li> <li>Antibiotic treatment</li> <li>Size and depth of ulcer including presence of sinus tract</li> <li>Probe to bone test</li> </ul>
Investigations	<ul style="list-style-type: none"> <li>Investigations of contributory systemic disease (e.g. HbA1c, BP, cholesterol)</li> <li>Exclude Charcot</li> </ul>	<ul style="list-style-type: none"> <li>Ankle Brachial index</li> <li>Arterial Doppler</li> <li>Angiography</li> <li>Diagnostic imaging (including X-Ray, bone and white cell scan, MRI, CT, ultrasound)</li> </ul>	<ul style="list-style-type: none"> <li>Gait analysis</li> <li>Plantar pressures</li> </ul>	<ul style="list-style-type: none"> <li>Wound, tissue and/or bone specimens for microscopy, culture and sensitivity</li> <li>Diagnostic imaging (including X- ray, bone and white cell scan, MRI, CT, ultrasound) to exclude osteomyelitis/ abscess</li> <li>Bone biopsy</li> <li>Inflammatory markers</li> </ul>
Acute Care	<ul style="list-style-type: none"> <li>Optimise underlying medical conditions</li> <li>Education in foot care, wound dressings, self examination</li> <li>Provision of emergency contacts</li> <li>Psychosocial factors</li> <li>Cultural safety context</li> </ul>	<ul style="list-style-type: none"> <li>Optimise blood supply</li> <li>Resection of infected/necrotic tissue and/or drainage of pus</li> <li>Correction of bone, joint and/or tendon anomaly</li> <li>Appropriate wound dressing</li> </ul>	<ul style="list-style-type: none"> <li>Debridement of peri-wound callous</li> <li>Provision of external offloading device (including removable CAM walkers and total contact casting)</li> <li>Non-weight bearing and use of crutches</li> </ul>	<ul style="list-style-type: none"> <li>Oral and/or IV antibiotic therapy</li> <li>Close monitoring of bloods (including WC, CPR)</li> <li>Wound bed preparation</li> <li>Appropriate wound dressing</li> <li>Regular review to monitor clinical response</li> </ul>
Follow-up Treatment	<ul style="list-style-type: none"> <li>Management of contributory systemic disease e.g. diabetes</li> <li>Reduce modifiable risk factors</li> <li>Promote healthy lifestyle changes</li> <li>Regular foot assessment</li> <li>Psychosocial factors</li> <li>Cultural safety context</li> </ul>	<ul style="list-style-type: none"> <li>Regular reassessment of lower limb circulation</li> <li>Education in foot care, self examination and advice on when to seek help</li> <li>Provision of emergency contacts</li> </ul>	<ul style="list-style-type: none"> <li>Provision of orthotics</li> <li>Provision of extra depth/ width or customised orthopaedic footwear</li> <li>Regular podiatric management of callous</li> </ul>	<ul style="list-style-type: none"> <li>Monitor closely for infection recurrence</li> <li>Education in foot care, self examination and advice on when to seek help</li> <li>Provision of emergency contacts</li> </ul>





### **Charcot neuro-osteoarthropathy**

Charcot neuro-osteoarthropathy develops in patients secondary to peripheral neuropathy and trauma (repetitive stress or distinct injury). The reported incidence of the condition varies significantly from 0.1 – 10%.<sup>42, 56</sup> Diabetes is acknowledged as the most common cause of the condition.

Charcot foot can result in sudden, gross and permanent foot deformity. The prognosis for the foot is generally poor if the condition is not treated early to prevent distortion of the architecture of the foot, which makes it prone to ulceration, infection and amputation.<sup>56</sup>

The management of Charcot neuro-osteoarthropathy is dictated by which stage the condition presents. In the acute phase, the main aim of treatment is to immobilise the foot to arrest the progression of the osseous changes (fragmentation, joint dislocation/subluxation) and prevent significant foot deformity.

Surgical treatment is required if conservative measures fail, particularly in the presence of chronic/recurrent foot ulceration or joint instability. In the chronic phase of the condition the treatment shifts towards rehabilitation and the issuing of either orthopaedic footwear with custom-made foot orthoses (or ankle foot orthoses) or a CROW (Charcot Restraining Orthotic Walker).



## **4. Current service delivery gaps in Western Australia for the high risk foot**

Services for the prevention, screening, assessment, education and management of the high risk foot in WA are provided in many settings including: private podiatrists, community health centres, GP practices, secondary health services and tertiary hospitals. It is estimated anecdotally that between 75 and 80% of the podiatry clinic caseload in the public health sector is made up of patients with diabetes.

Despite this range of settings and health service providers, services are often not accessible to all who require them.

### **4.1 Prevention**

Primary prevention of high risk foot focuses on modifiable lifestyle risk factors such as maintaining a healthy weight through diet and exercise, smoking cessation and moderating alcohol intake, to prevent the underlying causes, particularly, type 2 diabetes and cardiovascular disease. Relevant state and national social marketing and health promotion strategies include: Go for 2 and 5, Measure Up; Draw the Line, Find Thirty every day, Respect Yourself, Respect Your Culture, Alcohol. Think Again, Smarter than Smoking, Make Smoking History and DrinkWise guidelines.

People with diabetes are made aware of the high risk foot as a potential complication of diabetes when they are educated about foot monitoring and the use of appropriate footwear. According to the Diabetes Model of Care<sup>3</sup>, awareness and prevention services are provided by many organisations, most with limited capacity, operating independently of each other and other diabetes services.

The self management approach emphasizes an individual's role in managing their own health. It also links them to personal and community resources and includes strategies for assessment, goal setting, problem solving and follow-up<sup>57</sup>. Self management programs such as Living with Diabetes, offer people with chronic health conditions the knowledge, skills and resources to help them better manage their health. The Journey of Living with Diabetes program is specifically designed for Aboriginal people.

### **4.2 Screening, assessment and education**

Screening for foot ulcer risk factors includes neurovascular screening and/or assessment conducted on initial consultation then annually thereafter. Screening and basic podiatric care are the key strategies to prevent progression to the high risk foot. These strategies are complemented by patient education and promotion of self management.

Generalist health professionals (non podiatrists) can play a critical role in the monitoring and prevention of high risk foot by carrying out foot screening to detect early problems. A barrier to general health professionals undertaking screening is limited uptake of training in this area despite the existence of training modules for screening and early detection of foot problems.

The Living with Diabetes self management program contains a module on foot education and screening. Practice Nurses who have been trained in this and similar courses are more likely to check people's feet at their regular review appointments. Many diabetes educators use the National Diabetes Foot Screening tool (Appendix 3), which has been tested for validity<sup>58</sup> and then subsequently updated (Appendix 4), but no single screening or assessment tool is endorsed or consistently applied in WA



Health. The current Medicare scheme discourages screening by private podiatrists, GP's or nurses as it does not rebate screening/ assessment separately.

There is a lack of Aboriginal-specific education resources and culturally appropriate services. There are no WA specific resources, however, the Queensland Indigenous Diabetic Foot Program is a useful educational resource as are those produced by the organisation Services for Australian Rural and Remote Allied Health (SARRAH).

## **4.3 Management**

### **4.3.1 Primary services**

General practitioners, practice nurses and diabetes educators screen, assess, educate and manage people with high risk foot in community settings. These practitioners often utilise Enhanced Primary Care (EPC) management plans to engage podiatry services. Uptake of this relatively new scheme has been significant, with over 1.33 million rebated Medicare visits recorded in the period 2004-2008 (second only to physiotherapy at 1.38 million) <sup>59</sup>. Access to this service, however, is limited by the Medicare payment cap of five appointments per year across all allied health professionals, which is not sufficient to support best practice monitoring and treatment for people with high risk foot. There are also issues of access to GPs for infection management and unclear referral pathways to specialist high risk foot services of more complex cases resulting in delays.

In senior citizen and community health centres, auxiliaries and volunteer workers provide basic nail cutting at a limited number of locations.

The majority of podiatrists work in the private sector and this can limit access to people from low socio-economic backgrounds and Aboriginal populations. This is due to the often prohibitive cost of private care for people without insurance or who require regular follow up or specialist footwear/ orthotics to reduce the risk of high risk foot complications.. People who access private providers can claim from private insurance. The Derbarl Yerrigan Aboriginal Medical Service in Perth is the only Aboriginal specific service to offer podiatry to Aboriginal people.

Access to public metropolitan podiatry services is severely limited by excess demand and relatively low staffing, requiring clinics to implement strict eligibility and discharge criteria.

### **4.3.2 Secondary services**

At secondary hospitals, general physicians case manage people with the high risk foot. Established Podiatry Departments provide services to high risk patients in; dedicated outpatient clinics, exclusively for diabetic patients, as a component of a Living with Diabetes program, general outpatient clinics and in specialised and general inpatient clinics.

On referral the podiatry services provided include; foot assessment with vascular/ neurological testing, gait and biomechanical assessment, triage/ treatment of early foot ulceration and skin injuries and the supply of custom shoes and insoles.

### **4.3.3 Tertiary services**

At the tertiary hospitals, a range of medical specialities are involved including: endocrinology, general medicine, infectious disease, microbiology, amputee/ rehabilitation medicine and surgeons. These specialities manage people with high risk foot largely in the outpatient setting, although there is an important inpatient role. While people may be managed by single specialty areas, given the complexity of the high risk



foot, it is more common for multidisciplinary care teams to be involved. However, there is a need for improved co-ordination and multidisciplinary care planning.

Royal Perth (RPH), Sir Charles Gairdner (SCGH) and Fremantle Hospitals (FH) have outpatient Multi-disciplinary Foot Ulcer Clinics (MDFUC). In line with the evidence base, these clinics are designed to improve patient outcomes, prevent costly hospitalisations, provide an environment for comprehensive and coordinated case management and care planning, improve communication between health professionals and utilise resources more efficiently by reducing the duplication of service.

In addition, these three hospitals have well-established Podiatry Departments, specialised units that focus on the management of high risk patients with an emphasis on wound management. These departments work in a multi-disciplinary environment to manage complex foot conditions.

Chronic complex foot sepsis and wounds are managed on an outpatient basis either as a part of a Multi Disciplinary Clinic or in conjunction with other relevant disciplines, particularly podiatrists. There are also wound clinics available as follow up care for patients.

The hospital in the home (HITH) program provides services to people who require intravenous antibiotics and local wound care. This service is available at all major centres in the metropolitan region and is expanding to major rural sites.

#### **4.3.4 Financial Support for orthoses and footwear**

The Community Aids and Equipment Program (CAEP) funds those who are eligible (possess a pension or health concession card and have consultant ratification) to purchase customised orthoses and footwear. Unfortunately there is often an extensive waiting list for the program, particularly for those using community and secondary level services.



#### 4.3.5 Levels of service

**Figure 9** Comparison between the level of diabetic foot acuity seen at tertiary and secondary podiatry services, Perth 2007.<sup>32</sup>

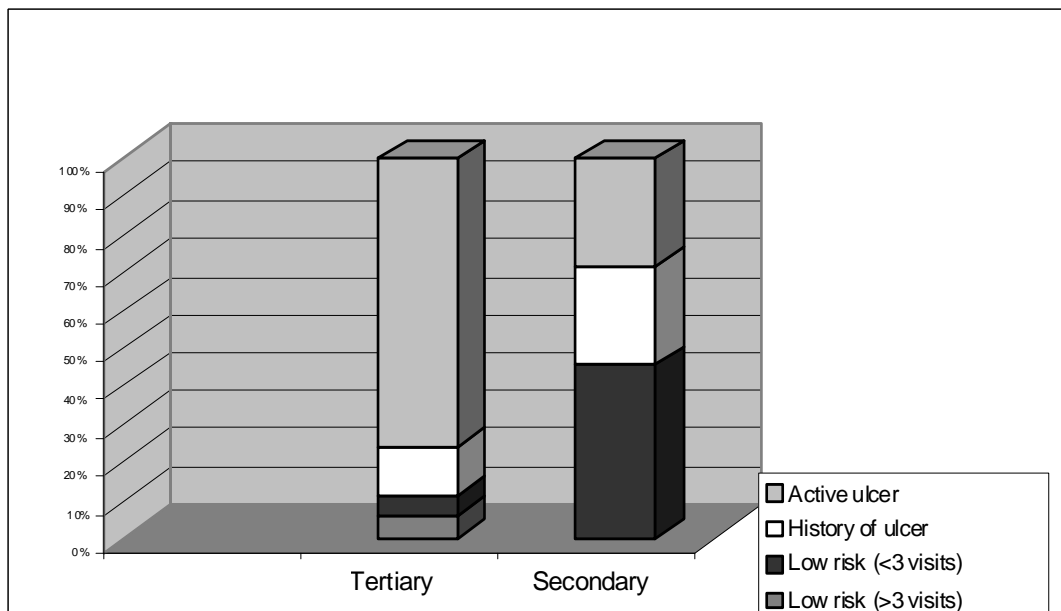
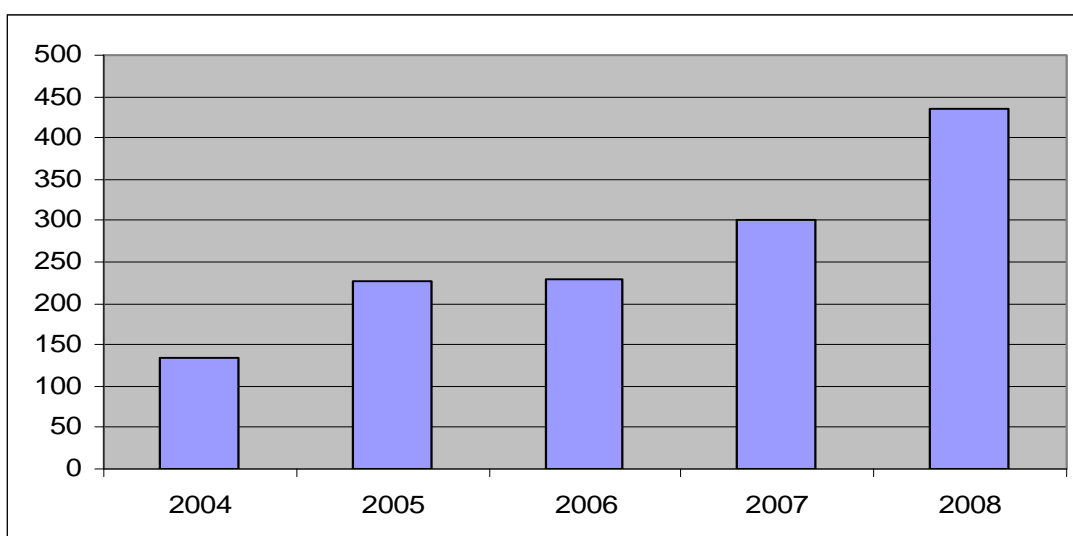


Figure 9 demonstrates the differences in the foot acuity of patients managed in a secondary versus tertiary hospital podiatry service. Since 2007 increasingly stringent criteria to manage service demand have resulted in secondary podiatry services managing a greater percentage of high acuity patients than indicated in the graph.

Figure 10 shows the continued growth in demand for tertiary podiatry services at RPH.

**Figure 10** Occasions of service at Royal Perth Multidisciplinary Foot Ulcer Clinic, WA 2004-2008.<sup>32</sup>





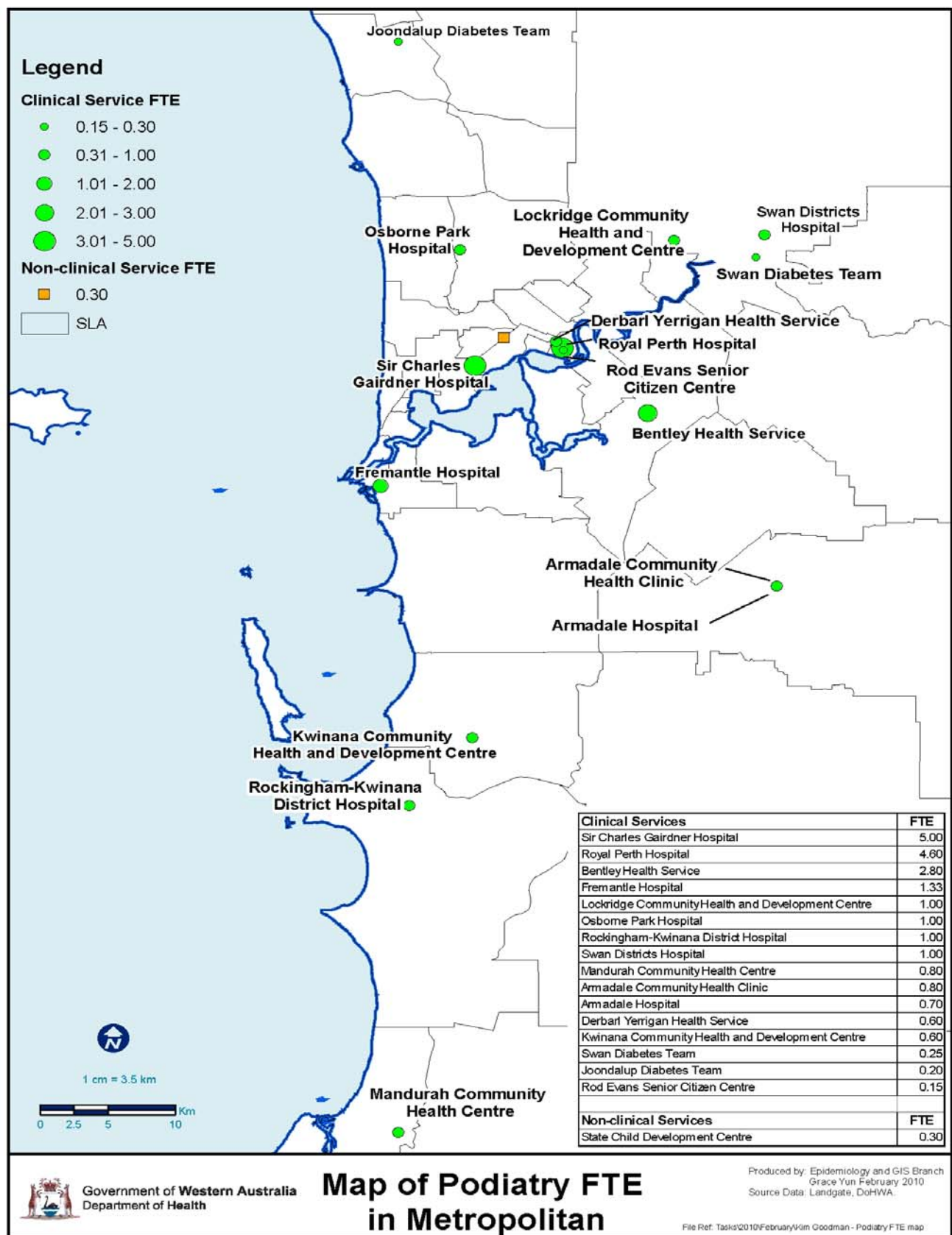
The map in Figure 11 shows the geographic breakdown of podiatry services funded by the Department of Health Western Australia, including the budgeted full time equivalent (FTE) positions and level of service. From the map it is clear that there are significant geographic gaps in high risk foot services in the metropolitan area. Appendix 7 shows a more detailed breakdown of the podiatry services provided at each level for the high risk foot.

Specialist and multidisciplinary services are concentrated in the major teaching hospitals which are centrally clustered.

There is only one dedicated public Aboriginal podiatry service at Derbarl Yerrigan in metropolitan WA.



**Figure 11 Map showing WA Health podiatry full time equivalent positions in metropolitan Perth, December 2009**







#### **4.4 Current services provided in Western Australian country areas**

For rural and remote patients the issues presented previously are exacerbated by geographic isolation, the limited number of trained personnel and the need for practitioners to deal with a range of problems - to practice as a 'specialist generalist'

##### **4.4.1 Prevention, Screening, Assessment and Education**

In rural and remote areas there is not universal access to screening, assessment and education for people at risk of or who have high risk foot. Some Aboriginal Community Controlled Health Organisations provide preventative and screening services but are hampered by the lack of referral pathways to access specialist service. There is a need to improve the consistency of management, education messages and referral pathways between health professionals and organisations to improve patient outcomes.

##### **4.4.2 Management - Primary and Secondary Services**

Private podiatrists service many of the small towns and surrounding areas, typically on a 'fly-in, fly-out' basis. Many are employed through the Divisions of General Practice, such as in the Kimberley, and others via Western Australian Country Health Services.

Silver Chain and some local hospitals provide wound management services. The shortage of skilled podiatrists and /or nurses coupled with the underutilisation of Telehealth clinics results in patients travelling to Perth for assessment and management of complex high risk foot cases.

A pilot study carried out by Wounds West identified lack of equipment and skilled personnel to perform lower limb and foot assessments<sup>60</sup>. This needs to be addressed in all health settings in order to improve patient outcomes.

#### **4.5 Service gaps across settings**

##### **4.5.1 Workforce and professional development**

The majority of podiatrists work in private practices. Future workforce modelling indicates a significant shortfall of podiatrists. The WA Podiatry Workforce Modeling Report<sup>61</sup> predicts that the most optimistic scenario modeling will produce a 47% shortfall in the supply of fulltime equivalence podiatrists by 2013/14. The WA Podiatry Labour Force Survey (2007)<sup>62</sup> found that:

- Approximately 84-90% of podiatrists work in the private sector. The existing funding structures via Medicare or private insurance provide limited scope for management of the high risk foot in private podiatry practices.
- For the 10-16% podiatrists who work in the government sector, there is a disparity in the classification and recognition of clinical positions providing specialist high risk foot care.
- There has been minimal increase in podiatry fulltime equivalent positions in the public sector in recent years despite growing demand.

These gaps are further exacerbated in rural and remote areas due to the difficulty in recruiting and retaining staff.

There are insufficient opportunities for professional development and upskilling for health professionals in screening, assessment, treatment and management of high risk foot. Training, when it does occur, is seldom linked to annual refreshers or accreditation.





In rural and remote areas podiatrists and Aboriginal Health Workers usually work for different organisations resulting in poor referral pathways, lack of coordination and inconsistent care and educational messages.

RPH and SCGH have 12-month intern positions for graduate podiatrists in partnership with the North Metropolitan Area Health Services Ambulatory Care Diabetes service. These positions expose clinicians to public sector podiatry and to high risk foot management across the continuum of the disease.

Wounds West has developed on-line education modules, incorporating vascular and neurological assessment of the lower limb in the presence of ulceration, to provide specialist wound care advice to remote and rural clinicians including Aboriginal Health Workers (<http://www.health.wa.gov.au/WoundWest/home/>). A face to face education module is also provided for rural and remote practitioners, however, the team does not include a podiatrist to provide high risk foot consultations.

It is often difficult to recruit podiatrists to rural and remote areas and there is often frequent turnover of podiatrists in these places. Anecdotal evidence suggests that the limited support services and professional development opportunities for staff in rural and remote areas make retention of skilled professionals difficult.

#### **4.5.2 Lack of culturally appropriate services**

Aboriginal people have a higher prevalence of diabetes and amputation but do not have equivalent culturally appropriate resources. In rural and remote areas services often do not exist. In the metropolitan area there is only one dedicated service for Aboriginal people and no dedicated cultural support for Aboriginal patients undergoing treatment or amputations.

There is a high non-attendance rate for Aboriginal people across all settings. Premature discharge from hospital after amputation by Aboriginal patients is common and anecdotal evidence suggests low uptake of leg prostheses. For those who prefer to use the Aboriginal Medical Services strong links with mainstream services frequently do not exist.

In early 2010 the Council of Australian Governments (COAG) approved funding for 80 programs in WA as part of the “Close the Gap” initiative to improve health outcomes for Aboriginal people. Programs for the management of the high risk foot recently developed include an Aboriginal Podiatry and Nutrition outreach program, an Aboriginal hospital liaison program and the chronic disease self management, Living Improvements For Everyone (LIFE), program.

#### **4.5.3 Lack of coordination and consistency of high risk foot services.**

The lack of coordination and consistency in the provision of high risk foot services is due to systemic problems both with and between service providers. There is a lack of agreement in relation to state-wide referral pathways for patients. In addition, there are often inadequate referral mechanisms across professions and between public and private providers which result in limited access to multidisciplinary care.

The inpatient with high risk foot is admitted under a number of specialties, with management being provided by the specific surgical or medical admitting team. This results in delays, inconsistent treatment and management and less than optimal patient care and outcomes. These issues all impact negatively on Aboriginal patients, many of whom are in Perth for treatment far away from their rural and remote communities.



The diabetic high risk foot has generally been prioritised ahead, and at the expense of, other causes such as inflammatory arthritis and connective tissue disorders. These other conditions may also result in complex foot ulceration, infection, and musculoskeletal pain, and thus require similar prevention, assessment and management strategies as the diabetic high risk foot.

#### **4.5.4 Summary of gaps in current services**

Service gaps across the continuum of care for people at risk of or with high risk foot:

- Insufficient emphasis on prevention, screening, assessment and education of at risk populations.
- Inequalities in access to services due to:
  - Lack of services in outer metropolitan and rural remote areas
  - Issues of funding and affordability
  - Lack of culturally appropriate high risk foot services for Aboriginal people.
- Lack of consistency and coordination of high risk foot services
- Lack of workforce resources and professional development.



## 5. Future Model of Care for state-wide services for the high risk foot

The Model of Care outlines best practice and seeks to:

- Increase awareness of the need for foot examination incorporating a self management approach
- Improve community based screening and assessment services using appropriate and available staff
- Establish and improve referral pathways across disciplines to improve access to specialist services and to higher levels of care
- Extend the multidisciplinary clinic model, both in and out of the hospital setting, and select a single set of guidelines and tools to govern service provision and referral
- Integrate with the Diabetes Model of Care patient pathways and optimal care delivery.

### 5.1 System-wide guiding principles

The Model of Care takes a holistic, patient-centred approach to the provision of culturally appropriate services and resources for people with a high risk foot. It outlines best practice through the application of the following service principles:

- Primary and secondary prevention to support healthy lifestyles and risk reduction in the well population. Health professionals should maximise opportunities for early identification and risk modification.
- Integrated and coordinated care between the self-managing individual, members of the multidisciplinary team, general practitioners and specialists.
- Integrated and coordinated care across funding agencies supported by guidelines, pathways and protocols.
- Building service capacity at the primary care level. Where possible, this should be supported by health professionals from secondary and tertiary services.
- Building workforce capacity to manage the complex requirements of people with a high risk foot. This includes up-skilling, education and training of both community and health service sectors, with particular attention to rural practitioners.
- Delivery of culturally sensitive, appropriate care to meet the needs of Aboriginal and culturally and linguistically disadvantaged populations.
- Delivery of optimal care in line with evidence-based guidelines or best practice consensus documents.
- Development and implementation of new initiatives to meet service delivery gaps.
- Future research supported by integrated clinical information systems.

The Model aims to ensure people receive the right care, at the right time, by the right team and in the right place.



## 5.2 Recommendations

Eight key recommendations and strategies have been developed. The key recommendations are:

1. Raise awareness of the high risk foot.
2. Prevent complications of the high risk foot through early detection.
3. Establish evidence-based guidelines and protocols to manage the high risk foot.
4. Address access inequities to services (due to geographic and resource allocation disparities) for the high risk foot.
5. Improve care co-ordination and strengthen the multi-disciplinary approach to management of the high risk foot.
6. Improve access to health services for Aboriginal patients with a high risk foot.
7. Conduct research and address ongoing professional development and training in management of the high risk foot.
8. Address workforce capacity and capability issues.

### **Recommendation 1: Raise awareness of the high risk foot**

#### **Proposed strategies**

- Establish a comprehensive and coordinated multimedia health promotion and education campaign to raise general awareness of foot problems.
- Include self management initiatives targeting patients and carers in all education and health promotion campaigns for patients with the high risk foot.

### **Recommendation 2: Prevent complications of the high risk foot through early detection**

#### **Proposed strategies**

- Upgrade and expand subsidised senior citizens clinics to include full screening and assessment for the high risk foot, including annual recall systems. Establish systems to oversee and coordinate these services.
- Encourage generalists in all settings, including therapy/nursing assistants, to carry out foot screening and assessment.
- Advocate for a new Medicare item number for foot screening/assessment by an accredited health professional.

### **Recommendation 3: Establish evidence-based guidelines and protocols to manage the high risk foot**

#### **Proposed strategies**

- In consultation with key stakeholders, endorse and promote the use of:
  - A universal high risk foot screening and assessment tool across WA Health.
  - Evidence based or best practice consensus guidelines (e.g. for foot ulceration, foot osteomyelitis.).



#### **Recommendation 4: Address access inequities to services (due to geographic and resource allocation disparities) for the high risk foot**

##### **Proposed strategies**

- Address current geographical imbalance at all levels of high risk foot services and focus on the areas of greatest need.
- Use Telehealth to improve access to specialist review and to multi-disciplinary foot ulcer services statewide.
- Ensure people living in all metropolitan postcodes are allocated to and can access a community podiatry service.
- Improve access to orthopaedic footwear and custom foot orthoses for high risk foot patients at the primary and secondary levels.
- Investigate expanding the inclusion criteria for the Community Aids and Equipment Program (CAEP) to include all patients with a high risk foot.
- Advocate increasing the Medicare Enhanced Primary Care / Team Care Arrangement podiatry allowance for patients with chronic disease co-morbidities. This will allow continuity and regular management of lower risk clients (who don't need specialised secondary or tertiary podiatry) to prevent exacerbations.

#### **Recommendation 5: Improve care co-ordination and strengthen the multi-disciplinary approach to management of the high risk foot**

##### **Proposed strategies**

- Improve referral pathways to avoid delays in accessing high risk foot services:
  - Establish clear bi-directional and enforced referral pathways between primary, secondary and tertiary high risk foot service providers.
  - Remove barriers to rapid access to high risk foot services or the multidisciplinary foot ulcer clinics in the instance of an acute event.
- Establish a modified multidisciplinary high risk foot team (e.g. physician, nurse and podiatrist) at secondary sites to manage early stage high risk foot complications
- Improve co-ordination, communication and liaison for those admitted to secondary or tertiary hospitals:
  - Strengthen the multidisciplinary approach for inpatients admitted with a high risk foot complication from admission all the way through to discharge.
  - Ensure all patients admitted to a metropolitan hospital with an acute high risk foot problem are assessed and followed up by a podiatrist.
  - Establish a (virtual) Diabetic Foot Unit at tertiary hospitals, under which patients with an acute diabetic foot complication can be admitted.
  - Develop a clinical consultant nurse / podiatrist-driven wound service across all sites for high risk foot in-patients.
- Facilitate and support Aboriginal Health Workers / Aboriginal Liaison Officers to support Aboriginal patients with acute high risk foot problems while in hospital and on discharge to provide a link to podiatrists in the community.
- Facilitate inter-professional learning and inter-professional practice.



## **Recommendation 6: Improve access to health services for Aboriginal patients with a high risk foot**

### **Proposed strategies**

- Ensure access to culturally appropriate foot education, screening, assessment and treatment programs targeting Aboriginal people in metropolitan areas as well as rural and remote communities.
  - Implement innovative strategies to engage Aboriginal communities e.g. implement a multimedia campaign using an Aboriginal celebrity to demonstrate high risk foot prevention and management.
  - Integrate and standardise processes such as screening, referral and two-way professional development between podiatrists and Aboriginal Health Workers. Develop clear referral guidelines and pathways that distinguish acute from chronic high risk foot for Aboriginal patients.
- Develop collaborative service and education models between Aboriginal Community Controlled Organisations, WA Country Health Services and GP practice staff to ensure podiatrists deal with complex high risk foot problems, particularly in rural and remote areas.
- Develop mobile outreach high risk foot teams and ensure capacity building occurs within the target communities. Consider integration with dialysis services in rural and remote areas.
- Develop an Aboriginal Liaison Officer / Aboriginal Health Worker position to support Aboriginal amputees in hospital.

## **Recommendation 7: Conduct research and address ongoing professional development and training in management of the high risk foot**

### **Proposed strategies**

- Conduct interdisciplinary research into the high risk foot including epidemiology, assessment of new interventions and qualitative research.
- Investigate innovative emerging treatment modalities in the management of the high risk foot, such as hyperbaric oxygen therapy<sup>63</sup>, negative wound pressure therapy<sup>64</sup> and ultrasonic wound debridement.
- Include diabetic foot care and screening competencies in undergraduate training for nurses, Aboriginal Health Workers, therapy/ nursing assistants and other allied health professionals.
- Promote (and if necessary, develop) high risk foot education programs for non podiatrists e.g. practice nurses, nurse practitioners, GP's and other allied health professionals. Ensure regular refreshers, professional development opportunities and competency assessments.
- Recognise the high risk foot as a specialty area and encourage, enable and support generalists to gain post graduate qualifications in this area.

## **Recommendation 8: Address workforce capacity and capability issues**

### **Proposed strategies**

- Address podiatry shortages to ensure future service needs are met:
  - Develop policies to address rural staff recruitment and retention.
  - Recruit to fill vacant rural posts and create new positions in areas of most need.
  - Provide a coordinated approach to professional development.
  - Provide management support.



- Engage and develop strong relationships between private and public podiatrists through education and training.
- Build the capacity of private practitioners to manage the high risk foot at the primary care level.
- Eliminate the disparity in the classification of clinical podiatry positions providing specialist high risk foot services.
- Explore opportunities for extended scope practitioners involved in the management of the high risk foot, particularly where access to specialist podiatry, medical or wound care services is limited.
- Expand the existing podiatry internship program to include all tertiary facilities, secondary service sites and rural centres.
- Assist in the establishment of career pathways and registration for therapy assistants, allied health, nurse assistants, foot care assistants and Aboriginal Health Workers / Aboriginal Liaison Officers involved in basic foot screening and education.
- Investigate the inclusion of a specialist podiatrist with the WoundsWest consultancy service.

## IMPLEMENTATION

The High Risk Foot Working Party understands these recommendations require different resource and time allocations for implementation. Given this, a strategy for the phased implementation of recommendations will be developed using the following parameters:

- **Phase 1:** Early implementation of recommendations that are achievable within existing resources and current service provision.
- **Phase 2:** Delayed implementation of recommendations requiring further planning and development.
- **Phase 3:** Later implementation of recommendations requiring additional human resources, funding and endorsement.

**Appendix 8** shows the recommendations and the 3 phases of implementation. An implementation group will be convened to determine priorities and achievable outcomes, commencing with those that can be undertaken within the existing resources and in partnership with health service providers.





## 6 Glossary of terms

Term	Description
<b>Ankle brachial index (ABI)</b>	The ratio of the blood pressure in the foot (measured with a hand held Doppler) and the blood pressure in the arm. This is a simple non-invasive means of assessing the adequacy of the arterial supply to the foot.
<b>Callus</b>	Thickened hardened skin due to localised chronic excessive pressure.
<b>Charcot's foot/arthropathy</b>	A degenerative arthritis affecting the joints in the foot due to loss of sensation and muscle tone caused by damaged nerves (peripheral neuropathy)
<b>Foot assessment</b>	Foot examination undertaken by an expert health professional with specialist skill, knowledge and training and supported by the use of specialised technology and equipment.
<b>Foot screening</b>	Foot examination undertaken by a generalist health professional requiring minimal training, technology and equipment.
<b>Foot Ulceration</b>	Diabetic foot ulcer according to the International Working Group on the Diabetic Foot (IWGDF): a full-thickness break in the skin occurring below the malleoli in a patient with diabetes. <sup>16</sup>
<b>Glycosylated haemoglobin (HbA1c)</b>	A blood test used to assess the adequacy of recent blood glucose control in patients with diabetes.
<b>High Risk Foot</b>	A foot with progressive deformity, ulceration, infection and/or amputation as a result of a patient's underlying medical condition. Consideration is given to those "at risk" of complications, so the full spectrum of high risk foot management can be analysed. In Australia and internationally the high risk foot is generally associated with diabetes. Other less common underlying diagnoses include neurological disorders, vascular disease, inflammatory conditions (e.g. rheumatoid arthritis) and renal disease.
<b>Home Hospital Silver Chain</b>	Hospital@Home provides care in the home for patients who would otherwise require hospitalisation, are clinically stable and require 24 hour medical governance.
<b>Hospital in the Home (HITH)</b>	Hospital in the Home (HITH) is the delivery of short term acute care services in the patient's home for conditions that traditionally require hospital admission and inpatient treatment. HITH services are based on daily home visits by nurses and allied health staff, with medical management by either a hospital based doctor or GP.



<b>Term</b>	<b>Description</b>
<b>Major Amputation</b>	Amputation above, at or below the knee.
<b>Minor Amputation</b>	Amputation of the toe or foot.
<b>Offloading</b>	Reducing and redistributing pressure on the sole of the foot.
<b>Orthoses</b>	Devices which support and/or correct the function of a foot, limb or torso.
<b>Peripheral arterial (vascular) disease (PAD)</b>	An arterial disease that may impair the blood supply of the lower limb, particularly the foot. The most common cause is atherosclerosis (hardening of the arteries)
<b>Total Contact Casting</b>	A method used to offload pressure and hasten healing of the neuropathic, non-infected foot ulcer.
<b>University of Texas Diabetic Foot Risk Classification System<sup>65</sup></b>	Category 0 Minimal pathology present Category 1 Insensate foot Category 2 Insensate foot with deformity Category 3 Demonstrated pathology Category 4A Neuropathic Ulceration Category 4B Acute Charcot's arthropathy Category 5 Infected diabetic foot Category 6 Dysvascular foot



## 7. Appendices

### Appendix 1 Sections of Diabetes and Amputee Services and Rehabilitation Models of Care relevant to High Risk foot

**The Diabetes Model of Care** highlights the need for coordinated general and specialist podiatry services, multidisciplinary high risk foot clinics. The Model prioritises the following:

#### *Key Priority 3 Reconfigure specialist services for optimal effectiveness*

- Provide new specialised services, e.g. crisis clinics, insulin initiation services, and high risk foot clinics (11a, 16d, 18, 20f)
- Improve coordination, capacity and effectiveness of general and specialist podiatry services; established high risk foot clinics at all tertiary hospitals and provide outreach high risk foot services to regional centres (16d)
- Establish outer metropolitan and regional outreach and telehealth services, including complication screening services for high risk, vulnerable and under-resourced groups (11a, 17b)

#### *Model of Care recommendations related to high risk foot include:*

- Recommendation 11a: Endocrine Health Network to assist Area and Country Health Services to review and reconfigure specialist services for outer metropolitan, rural and Aboriginal patients and special needs groups; specific purpose clinics and other service innovations, and to ensure high quality service planning and coordination, professional education and research.
- Recommendation 16d: Area and Country Health Services to establish high risk foot clinics at all tertiary hospitals and provide outreach high risk foot services to regional centres.
- Recommendation 17b: WA Health, Area and Country health Services, in partnership with Divisions of General practice and other key groups including podiatry, nephrology and ophthalmology, to develop multidisciplinary outreach specialist services/teams to visit remote vulnerable and high risk groups.
- Recommendation 18: Area Health Services to review and reconfigure specialist endocrine services to improve access, maximise effectiveness and provide new specialised services, e.g. general hospital, outer metro clinics, complication screening, high risk foot care, etc.
- Recommendation 20f: Develop and expand outreach and telehealth services to fill identified service gaps.

**Amputee Services and Rehabilitation Model of Care** developed by the Aged Care Network:

Outlines the need for diabetic foot care programs and high risk clinics to provide prevention and education activities to prevent lower limb amputation. The Model emphasises the need for the identification of high risk population groups and referral to clinics for management.




## Appendix 2 University of Texas Diabetic Foot Risk Classification System


<b>Category 0: NO Neuropathy</b>	<b>Category 1: Neuropathy NO Deformity</b>	<b>Category 2: Neuropathy with Deformity</b>	<b>Category 3: History of Pathology</b>
<p>Patient diagnosed diabetes. Protective sensations intact (Semmes-Weinstein 10gm monofilament detectable) Ankle-brachial index (ABI) &gt;0.8 and toe systolic pressure &gt;45 mmHg Foot deformity may be present No history of ulceration POSSIBLE TREATMENT Possible shoe accommodation Patient education Follow up 6-12 months</p>	<p>Protective sensation absent (Semmes-Weinstein 10gm monofilament NOT detectable) ABI&gt;0.80 and toe systolic pressure &gt;45mmHg No history of ulceration No history of diabetic Charcot Joint No foot deformity POSSIBLE TREATMENT Possible shoe gear accommodation (Orthotist) Quarterly visits to assess shoe gear / monitor for signs of irritation Follow up 3-4 months Patients are 1.7 times more likely to develop ulcer</p>	<p>Protective sensation absent ABI&gt;0.80 and toe systolic pressure &gt;45 mmHG No history of neuropathic ulceration No history of Charcot's arthropathy Foot deformity present POSSIBLE TREATMENT As for Category 1 plus : Orthotist consult re possible custom-made/extra depth shoe accommodation Possible prophylactic surgery to alleviate focus of stress (eg. Correct hammertoe or bunion deformity) Follow-up 2-3 months Patients are 12.1 times more likely to develop ulcer</p>	<p>Protective sensation absent ABI &gt;0.80 and tow systolic pressure &gt;45mmHg History of neuropathic ulceration, amputation or Charcot's arthropathy Foot deformity present POSSIBLE TREATMENT As for Category 2 plus: More frequent visits may be indicated for monitoring Follow-up 1-2 months Patients are 36 times more likely to develop ulcer</p>
<b>Category 4A Neuropathic Wound</b>	<b>Category 4B: Acute Charcot's Joint</b>	<b>Category 5: Infected Diabetic Foot</b>	<b>Category 6 Ischaemic Limb</b>
<p>Protective sensation absent ABI&gt;0.80 and toe systolic pressure &gt;45mmHg Foot deformity present No acute diabetic Charcot's arthropathy POSSIBLE TREATMENT Same as Category 3 plus: Pressure reduction program instituted Wound care regime instituted</p>	<p>Protective sensation absent ABI&gt;0.80 and toe systolic pressure &gt;45jmmHG Non-infected neuropathic ulceration may be present Diabetic neuropathic Charcot POSSIBLE TREATMENT Same as Category 3 plus: Pressure reduction program Thermometric and radiographic monitoring If ulcer present, same as Cat4A</p>	<p>Protective sensation may be present Infected wound Charcot joint may be present POSSIBLE TREATMENT Debridement of infected, necrotic tissue and/or bone as indicated Possible hospitalisation, AB regime Medical management</p>	<p>Protective sensation may be present ABI&lt;0.80 okr toe systolic pressure &lt;45mmHg Ulcer may be present POSSIBLE TREATMENT Vascular consult, possible revascularisation If infection present, treatment same as for Cat 5</p>

## Appendix 3 Basic foot screening checklist: National Association of Diabetes Centres & Australasian Podiatry Council





National Association of Diabetes Centres



Australasian Podiatry Council

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### Basic Foot Screening Checklist

**1. Ask the patient**

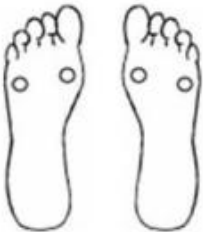
neuropathic symptoms	Y	N	
intermittent claudication	Y	N	
previous foot ulcer	Y	N	
amputation	Y	N	

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	
<b>3. Check foot pulses</b>	Dorsalis pedis	Y	N	Y	N
	Posterior tibial	Y	N	Y	N
		LEFT		RIGHT	
<b>4. Test for neuropathy</b>	Monofilament	Y	N	Y	N
	<small>detected at sites marked - o</small>				



**5. Assess footwear**

style	Good	Poor
condition	Good	Poor
fit	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*

National Diabetes Foot Screening Project  
January 2004

### 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*

National Diabetes Foot Screening Project  
January 2004

## Appendix 4 Revised version of the Basic Foot Screening Checklist<sup>58</sup>

Patient's Name:		Date of Screening:	
DOB:		Name of Foot Screener:	

### NMAHS-East Diabetes Foot Screening & Review Tool

#### Identify Foot Problems

1. Current foot ulcer (present for > 1 month and below the ankle)	No go to 2	Yes stop screening go to referral action 1
2. Infection (bacterial infection with cellulitis, discharge, swelling or other sign of infection)	No go to 3	Yes stop screening go to referral action 1
3. Amputation (caused by diabetes or circulation problem not traumatic event)	No go to 4	Yes stop screening go to referral action 2
4. Foot deformity (bunion, hammer/claw toe, Charcot joint, prominent bone)	No go to 5	Yes stop screening go to referral action 2
5. Previous foot ulcer (present for > 1 month prior to healing and below the ankle)	No go to 6	Yes stop screening go to referral action 2
6. Calluses or corns (very thick skin over a joint or on the heels)	No go to 7	Yes stop screening go to referral action 2
7. Skin breaks (full thickness exposing raw underlying tissue, not superficial cracks)	No go to 8	Yes stop screening go to referral action 2
8. Nail disorders (ingrown, painful, very thick, )	No go to 9	Yes stop screening go to referral action 2

#### Identify Change in Circulation

9. Left foot Dorsalis pedis pulse felt	Yes go to 10	No go to 10
10. Left foot Posterior tibial pulse felt	Yes go to 11	No If 9 = Yes go to 11 If 9 = No stop screening, referral action 2
11. Right foot Dorsalis pedis pulse felt	Yes go to 12	No go to 12
12. Right foot Posterior tibial pulse felt	Yes go to 13	No If 11 = Yes go to 13 If 11 = No stop screening, referral action 2

#### Identify Change in Nerve Function

13. Left foot 10 gram monofilament felt	Yes go to 14	No stop screening go to referral action 2
14. Right foot 10 gram monofilament felt	Yes go to 15	No stop screening go to referral action 2
15. Neuropathic symptoms (burning, numbness, tingling, sharp shooting pain)	No go to 16	Yes stop screening go to referral action 5

#### Identify Self Care Capacity

16. Does the patient have normal vision?	Yes go to 17	No stop screening go to referral action 3
17. Can the patient reach their own feet for safe self-care?	Yes go to 18	No stop screening go to referral action 3
18. Are there any other factors influencing ability to safely care for own feet?	No go to 19	Yes stop screening go to referral action 3

#### Identify Education Need

19. Does the patient understand the effects of diabetes on foot health?	Yes go to 20	No stop screening go to referral action 3
20. Can the patient identify appropriate foot care practices?	Yes go to 21	No stop screening go to referral action 3
21. Are the patient's feet adequately cared for?	Yes go to 22	No stop screening go to referral action 3

#### Check Footwear

22. Style	Good go to 23	Poor stop screening go to referral action 3
23. Condition	Good go to 24	Poor stop screening go to referral action 3
24. Fit	Poor stop screening, referral action 3	Good and screening go to referral action 4

**Referral Action**

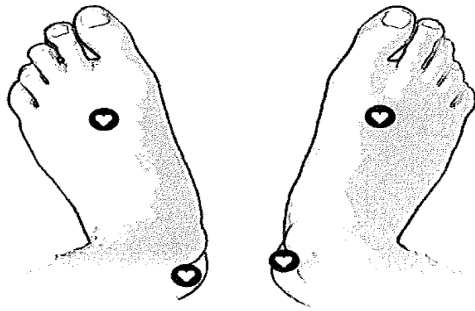
1 General Practitioner  
2 NMAHS Primary Podiatry (Inner City/H-DGP)

**3 Group Foot Health Education**  
**4 Re-screen in twelve months time**  
**5 Community Diabetes Educator**

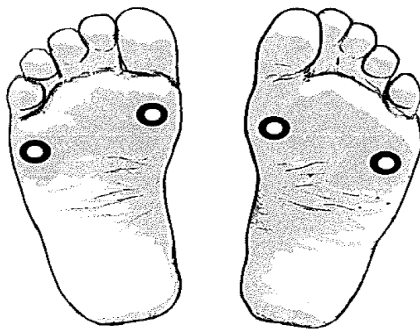




## Appendix 5 DART foot screening tool



Just draw it!



When the DART targets *any* HIGH risk results, it is important for a more comprehensive test to be completed. This will involve repeating the DART, confirming the result, and then going onto the DART Asks.

The DART Asks can be completed by anyone who is confident and competent of doing the more comprehensive assessment and making the appropriate referrals.



**The Indigenous Diabetic Foot**

SARRAH  
PO Box 74  
Deakin West ACT 2600  
[www.sarrah.org.au](http://www.sarrah.org.au)

Client's name: \_\_\_\_\_  
Assessed by: \_\_\_\_\_ Date: \_\_\_\_\_

### 1) Feel for Foot Pulses (both feet)

- Top of the foot pulse
- Inside ankle pulse
- ✓ on the foot outline, if you can feel the pulse [LOW risk]
- ✗ on the foot outline, if you are unable to feel the pulse [HIGH risk]

To score this Section Risk Result – If all four pulses felt, tick the LOW box.  
If one or more pulses not felt, tick the HIGH box

SECTION RISK RESULT: ☐ LOW ☐ HIGH

### 2) Test for Sensation

- Monofilament to both feet
- ✓ on the foot outline, if the client feels the touch [LOW risk]
- ✗ on the foot outline, if the client cannot feel the touch [HIGH risk]

To score this Section Risk Result – If all four areas are felt, tick the LOW box.  
If one or more areas not felt, tick the HIGH box

SECTION RISK RESULT: ☐ LOW ☐ HIGH

### 3) Look at both Feet - Identify active foot lesions

Draw on the foot outlines if the following active foot lesions are found on the client's feet

- |                      |                              |
|----------------------|------------------------------|
| 1 Flat Feet          | 8 Sores / Ulcers             |
| 2 Highly arched feet | 9 Infection                  |
| 3 Bunion             | 10 Thick toenails            |
| 4 Crooked toes       | 11 Curly Toenails            |
| 5 Amputation         | 12 Infected ingrown toenails |
| 6 Hard skin          | 13 Splinter                  |
| 7 Heel cracks        | 14 Pigmentation              |

To score this Section Risk Result – If no active foot lesions, tick the LOW risk box.  
If one or more active foot lesions, tick the HIGH risk box

SECTION RISK RESULT: ☐ LOW ☐ HIGH

### 4) Identify scars and amputations

Draw on the foot outlines if any scars or amputations are on the client's feet

To score this Section Risk Result – If no scars or amputations, tick the LOW risk box. If one or more scars or amputations, tick the HIGH risk box

SECTION RISK RESULT: ☐ LOW ☐ HIGH

### 5) Identify self-care practices

- Is the client aware of the need to look after diabetic feet?  
Yes / No [circle one]
- Do these feet look well cared for?  
Yes / No [circle one]
- Is the client able to provide the care required?  
Yes / No [circle one]

If you score YES to all questions, tick the LOW risk box. If you score NO to one or more questions, tick the HIGH risk box

SECTION RISK RESULT: ☐ LOW ☐ HIGH

### OVERALL RISK RESULT:

<input type="checkbox"/> LOW	Review Date: _____
<input type="checkbox"/> HIGH	Urgent Referral To: _____





## Appendix 6 Supplementary Data used in this Model

### Methods for data extraction

Data presented include hospitalisation for any lower limb amputation (identified with amputation procedure codes) for individuals aged 25 years and older with atherothrombosis or diabetes. These amputations comprise 75.7% of all amputations in this age group over the time period, the remaining amputations being for conditions that were unlikely to be related to the complications of atherothrombosis (e.g. malignancy or mechanical deformities). Toe and foot amputations were all combined and below, through and above the knee amputations were combined. Men and women were analysed separately. Aboriginal and non-Aboriginal patients were also compared.

In order to minimize variability over time or age group, all toe and foot amputations were aggregated as 'minor' amputations and below, through and above the knee amputations were aggregated (and called 'major' amputations).

#### ICD10-AM codes

Minor: Toe/foot amputation procedure codes: 44338-00, 44358-00, 44361-00, 44361-01, 44364-00, 44364-01, and 90557-00

Major: Above, through, or below knee amputation procedure codes: 44367-00, 44367-02, and 44367-01

Diagnosis of interest:

Disease of the arteries, arterioles, and capillaries: Diagnostic codes 170.xx-179xx in any diagnostic field

Diabetes: Diagnostic codes E10.xx-E14.xx as the principal diagnosis

Ulcer of the lower limb, not elsewhere classified: Diagnostic codes L97.xx as the principal diagnosis

Gangrene, not elsewhere classified: Diagnostic codes R02.xx as the principal diagnosis

Diabetes diagnostic codes: E10.xx-E14.xx



**Table 1 Number of amputations by location, gender, diabetic co-morbidity and financial year, WA, 1999-2008**

	1999_00	2000_01	2001_02	2002_03	2003_04	2004_05	2005_06	2006_07	2007_08	TOTAL
Minor Male without diabetes	30	26	18	21	27	22	21	29	26	220
Minor Male with diabetes	101	118	122	144	135	126	158	165	149	1218
Major Male without diabetes	64	54	51	43	42	45	57	48	37	441
Major Male with diabetes	59	50	48	49	54	51	96	57	52	516
Minor Female without diabetes	11	15	9	21	13	14	12	12	14	121
Minor Female with diabetes	45	48	58	60	67	46	75	56	54	509
Major Female without diabetes	25	23	34	25	13	22	24	19	18	203
Major Female with diabetes	17	20	26	24	24	21	35	32	28	227

**Table 2 NUMBER OF CASES [n] contributing to rates shown in table 3.**

	25-29 yrs	30-34 yrs	35-39 yrs	40-44 yrs	45-49 yrs	50-54 yrs	55-59 yrs	60-64 yrs	65-69 yrs	70-74 yrs	75-79 yrs	80-84 yrs	85+ yrs
Aboriginal, Toe/Foot with Diabetes	3	10	21	22	37	26	41	31	12	3	2	2	1
Non-Aboriginal, Toe/Foot with diabetes	3	8	20	23	54	118	178	197	206	221	227	169	92
Aboriginal, Toe/Foot without diabetes	0	0	0	0	0	0	1	2	0	0	0	0	0
Non-Aboriginal Toe/Foot without diabetes	1	2	4	6	8	5	13	18	29	56	48	69	79
Aboriginal, Knee with diabetes	0	7	2	6	15	15	9	12	4	4	4	1	0
Non-Aboriginal, Knee with diabetes	1	2	2	5	16	39	36	61	102	92	139	97	72
Aboriginal, Knee without diabetes	0	0	1	1	0	0	0	0	0	0	0	2	0
Non-Aboriginal, Knee without diabetes	0	3	3	2	9	13	14	36	56	90	124	133	157



**Table 3 Age-adjusted rates (per 100,000 persons) and trends, toe/foot amputations with/without diabetes for males and females, aged 50 years and over, WA, 1999-2008**

	MALES		FEMALES	
	Without Diabetes	With Diabetes	Without Diabetes	With Diabetes
<b>1999_2000</b>	14.5 (9.1-19.9)	43.9 (34.7-53.1)	4.1 (1.5-6.6)	14.7 (9.9-19.6)
<b>2000_2001</b>	13.0 (7.7-18.3)	47.5 (38.3-56.7)	5.5 (2.7-8.3)	15.7 (10.9-20.6)
<b>2001_2002</b>	9.2 (4.8-13.5)	46.7 (37.5-55.5)	2.5 (0.6-4.4)	18.1 (12.9-23.2)
<b>2002_2003</b>	9.4 (5.1-13.7)	55.1 (45.5-64.7)	7.5 (4.3-10.7)	18.5 (13.4-23.6)
<b>2003_2004</b>	13.1 (8.0-18.2)	49.4 (40.3-58.5)	4.0 (1.7-6.3)	19.9 (14.7-25.1)
<b>2004_2005</b>	9.9 (5.7-14.1)	43.5 (35.3-51.8)	4.2 (1.9-6.5)	12.2 (8.2-16.2)
<b>2005_2006</b>	9.4 (5.2-13.7)	52.9 (44.1-61.8)	3.4 (1.3-5.5)	21.6 (16.3-26.9)
<b>2006_2007</b>	11.3 (6.9-15.7)	54.9 (46.1-63.7)	3.5 (1.4-5.6)	17.1 (12.4-21.8)
<b>2007_2008</b>	9.0 (5.3-12.8)	43.9 (36.3-51.6)	4.2 (2.0-6.5)	14.8 (10.6-19.0)
<b>TREND</b>	Not significant	Not significant	Not significant	Not significant

**Table 4 Age-adjusted rates (per 100,000 persons) and trends, knee amputations with/without diabetes for males and females ages 50 years and over, WA, 1999-2008**

	MALES		FEMALES	
	Without Diabetes	With Diabetes	Without Diabetes	With diabetes
<b>1999_2000</b>	37.2 (27.8-46.5)	26.5 (19.1-33.9)	9.7 (5.9-13.5)	6.3 (3.2-9.5)
<b>2000_2001</b>	29.5 (21.5-37.6)	22.8 (16.1-29.4)	8.6 (5.1-12.2)	7.0 (3.7-10.2)
<b>2001_2002</b>	25.2 (18.1-32.4)	22.2 (15.7-28.8)	12.1 (8.0-16.2)	8.9 (5.3-12.4)
<b>2002_2003</b>	20.6 (14.3-26.9)	20.3 (14.4-26.2)	7.8 (4.6-11.0)	8.3 (4.9-11.8)
<b>2003_2004</b>	18.9 (12.7-25.1)	21.1 (15.0-27.2)	4.1 (1.8-6.4)	8.3 (4.9-11.8)
<b>2004_2005</b>	20.2 (14.0-26.4)	19.8 (14.1-25.5)	7.2 (4.2-10.3)	6.7 (3.7-9.7)
<b>2005_2006</b>	23.7 (17.4-30.1)	35.7 (28.2-43.2)	7.4 (4.4-10.3)	9.7 (6.2-13.2)
<b>2006_2007</b>	17.1 (11.9-22.4)	19.5 (14.2-24.8)	6.0 (3.3-8.7)	9.4 (6.0-12.9)
<b>2007_2008</b>	14.1 (9.4-18.7)	16.2 (11.4-20.9)	5.2 (2.7-7.7)	8.4 (5.2-11.6)
<b>TRENDS</b>	Average yearly % change significant - 8.54 per year (p<0.0001)	Average yearly % change not significant -1.19 (p=0.528)	Average yearly % change significant - 7.74 per year (p=0.0042)	Average yearly % change not significant -3.33 (p=0.208)



## Appendix 7 Current Podiatry Services Perth Metropolitan

Level of Care	Services	Screening	Neurovascular Assess	Education	Treat DM Cat 0-2	TreatDM Cat 2-4, 4A*, 5*, 6*	Treat DM Cat 4A, 4B, 5, 6	Orthoses Non-prescription	Orthoses Prescription	Foot Wear	MDFUC*
Primary – Low acuity foot	CHC's										
	-Armadale	✓	✓	✓	✓			✓			
	-Mandurah	✓	✓	✓	✓			✓			
	-Kwinana	✓	✓	✓	✓			✓			
	Podiatrist NMAHS/SMAHS	✓	✓	✓	✓			✓			
	Derbarl Yerrigan	✓	✓	✓	✓			✓			
	Private Podiatry	✓	✓	✓	✓			✓	✓		
	Senior Citizen Centres	✓		✓	✓						
	NMAHS Ambulatory Care Diabetes team**	✓	✓	✓	✓			✓			
	- Lockridge	✓	✓	✓	✓	✓		✓			
	GP Clinics (GP/Practice Nurse)	✓		✓							
Secondary – Moderate to high acuity foot	Armadale Health	✓	✓	✓		✓		✓	✓	✓	
	Bentley Health	✓	✓	✓		✓		✓	✓	✓	
	Osborne Park	✓	✓	✓		✓		✓	✓	✓	
	Rockingham General	✓	✓	✓		✓		✓	✓	✓	
	Swan Districts	✓	✓	✓		✓		✓	✓	✓	
Tertiary – High acuity foot	Fremantle Hospital		✓	✓			✓	✓	✓	✓	✓
	Royal Perth Hospital		✓	✓			✓	✓	✓	✓	✓
	Sir Charles Gairdner Hospital		✓	✓			✓	✓	✓	✓	✓

\*Multidisciplinary Foot Ulcer Clinic



## Appendix 8 Implementation plan for the high risk model of care

Recommendation	Achieve Now	Further Planning Needed	Extra Resource Required	Partnership	Responsible person (allocated by working group once been to SHEF)
<b>1. Raise awareness of the high risk foot</b>					
<ul style="list-style-type: none"> <li>Establish a comprehensive and coordinated multimedia health promotion and education campaign to raise general awareness of foot problems.</li> </ul>		×	×	Funders, Diabetes WA & other NGOs, DOH WA, DOHA, Aboriginal community controlled health organisations (ACCHO)	
<ul style="list-style-type: none"> <li>Include self management initiatives targeting patients and carers in all education and health promotion campaigns for patients with the high risk foot.</li> </ul>		×		ABHI, training organisations, public & private service providers	
<b>2. Prevent complications of the high risk foot through early detection</b>					
<ul style="list-style-type: none"> <li>Upgrade and expand subsidised senior citizens clinics to include full screening and assessment for the high risk foot, including annual recall systems. Establish systems to oversee and coordinate these services.</li> </ul>		×	×	Local government in partnership with Area Health Services	
<ul style="list-style-type: none"> <li>Encourage generalists in all settings, including therapy/nursing assistants, to carry out foot screening and assessment.</li> </ul>	×	×		Those involved in high risk foot services, WA GP Network, Inter-professional associations, Australian Podiatry Association WA, Silverchain	
<ul style="list-style-type: none"> <li>Advocate for a new Medicare item number for foot screening/assessment by an accredited health professional</li> </ul>		×		Inter-professional learning bodies, DOHA, Australian Podiatry Association	
<b>3. Establish evidence-based guidelines and protocols to manage the high risk foot</b>					
<ul style="list-style-type: none"> <li>In consultation with key stakeholders, endorse and promote use of:               <ul style="list-style-type: none"> <li>○ A universal high risk foot screening and assessment tool</li> </ul> </li> </ul>	×	×		Australian Podiatry Association WA, WA GP	



Recommendation	Achieve Now	Further Planning Needed	Extra Resource Required	Partnership	Responsible person (allocated by working group once been to SHEF)
<p>across WA Health.</p> <ul style="list-style-type: none"> <li>○ Evidence based or best practice consensus guidelines (e.g. foot ulceration, foot osteomyelitis) with key stakeholders for the management of the high risk foot</li> </ul>	×	×		Network, ACCHOs, others involved in screening and management of high risk foot at primary, secondary and tertiary services	
<b>4. Address access inequities (due to geographic and resource allocation disparities) to services for the high risk foot</b>					
<ul style="list-style-type: none"> <li>■ Address current geographical imbalance at all levels of high risk foot services and focus on the areas of greatest need</li> </ul>			×	WACHS, Area Health Services, ACCHOs	
<ul style="list-style-type: none"> <li>■ Use Telehealth to improve access to specialist review and to multi-disciplinary foot ulcer services statewide.</li> </ul>	×			WACHS, Area Health Services, ACCHOs	
<ul style="list-style-type: none"> <li>■ Ensure people living in all metropolitan postcodes are allocated to and can access a community podiatry service.</li> </ul>	×			Area Health Services	
<ul style="list-style-type: none"> <li>■ Improve access to orthopaedic footwear and custom foot orthoses for the high risk foot patients at primary and secondary levels. Investigate expanding inclusion criteria for the Community Aids and Equipment Program (CAEP) to include all patients with a high risk foot.</li> </ul>		×	×	Disability services commission WA Public and private podiatry service providers	
<ul style="list-style-type: none"> <li>■ Advocate increasing the Medicare Enhanced Primary Care / Team Care Arrangement podiatry allowance for patients with chronic disease co-morbidities, to allow continuity and regular management of lower risk clients (who don't need specialised tertiary podiatry) to prevent exacerbations.</li> </ul>				Area Health Services, DOHA, DOH WA	
<b>5. Improve care co-ordination and strengthen the multi-disciplinary approach to management of the high risk foot</b>					
<ul style="list-style-type: none"> <li>■ Improve referral pathways to avoid delays in accessing high risk foot services: <ul style="list-style-type: none"> <li>○ Establish clear bi-directional and enforced referral pathways between primary, secondary and tertiary high risk foot service providers.</li> </ul> </li> </ul>	×	×		Area Health Services, Public & private service providers, ACCHOs	



Recommendation	Achieve Now	Further Planning Needed	Extra Resource Required	Partnership	Responsible person (allocated by working group once been to SHEF)
<ul style="list-style-type: none"> <li>Remove barriers to rapid access to high risk foot services or the multidisciplinary foot ulcer clinics in the event of an acute event.</li> </ul>	×	×		Area Health Services, ACCHOs, Tertiary providers	
<ul style="list-style-type: none"> <li>Establish a modified multidisciplinary high risk foot team at secondary sites (e.g. physician, nurse and podiatrist) to manage simpler high risk foot complications early to prevent deterioration and improve prognosis.</li> </ul>		×	×	Public service providers working in secondary hospitals, Area Health Services	
<ul style="list-style-type: none"> <li>Improve co-ordination, communication and liaison for those admitted to secondary or tertiary hospitals:               <ul style="list-style-type: none"> <li>Strengthen the multidisciplinary approach for inpatients admitted with a high risk foot complication from admission to discharge planning.</li> <li>Ensure all patients admitted to a metropolitan hospital with an acute high risk foot problem are assessed and followed up by a podiatrist.</li> <li>Establish a (virtual) Diabetic Foot Unit at tertiary hospitals, under which patients with an acute diabetic foot complication can be admitted.</li> <li>Develop a clinical consultant nurse / podiatrist-driven wound service across all sites for high risk foot in-patients.</li> </ul> </li> </ul>	×  ×  ×  ×	×  ×  ×  ×	×    ×	Public service providers working in hospitals, Area Health Services	
<ul style="list-style-type: none"> <li>Facilitate and support Aboriginal Health Workers / Aboriginal Liaison Officers to support Aboriginal patients with acute high risk foot problems while in hospital and on discharge and to provide a link to podiatrists in community settings.</li> </ul>		×	×	Workforce, Area Health Services, public sector podiatrists	
<ul style="list-style-type: none"> <li>Foster a culture of Inter-professional learning and Inter-professional practice whenever possible.</li> </ul>	×	×		Area Health Services, Medical, Nursing, Consumer & Allied Health Associations	
<b>6. Improve health outcomes for Aboriginal patients with the high risk foot</b>					
<ul style="list-style-type: none"> <li>Ensure access to culturally appropriate foot education, screening,</li> </ul>					





Recommendation	Achieve Now	Further Planning Needed	Extra Resource Required	Partnership	Responsible person (allocated by working group once been to SHEF)
<p>assessment and treatment programs targeting Aboriginal people in the metropolitan area as well as rural and remote communities.</p> <ul style="list-style-type: none"> <li>○ Implement innovative strategies to engage Aboriginal communities e.g. Multimedia campaign using an Aboriginal celebrity to demonstrate high risk foot prevention and management</li> <li>○ Integrate and standardise processes such as screening, referral and two-way professional development between podiatrists and Aboriginal Health Workers with the development of clear referral guidelines and pathways that distinguish acute from chronic high risk foot for Aboriginal patients.</li> </ul>	<p>×</p> <p>×</p>	<p>×</p> <p>×</p>	<p>×</p> <p>×</p>	<p>ACCHOs, DOH WA, Funders, GTV</p> <p>ACCHOs, Area Health Services, public &amp; private podiatrists</p>	
<ul style="list-style-type: none"> <li>■ Develop collaborative service and education models between Aboriginal Community Controlled Health Organisations, WA Country Health Services and GP practice staff to ensure podiatrists deal with complex high risk foot problems particularly in rural and remote areas</li> </ul>	×	×		ACCHOs, Area health Services, podiatrists	
<ul style="list-style-type: none"> <li>■ Develop mobile outreach high risk foot teams and ensure capacity building occurs with the target communities. Initially consider integration with dialysis services in rural and remote areas</li> </ul>		×	×	ACCHOs Area Health Services, podiatrists in working in private sector	
<ul style="list-style-type: none"> <li>■ Develop an Aboriginal Liaison Officer / Aboriginal Health Worker position specifically to support Aboriginal amputees while in hospital.</li> </ul>		×	×	Area Health Services, training, Workforce	



Recommendation	Achieve Now	Further Planning Required	Extra resource required	Partnership	Responsible person (allocated by working group once been to SHEF)
<b>7. Conduct further research and address ongoing professional development and training in management of the high risk foot</b>					
<ul style="list-style-type: none"> <li>Conduct interdisciplinary research into the high risk foot including epidemiology, assessment of new interventions and qualitative research.</li> </ul>			X	Academics, Area Health Services	
<ul style="list-style-type: none"> <li>Investigate innovative emerging treatment modalities in the management of the high risk foot, such as hyperbaric oxygen therapy<sup>63</sup>, negative wound pressure therapy<sup>64</sup> and ultrasonic wound debridement.</li> </ul>		X	X	Australian Podiatry Association WA, WoundsWest, providers involved in management of the high risk foot	
<ul style="list-style-type: none"> <li>Include diabetic foot care and screening competencies in undergraduate training for nurses, Aboriginal Health Workers, therapy/ nursing assistants and other allied health professionals</li> </ul>	X			Australian Podiatry Association WA, Diabetes WA, Area Health Services	
<ul style="list-style-type: none"> <li>Promote (develop new if required) existing high risk foot education programs for non podiatrists e.g. practice nurses, nurse practitioners, GP's and other allied health professionals. Ensure regular refreshers and professional development opportunities and competency assessments.</li> </ul>	X			Australian Podiatry Association WA, Diabetes WA	
<ul style="list-style-type: none"> <li>Recognise the high risk foot as a specialty area and encourage, enable and support generalists to gain post graduate qualifications</li> </ul>		X	X	Australian Podiatry Association WA, Diabetes WA	
<b>8. Address workforce capacity and capability issues</b>					
<ul style="list-style-type: none"> <li>Address podiatry shortages to ensure future service needs are met.</li> <li>Develop policies to address rural staff recruitment and retention, provide a coordinated approach to professional development; recruit to fill vacant rural posts and create new positions in areas of most need; provide support and management oversight.</li> </ul>		X		Area Health Services, DOH WA	
Recommendation	Achieve	Further	Extra	Partnership	Responsible person (allocated by



	Now	Planning Required	resource required		working group once been to SHEF)
<ul style="list-style-type: none"> <li>Engage and develop strong relationships between private and public podiatrists through education and training, to build the capacity of private practitioners to manage the high risk foot at the primary care level.</li> </ul>		×	×	Australian Podiatry Association WA, Universities	
<ul style="list-style-type: none"> <li>Eliminate the disparity in the classification of clinical podiatry positions providing specialist high risk foot services.</li> </ul>		×		Area Health Services	
<ul style="list-style-type: none"> <li>Explore opportunities for extended scope practitioners involved in the management of the high risk foot, particularly for potential community-based positions where access to specialist podiatry, medical or wound care services is limited.</li> </ul>		×		Area Health Services	
<ul style="list-style-type: none"> <li>Expand the existing podiatry internship program to include all tertiary facilities, secondary service sites and rural centres.</li> </ul>	×			Academic institutions and WACHS	
<ul style="list-style-type: none"> <li>Assist in the establishment of career pathways and registration facilities for therapy/ allied health / nurse assistants / foot care assistants, Aboriginal Health Workers / Aboriginal Liaison Officers involved in basic foot screening and education.</li> </ul>		×		Area Health Services, Workforce, Marr Mooditj	
<ul style="list-style-type: none"> <li>Investigate the inclusion of a specialist podiatrist with the WoundsWest consultancy service.</li> </ul>		×	×	DOH WA, WoundsWest	



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