

“Footprints for Life”

Foot Health of Aboriginal and Torres Strait Islander Peoples

Matthew West

Bachelor of Podiatry
Bachelor of Health Science (Honours)

Submitted for the degree of Doctor of Philosophy



University of Newcastle, Ourimbah
Faculty of Health and Medicine
Discipline of Podiatry

Statement of originality

I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

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Acknowledgement of authorship

I hereby certify that the work embodied in this thesis contains published papers of which I am a joint author. I have included as part of the thesis a written declaration endorsed in writing by my supervisor, attesting to my contribution to the joint publications. By signing below I confirm that Matthew West contributed to:

Conception of study, database searches, assessment of papers for inclusion, performing quality appraisal of included studies, data extraction, manuscript preparation and management of its submission, and responded to peer review to the publications entitled:

- Defining the gap: a systematic review of the difference in rates of diabetes-related foot complications in Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians
- Where do we stand? The availability and efficacy of diabetes related foot health programs for Aboriginal and Torres Strait Islander Peoples: a systematic review.

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- Foot health of Aboriginal and Torres Strait Islander Peoples in regional and rural NSW, Australia

Study design, data collection, results interpretation and manuscript preparation for the papers submitted for publication entitled:

- Development and implementation of a culturally safe foot care service for Aboriginal and Torres Strait Islander Peoples: The Buridja Clinic
- Yarning about foot care: Evaluation of a foot care service for Aboriginal and Torres Strait Islander Peoples
- Effect of a culturally safe student placement on students' understanding of, and confidence with, providing culturally safe podiatry care

[Supervisor Signature]

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Synopsis

The limited available data shows Aboriginal and Torres Strait Islander Peoples have disproportionately high rates of diabetes-related foot disease, and experience amputation up to 38 times more frequently than non-Indigenous Australians. The high rate of diabetes-related foot disease in this population results in reduced quality of life, elevated hospitalisation rates and associated expenditure, and significantly contributes to preventable deaths. The reasons for higher rates of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples are complex, with a lack of available culturally safe care, low socioeconomic status and poor engagement with Western health services significantly contributing to the current catastrophic outcomes. To effectively address diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples, a better understanding of the extent of the problem is required, and, there needs to be improved access to culturally safe foot care through better service provision and a more culturally capable health workforce.

This thesis had the overarching aims of establishing the foot health of Aboriginal and Torres Strait Islander Peoples in the local Central Coast community, and developing methods to improve access to, and delivery of, culturally safe foot care. This thesis investigated, via systematic review, the current state of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples and the availability and effectiveness of foot care services to reduce diabetes-related foot complications in this population. The reviews demonstrated there is a lack of nationwide data relating to diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples, and, that most data focuses on amputation rates, with little information available regarding specific types of diabetes-related foot complications. Nevertheless we found Aboriginal and Torres Strait Islander Peoples had between a 3 to 6 fold increased likelihood of both foot ulcer and minor or major amputation, and, that these occurred at a younger age. Furthermore, we found no evidence of state- or nation-wide foot health programs for prevention of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples. Existing services were localised and there was little evaluation of the acceptability of these programs, levels of community engagement or impact on foot disease.

Subsequently through an extensive community consultation process we used an effective co-design approach to develop a foot care service embedded in an undergraduate podiatry program. Key design elements included; integrating ongoing community consultation; involvement of Aboriginal health workers and practitioners connected to their local community; recognising the role of community in cultural capability training of health students; and, creating a flexible and accessible care model that is aligned with the community foot care priorities.

To conduct a comprehensive evaluation of the foot care service model, we used culturally appropriate methods to determine the Aboriginal and Torres Strait Islander perspective of program success through research yarns and customised surveys, as well as service utilisation data. These data demonstrated that service elements including yarning circles and group appointments, as well as student placements, increased participant engagement with, and ownership of the clinic. Increasing accessibility to the clinic was flagged as a mechanism to further increase engagement. In addition, student placement in a culturally safe clinic significantly improved students' understanding of multiple aspects of cultural capability (e.g. understanding of culture, history, and their interrelationship with health and health care delivery), and level of confidence with providing culturally appropriate and safe foot care. In summary this research highlights the devastating impact of diabetes-related foot disease for Aboriginal and Torres Strait Islander people and the importance of a co-designed approach to delivery of culturally safe foot health care, as well as the central role of immersive experiences for developing a culturally safe future podiatry workforce

List of Definitions

Cultural Safety: ‘the ongoing critical reflection of health practitioner knowledge, skills attitudes, practising behaviours and power differentials in delivering safe, accessible and responsive healthcare free of racism’

Cultural Capability:

List of Abbreviations

ACCHO Aboriginal Community Controlled Health Organisations

ACCHS Aboriginal Community Controlled Health Services

AHW Aboriginal Health Worker

AHS Aboriginal health service

AMS Aboriginal Medical Service

CAD Coronary artery disease

DART Diabetic Foot Assessment of Risk form

DFD Diabetes-related foot disease

DM Diabetes mellitus

FHSQ Foot Health Status Questionnaire

GP General Practitioner

IDFP Indigenous diabetic foot program

NSW New South Wales

NT Northern Territory

QLD Queensland

OR Odds ratio

RR	Risk ratio
PAD	Peripheral arterial disease
SD	Standard deviation
SPSS	Statistical package for social sciences
T2DM	Type 2 diabetes mellitus
WA	Western Australia

Chapter 1

Introduction

1.1 Indigenous health and health outcomes

Globally the health of Indigenous peoples in countries such as the United States, Canada, New Zealand and Australia is known to be significantly worse than the general population (1, 2). Sharing characteristics as minority populations in colonised countries, the health disparities between Indigenous and non-Indigenous peoples are significant, with the Indigenous populations having substantially worse health outcomes across a range of health indicators (1, 2). These include higher rates of cancers and chronic disease and increased likelihood of poor outcomes including development of related complications, lower life expectancy and higher rates of infant mortality (3).

In Australia, Aboriginal and Torres Strait Islander Peoples have lower life expectancy by 7.8 years for females and 8.6 years for males compared with non-Indigenous Australians (3). Consistent with Indigenous populations globally, Aboriginal and Torres Strait Islander Peoples experience chronic diseases such as diabetes at far higher rates than non-Indigenous Australians, and this significantly contributes to the lower life expectancy of this population (4). High prevalence of risk factors including overweight/ obesity, hypertension, dyslipidaemia and smoking, as well as poor diet and physical inactivity in this population, are directly linked to poorer health outcomes. Risk of ill-health is further exacerbated by a clustering of factors that directly influence health and health seeking behaviour. These include historical, cultural, economic, geographic and community-based factors that cumulatively reduce access to adequate health care, resulting in poorer health outcomes (5, 6).

1.1.1 Diabetes in Aboriginal and Torres Strait Islander Peoples

Globally, the prevalence of diabetes is rapidly increasing. In 2011, 366 million people were affected and this figure is expected to rise to 552 million by 2030 (7). In Australia in 2013 there were 1.6 million people living with diabetes and this is anticipated to increase to 2.3 million cases by 2035 (8). Increased prevalence of diabetes will be accompanied by significant increases in the associated health care costs which are already estimated to be in excess of \$14 billion annually (9).

International trends suggest that prevalence of diabetes is disproportionately high among socioeconomically disadvantaged people (10). This finding is reflected at a national level with the burden of diabetes much greater among the Aboriginal and Torres Strait Islander community than the broader Australian population (4). The rate of diabetes among the Aboriginal and Torres Strait community is three times that of the general population (4). Approximately 11% of all Aboriginal and Torres Strait Islander adults are diagnosed with diabetes, while another estimated 11% have the disease but are undiagnosed (11). Aboriginal and Torres Strait Islander people also develop diabetes at a younger age (approximately 14 years earlier than in the general population) and have a six times increased risk of the disease in adolescence compared with their non-Indigenous counterparts (12). Consistent with elevated prevalence of diabetes, rates of hospitalisation as a result of diabetes-related complications are four times higher in the Aboriginal and Torres Strait Islander community than in any other group of Australians (13).

1.1.1.1 Diabetes and its complications

Diabetes is a systemic chronic metabolic disorder characterised by periods of hyper- and hypoglycaemia (14, 15). Type 1 diabetes refers to glycaemic volatility originating from an idiopathic or autoimmune process through which pancreatic beta cells are destroyed, resulting in complete insulin deficiency and requiring insulin therapy (16, 17). Type 2 diabetes develops as a result of insulin resistance which initially results in an increase in insulin production that is then followed by insulin deficiency (18). Type 2 diabetes is the most common form of diabetes, accounting for up to 90% of reported cases (18).

If well managed, diabetes can have minimal impact on an individual's physical health (15). Poorly controlled diabetes, however, can manifest as multi-system complications, with widespread endothelial dysfunction being a key component of pathologies affecting the macro- and microvascular systems (18). Both acute and chronic hyperglycaemia induce

endothelial dysfunction via disruption of a number of metabolic pathways. This leads to increased oxidative stress, reduction in bioavailability of nitric oxide (which is a potent vasodilator), and reduced vascular permeability (19). These pathogenic changes create a pro-ischaemic and pro-atherosclerotic state, increasing the incidence and severity of both coronary artery disease (CAD) and peripheral arterial disease (PAD). CAD and associated myocardial infarction is the leading cause of death in people with diabetes (18, 20). People with diabetes also have a 10-fold increase in risk of stroke (21) and poorer long-term health outcomes (22, 23). In addition, there is an increased risk of systemic microvascular disease including nephropathy, retinopathy, and neuropathy with the latter condition linked to the development of silent myocardial ischaemia and sudden death (18, 24, 25).

1.1.1.2 Foot related complications of diabetes

Diabetes-related foot disease (DFD) including ulceration, ischaemia, non-healing wounds and amputation are common complications of diabetes. Foot complications contribute significantly to the socioeconomic burden of chronic disease in Australia (26). Diabetes-related lower limb amputation also account for 85% of all lower limb amputations (27) and comprise approximately 9.6% of health care costs associated with diabetes (28).

In the lower limb, vascular pathology is the primary contributor to the development of DFD, including foot ulceration, ischaemia, non-healing wounds and limb loss (29). Macrovascular complications in the periphery present as PAD – progressive stenoses of the lower limb arteries due to atherosclerosis. In people with diabetes the incidence of PAD is four-fold higher than in those without diabetes and the condition progresses more rapidly, is more severe, is more likely to result in development of foot ulcer, and, is an independent risk factor for lower limb amputation (30-32).

In addition to increased risk of PAD, diabetes-related microvascular changes in the lower limb further contribute to the likelihood of foot complications, affecting cutaneous blood flow, the healing response and the development of peripheral neuropathy. Recent research has demonstrated a reduction in size, density and permeability of capillaries in older people with type 2 diabetes and neuropathic foot ulceration (33). In conjunction with increased stiffness of the capillary wall, these changes result in the reduced capacity for vasodilation and leukocyte migration in response to injury, subsequently reducing healing capacity and increasing the risk of infection (34, 35).

Microvascular disease also results in neural ischaemia and the development of diabetes-related neuropathy which in the periphery may affect the somatic and autonomic nervous systems (25). Peripheral sensorimotor (somatic) neuropathy results in a loss of protective

sensation in the foot, thereby increasing the risk of unperceived trauma (36). In addition, related muscle atrophy contributes to the development of foot deformity (25) and increases the likelihood of foot ulceration (37). Autonomic neuropathy results in changes to control of microvascular function which contribute to localised ischaemia and limited vasodilatory capacity (38, 39).

1.1.1.3 Diabetes-related complications in Aboriginal and Torres Strait Islander Peoples

Aboriginal and Torres Strait Islander People with diabetes are known to have significantly elevated risk of developing a range of complications associated with diabetes. This includes a 30-fold increase in risk of retinopathy and six-fold increase in renal disease (40). Risk of complications increase with smoking, chronic hyperglycaemia, and obesity. Aboriginality has been independently associated with a five-fold increase in risk of foot ulcer (40).

These findings are consistent with data relating to prevalence of diabetes-related complications in Indigenous populations globally. Although generally sparsely reported, prevalence is understood to be high with complications being more common and more severe regardless of geographical location (41). Rapid shifts away from traditional diets and lifestyles as well as possible genetic susceptibility to diabetes are proposed as possible causes for comparable increases in reported prevalence of diabetes and its complications in Indigenous populations (41).

In addition, contemporary socioeconomic disadvantage such as lower levels of education, low income and high unemployment are more common among Indigenous populations globally, and also correlate with increased prevalence of diabetes (10, 41). Data examining comparable risk of cardiovascular disease among Indigenous Canadians, urban Aboriginal and remote Aboriginal Australians found these groups share similar HbA1C readings, hypertension levels and diabetes duration, placing them at increased risk of diabetes-related cardiovascular disease (42, 43). In New Zealand, when compared to four other local ethnicities, Māori people were found to have the greatest risk of lower limb amputation secondary to diabetes (44).

1.1.1.4 Diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples

There are currently little existing data evaluating the nature and extent of DFD in Aboriginal and Torres Strait Islander people. Available evidence is limited to specific geographic regions and/or services and no data are currently available for New South Wales (NSW).

Nevertheless, data for other states and territories are consistent with global trends in Indigenous populations (45). In the Fremantle Diabetes Study, Aboriginality was demonstrated to be independently associated with a five-fold increase in likelihood of foot ulceration (40). Poor foot health outcomes including infection, neuropathy, ulceration and amputation are all reported to be more common or severe among Aboriginal and Torres Strait Islander cohorts (40, 46-48). Diabetes-related major lower limb amputation in the Aboriginal and Torres Strait population has also been shown to occur at a younger age and at a rate up to 38 times higher than that in age matched non-Indigenous counterparts. The disproportionate representation of Aboriginal and Torres Strait Islander Peoples in those undergoing lower limb amputation has been demonstrated at local and state-wide levels (48-50).

Various factors have been suggested to contribute to the poorer foot health outcomes in Indigenous Australians. As with other Indigenous populations, high prevalence of risk factors for DFD including PAD and peripheral neuropathy, poor glycaemic control, elevated rates of obesity, smoking as well as social disadvantage and geographic isolation are likely to influence the risk, and outcomes of, foot complications (48, 51, 52). In addition, lack of access to appropriate foot care services and lack of health literacy regarding foot care and foot complication prevention may also be significant contributors to current high rates of DFD (51).

1.1.2 Preventing diabetes-related foot disease

Best practice for managing risk of DFD in the broad population is well understood (53). Early mitigation of modifiable risk factors such as smoking, diet, alcohol consumption, hypertension and dyslipidaemia while maintaining appropriate blood glucose control, is known to reduce risk of future complications (18, 54-56). Despite this, prevalence of modifiable risk factors among Aboriginal and Torres Strait Islander Peoples remains high (4, 42).

Other strategies to reduce incidence of DFD include patient education, implementation of foot checks, objective measures of neurological and vascular health, and early referral to a podiatrist (53). Again, reported evidence indicates that interaction with early intervention programs and therefore opportunities to educate Aboriginal and Torres Strait Islander cohorts remains low across all regions where rates of amputation are high (48, 52). This is supported by the generally higher instance of diabetes-related neuropathy among the Aboriginal and Torres Strait Islander community (40), which is described as a preventable complication (53).

1.1.3 Existing prevention and management services for diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples

Despite the known elevated risk of DFD in the Aboriginal and Torres Strait Islander community, the success of diabetes foot care services for prevention and management of diabetes-related foot complications in this population is limited (57, 58). It is difficult to fully appreciate the relative success of existing services as limited data are available on how populations interact with currently available services. A recent audit of the Central Coast Local Health District Podiatry Service demonstrated a lack of engagement with preventative foot care services, with 100% of service utilisation associated with treatment of chronic and severe DFD (52). Other available evidence also suggests that Aboriginal and Torres Strait representation in existing public podiatry programs is low, despite high rates of foot disease. This is shown in recent data for far north Queensland in which Aboriginal and Torres Strait Peoples accounted for only 18% of people attending high risk foot service but more than 50% of people undergoing lower limb amputations (48). This research suggests there may be under-utilisation of existing diabetes-related foot care services however, further investigation nationally needs to be undertaken.

1.2 Barriers to accessing care

The ability of Aboriginal and Torres Strait Islander Peoples to access and engage with existing preventative foot care services is limited by a number of factors, particularly in rural and remote communities (encompassing all areas outside major cities in Australia) (48, 52). These are considered key drivers behind health disparities between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians (59). Barriers to accessing foot care services are multifactorial but are fundamentally related to lack of access to culturally safe care. Culturally safe care is defined as an ongoing process that encompasses lifelong the ‘critical reflection of health practitioner knowledge, skills attitudes, practising behaviours and power differentials in delivering safe, accessible and responsive healthcare free of racism’ (59) and is judged by the recipient of that care (60). Specific to foot health, service inadequacies include limited ability of foot care services to recognise the importance of family and community in care provision, as well as, their failure to understand the importance of culture and identity in Aboriginal and Torres Strait Islander Peoples’ perception and understanding of health and illness (61-64). Additionally, the fatalist beliefs towards one’s own health (i.e. that ill-health is unavoidable) and towards Western health service provision (i.e. that accessing health care is only for the very sick and has negative outcomes) has been documented in Australian Aboriginal and Torres Strait Islander Peoples. These beliefs are central to Indigenous people and are associated with

socioeconomic inequality and act as evidence for a lack of improvement in health outcomes through a Western model of health care delivery (64). These barriers have resulted in under-utilisation of existing preventative foot care services with data indicating that Aboriginal and Torres Strait Islander people typically only access foot care services when more complex problems, such as ulceration and infection, occur (50, 52). Contact with foot care services at this stage is a contributing factor to the high rates of hospitalisation, amputation, and overall poorer health outcomes seen in this population (50, 52). The limited engagement with existing preventative foot care services has also led to very little data on the health care seeking behaviours of Indigenous communities, adding further to the complexity of effectively closing the health inequities gap (48, 52).

Evidence suggests that culturally safe intervention programs are effective in managing short (three months) to medium (six months) term risk among ethnic minorities with type 2 diabetes (65). Specifically, improved glycaemic control is reported after people had access to culturally appropriate health education (65). Limited availability of culturally appropriate foot care programs may explain poor rates of recruitment and retention into preventive services (52). When consulted, Aboriginal and Torres Strait Islander people report they prefer to develop their own educational tools (57). Despite this, limitations in practitioner knowledge and inability to determine early risk status of DFD in rural and remote services may be contributing to poor outcomes in these regions (66). This is a major concern as the highest rates of amputation are in rural and remote Aboriginal and Torres Strait Islander populations (49, 50).

Consideration of these barriers by all stakeholders is needed to help shape future service development and delivery, and in order to unlock more pathways for these communities to better access and engage with culturally safe foot care services. Health care design and delivery that attempts to address these barriers is urgently needed. Importantly, service design and delivery must be driven by Aboriginal and Torres Strait Islander Peoples so that services are culturally safe in order to encourage and empower community members to seek out and engage with the foot care service. In addition to a high level of community participation and ownership, recommendations for effective health programs for Aboriginal and Torres Strait Islander people include delivery in the local area through a primary health care service to avoid cultural alienation and disempowerment, and to encourage attendance. Ideally, services are led by an Aboriginal or Torres Strait Islander person who has an established relationship with the community (67).

1.2.1 Culturally safe diabetes-related foot care services

There are a number of examples of new services that have improved access to diabetes health care service and patient outcomes in Indigenous communities in Australia. These share common characteristics, including: community consultation in the development, implementation and ongoing management of the service; involvement of Aboriginal Health Workers; and a focus on self-management and patient participation in health through improved health literacy (62, 68, 69). The Goorie Diabetes Complication and Assessment clinic, for example, runs across four sites in Casino, New South Wales, and was implemented following extensive community consultation, and included establishment of a multidisciplinary care team including Aboriginal Health Workers (62). This clinic significantly increased first time and recurrent attendances at the service. Similarly, the Better Living Diabetes project was developed in consultation with the local community by the Goondir Aboriginal and Torres Strait Islander Corporation for Health Services in Dalby, Queensland (68). The project provides clinical services and education to people with diabetes and includes training in self-management and risk assessment. High uptake of the service and continual community support for the project further demonstrates the success of a service that is customised to meet community need.

There have been several diabetes foot care services developed specifically for Indigenous Australians. These include the Indigenous Diabetic Foot Program which uses culturally appropriate resources and culturally capable staff and focuses on improving access to Podiatry care services through training of Aboriginal Health Workers to recognise “at risk feet” and establishing referral pathways for podiatry care (57). Although implemented in four rural area health services in NSW, there has been limited evaluation of the effectiveness of this workforce training approach to improving interaction with Podiatry services. The Mooditj Djena Foot Care program is a collaborative venture between a Local Aboriginal Medical Service and the Western Australian Department of Health (70). The service runs over eight separate sites and offers mobile clinics that target Aboriginal and Torres Strait Islander peoples with high risk feet (e.g. PAD or peripheral neuropathy, poorly controlled diabetes). Service providers include podiatrists, a diabetes educator, and Aboriginal Health Workers. The program reports high attendance although there has been little other evaluation of the service model.

1.3 Cultural capability in health practitioners

Health professionals play a vital role in determining the experiences of patients when accessing health care. A key determinant of the success of these experiences is the cultural capability of

health practitioners. Cultural capability in a health care setting has the goal of delivering culturally aware and safe care to every patient regardless of race, ethnicity, culture, or language proficiency (71). Health practitioners should approach management of Aboriginal and Torres Strait Islander people with an understanding that these patients place significant importance on culture, family, and community and view these interrelated concepts as central to their health and wellbeing (72).

Limited understanding and awareness of cultural safety by health professionals can lead to limited engagement of patients with health care (61, 64, 73), mistrust of health services and professionals (74), and disempowerment of patients (75). Contrastingly, research has demonstrated that when practitioners have increased cultural capability this has resulted in greater treatment adherence (76) and health seeking behaviour (77), as well as, improved patient satisfaction (78). However, research evaluating health practitioners' cultural capability has focused on Indigenous populations outside of Australia and health professionals such as medicine and nursing (79-81). Therefore, further investigation of the cultural capability in an Australian setting, and in foot health care professionals (such as podiatrists), is needed to help develop an understanding of existing levels of cultural capability in this profession.

1.4 Teaching cultural safety in health practitioners

Further to establishing existing levels of cultural capability in foot care professionals is the need to evaluate both the development and delivery of cultural capability and safety training programs. This is important because it is well established that improved cultural capability is a key determinant in reducing inequalities for both access to, and delivery of, effective health care for Aboriginal and Torres Strait Islander Peoples (59).

Educational institutions and health care organisations play an important role in the design and delivery of curricula for cultural capability training. However, a number of barriers to wide-ranging, ongoing, and mandatory cultural capability training have been identified at both an undergraduate and postgraduate level. For example, research has demonstrated a lack of flexibility and insufficient institutional investment in Indigenous health curricula development and delivery (82). These barriers are compounded by a lack of resources to promote integrated community engagement with existing programs (83), adding further to the schism between Indigenous and non-indigenous communities. Furthermore, in Australia there is a lack of national standards for the provision of cultural capable healthcare services (59). Further supporting the need to develop quality undergraduate curricula is research demonstrating that it can have a profound impact on health professionals entering the workforce (84), as well as,

improved health care outcomes for Aboriginal and Torres Strait Islander Peoples being linked to culturally capable practitioners (85).

Research evaluating the components of cultural capability training have identified the need for programs to shift from a categorical approach, in which participants are told what to do and what not to do, to a more holistic and shared approach (86). This pivot in approach is seen as a way to improve training design and delivery because a categorical approach has been criticised as misrepresenting and oversimplifying culture and fails to consider it as a fluid concept with little appreciation for diversity that occurs within this community group (87-89). Research evaluating immersive type training programs are limited and generally attempt to measure the effect on allied health professionals' cultural capability (90), with no research considering the role of cultural capability training in a podiatry specific setting. Importantly, cultural capability training should be developed and delivered by Aboriginal and Torres Strait Islander community members to help ensure programs are safe and applicable to local communities.

1.5 Summary

The nature and extent of DFD in Aboriginal and Torres Strait Islander people has not yet been comprehensively evaluated. A number of individual studies demonstrate over representation of Aboriginal and Torres Strait Islander people in clinical populations with DFD and undergoing amputation, particularly in regional, rural and remote Australia. While there are some examples of culturally safe approaches to provision of diabetes and diabetes-related foot care the success of such programs to date on uptake of services by communities and preventing DFD has not been systematically assessed. Further to the need to evaluate available services is the need to establish Indigenous perspectives of foot health and their own requirements for foot care. Such an approach to form the foundation of foot care service provision is vital to ensuring services meet the needs and expectation of the community. Development of a DFD prevention service using a community led co-designed approach to provide local services that are embraced by community members. Addressing the nationwide need support Aboriginal and Torres Strait Islander people to reduce the impact of DFD in their communities requires a translatable service framework founded on a successful co-design approach that supports development of a culturally safe health care workforce.

1.6 Thesis aims and hypotheses

The aims of this thesis are:

Aim 1 – To establish the scope of current literature relating to the nature and extent of DFD in Aboriginal and Torres Strait Islander Peoples compared to the broader Australian community (Chapter 2).

Aim 2 – To establish the nation-wide availability and effectiveness of currently available foot care services and programs for DFD prevention and management in Aboriginal and Torres Strait Islander Peoples (Chapter 3).

Aim 3 – To determine the self-perceived foot health status of community-based Aboriginal and Torres Strait Islander Peoples in regional and rural New South Wales, Australia (Chapter 4).

Aim 4 – To develop a foot care service for Aboriginal and Torres Strait Islander Peoples that is community led, promotes sustained community engagement, and contributes to long-term improvement in access to culturally safe foot care (Chapter 5).

Aim 5 – To undertake a multifaceted evaluation of a community led foot care service including service utilisation, and the acceptability of the service from the perspective of Aboriginal and Torres Strait Islander clients (Chapter 6).

Aim 6 – To evaluate the effect of undertaking clinical placement in a culturally safe podiatry service for Aboriginal and Torres Strait Islander Peoples on podiatry students' cultural capability (Chapter 7).

The hypotheses relating to these aims are that Aboriginal and Torres Strait Islander Peoples experience DFD including foot ulcer and amputations at higher rates than non-Indigenous Australians, and, that there are limited culturally safe foot health services available with little investigation of their effectiveness. It is expected Aboriginal and Torres Strait Islander Peoples in regional and rural areas are likely to perceive their foot health as poor due to the high rates of chronic disease in these populations. In addition, it is hypothesised that a co-designed culturally safe foot care service embedded in a university-based podiatry program will support strong community engagement, have high levels of acceptability from a client perspective, and, increase student perceived capability in delivering culturally safe care.

Chapter 2

Defining the gap: a systematic review of the difference in rates of diabetes-related foot complications in Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians

Matthew West¹, Vivienne Chuter^{1,2}, Shannon E. Munteanu^{3,4}, Fiona Hawke¹

¹Discipline of Podiatry, University of Newcastle, Ourimbah, NSW, 2258, Australia

²Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, Newcastle, NSW, 2308, Australia

³Discipline of Podiatry, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria 3086 Australia

⁴La Trobe Sport and Exercise Medicine Research Centre, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria, 3086, Australia

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*At stages throughout this chapter we have abbreviated Aboriginal and Torres Strait Islander to – ATSI. This has only been done in tables where it would not otherwise fit. We respectively acknowledge the importance of referring to this community as Aboriginal and Torres Strait Islander Peoples.

2.1 Abstract

2.1.1 Background

The Aboriginal and Torres Strait Islander community has an increased risk of developing chronic illnesses including diabetes. Among people with diabetes, foot complications are common and make a significant contribution to the morbidity and mortality associated with this disease. The aim of this review was to systematically evaluate the literature comparing the rates of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples to non-Indigenous Australians.

2.1.2 Methods

MEDLINE, EMBASE, The Cochrane Library; PUBMED and CINAHL were searched from inception until August 2016. Inclusion criteria were: published cross-sectional or longitudinal studies reporting the prevalence of diabetes-related foot disease in both a cohort of Aboriginal and Torres Strait Islander Peoples and a cohort of one other Australian population of any age with diabetes. Risk of bias was assessed using the STROBE tool.

2.1.3 Results

Eleven studies including a total of 157,892 participants were included. Studies were set in Queensland, the Northern Territory and Western Australia, primarily in rural and remote areas. Aboriginal and Torres Strait Islander Peoples experienced substantially more diabetes-related foot disease with the mean age up to 14 years younger than non-Indigenous Australians. Aboriginality was associated with increased risk of peripheral neuropathy, foot ulceration and amputation. In several studies, Aboriginal and Torres Strait Islander Peoples accounted for the vast majority of diabetes-related foot disease (57% to 91%) while comprising only a small proportion of the regional population. Reporting quality as assessed with the STROBE tool showed underreporting of: methods, sample description and potential sources of bias. There are no data available for some Australian states and for specific types of diabetes-related foot disease.

2.1.4 Conclusion

Aboriginal and Torres Strait Islander Peoples have a three to six-fold increased likelihood of experiencing a diabetes-related foot complication compared to non-Indigenous Australians. Evidence-based, culturally appropriate screening and intervention programs and improved access to effective health care services are required to prevent a widening of the gap in diabetes-

related foot disease between Aboriginal and Torres Strait Islander and non-Indigenous Australians.

2.2 Introduction

The Aboriginal and Torres Strait Islander community has increased risk of developing chronic illness including diabetes (11). Among people with diabetes, foot complications are common and make a significant contribution to the morbidity and mortality associated with the disease (28). In 2008, the age-standardised rate of diabetes was nearly three and four times greater among Aboriginal and Torres Strait Islander men and women respectively when compared to non-Indigenous Australians (51). This same report found diabetes accounted for 16% of all hospitalisations within the Aboriginal and Torres Strait Islander community, was the primary cause of hospitalisation in 6% of all hospitalisations and an associated diagnosis in 11% of all hospitalisations (51). Diabetes-related complications have also been found to make up the majority [67%] of preventable hospitalisations for chronic conditions for Aboriginal and Torres Strait Islander Peoples (91), significantly contributing to the seven-fold increase risk of diabetes-related mortality in this population (92).

For Aboriginal and Torres Strait Islander Peoples, development of complications secondary to diabetes commonly precedes the diagnosis of diabetes itself (93). Such complications include retinopathy, nephropathy and neuropathy (28) and indicate a patient has had prolonged periods of hyperglycaemia (94). The chronic nature of these conditions renders them difficult to treat. Recommended sustained lifestyle modifications and intensive multidisciplinary team action have varied effectiveness (95), especially when compared to the benefits of prevention through early effective management and education (96). The challenge of such management is further exacerbated by higher prevalence of known unhealthy lifestyle behaviours such as smoking, and high rates of obesity in the Aboriginal and Torres Strait Islander community which are associated with poorer treatment outcomes (92). In the foot, the secondary complications of diabetes often culminate in ulceration, chronic wounds, infection and amputation (28).

Considerably higher rates of diabetes among Aboriginal and Torres Strait Islander Peoples suggest the existing trend of higher diabetes-associated hospitalisation among this population compared to their aged match non-Indigenous peers will continue (51). Although estimated to be higher than in the general population, little is known about rates of diabetes-related foot disease (DFD) in Aboriginal and Torres Strait Islander Peoples, making development and implementation of targeted, effective prevention and management strategies challenging (91). Therefore, the aim of this review was to systematically evaluate the literature reporting rates of DFD for Aboriginal and Torres Strait Islander Peoples compared to non-Indigenous Australians.

2.3 Methods

This systematic review was developed and reported according to the guidelines provided by the Preferred Reporting of Systematic Reviews and Meta-Analysis (PRISMA) as seen in figure 2.1.

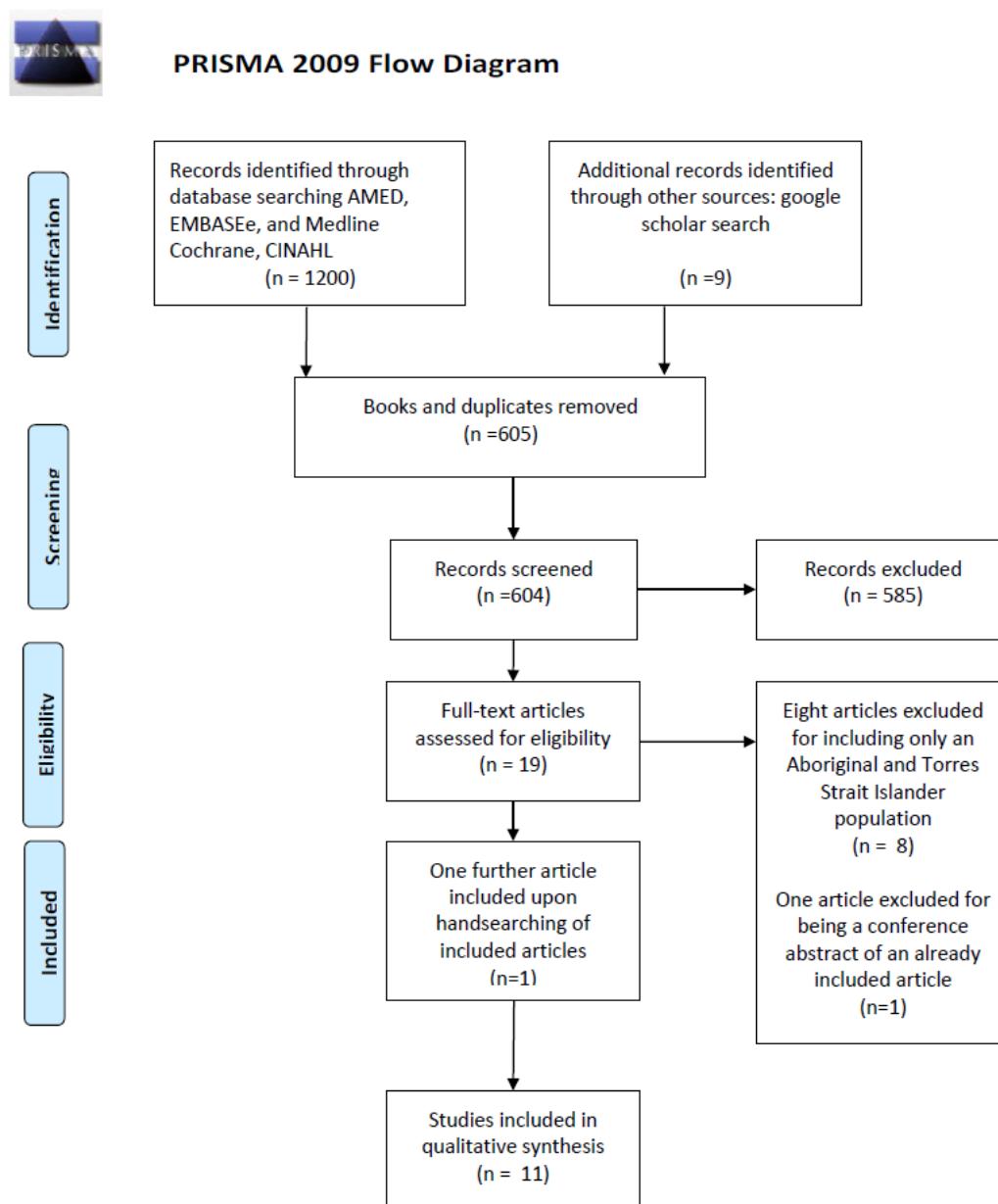


Figure 2.1. PRISMA flow diagram

2.3.1 Data sources

An electronic database search was conducted in August 2016 of MEDLINE (January 1966 to August 2016) EMBASE (January 1980 to August 2016); Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library, latest issue); PUBMED (January 1966 to August 2016); CINAHL (from 1982). The keyword terms used in different combinations were: Aborig*, Indigenous, Australia*, Lower limb, Foot, Leg, Ankle, Ulcer, Neuro*, Amputat*, Diabet*, Vascular, Peripheral arterial disease, Ischaemi*. No language, publication date or publication status restrictions were used but only original published literature were eligible for inclusion. The MEDLINE search string is provided in table 2.1 as an example. The following search strategies were used to supplement electronic searches: checking of reference lists of included studies, relevant clinical guidelines and review articles; citation tracking for included studies; and contacting prominent authors in the field.

Table 2.1. Example of search for MEDLINE

1.	Aborig*
2.	Indigenous
3.	1 or 2
4.	Australia*
5.	3 and 4
6.	Lower limb
7.	Foot
8.	Leg
9.	Ankle
10.	Ulcer
11.	Neuro*
12.	Amputat*
13.	Vascular
14.	Peripheral arterial disease
15.	Ischaemi*
16.	6-15/or
17.	5 and 16

Published studies providing cross-sectional or longitudinal data on the prevalence of DFD in both a cohort of Aboriginal and Torres Strait Islander Peoples and a cohort of one other Australian population of any age with diabetes were eligible for this review. Studies reporting prevalence of foot complications in Aboriginal and Torres Strait Islander Peoples only were excluded as comparative regional data for non-Indigenous Australians is required to determine the extent of the disparity in diabetes-related complications in Aboriginal and Torres Strait Islander Peoples. Included studies were required to report foot complications associated with diabetes, including lower limb amputation of any level, cellulitis, Charcot neuroarthropathy, intermittent claudication, ischaemia, necrosis, sensory, autonomic and/or motor neuropathy, peripheral arterial disease, ulceration and/or wound infection. One reviewer conducted the electronic searches (MW). Titles and abstracts were independently assessed by two reviewers

(MW and FH). Disagreements were resolved by discussion. A third reviewer (VC) was to arbitrate disagreements, but this was not required.

2.3.2 Data extraction

MW extracted study data using standardised, pilot-tested data extraction forms, which were checked for transcription errors and completeness by FH. Data were extracted for eligibility criteria, mean age and age range of the cohort, gender, ethnicity, geographic region (state and urban/remote setting), study types (including population based and hospital audits), method of data collection for complications (i.e. measured, hospital records, self-report), type of diabetes, and type of complication.

2.3.3 Assessment of study quality

Completeness of reporting was assessed independently by MW and FH using the STROBE checklist. The STROBE tool is a series of questions set out as a check list. See supplementary material. Articles are then scored as reporting or not reporting each item to give an overall view of completeness of reporting (97). Disagreements were resolved by discussion. No record was kept of disagreements. A third reviewer (VC) was to arbitrate disagreements that were not easily resolved but again, this was not required.

2.3.4 Analysis

Data are reported as whole numbers and/or percentages for prevalence or incidence, and odds ratios (OR) for magnitude of difference between Aboriginal and Torres Strait Islander and non-Indigenous groups where this was reported. Due to heterogeneity between studies and lack of reporting of participant numbers no meta-analysis was performed. This included heterogeneity of populations (i.e. regional versus urban) and heterogeneity of DFD complications outcomes

2.4 Results

2.4.1 Overview of included studies

Electronic searching retrieved 1,209 articles. All books (437) and duplicates (168) were excluded leaving 604 articles to be screened (figure 2.1). Of these, 585 were not relevant to the topic and 19 were potentially relevant. All potentially relevant studies were reviewed in full text. Eight articles were then excluded for including only an Aboriginal and Torres Strait Islander cohort (43, 98-103). One further article (104) was then excluded for being a conference

abstract of an already included study (105) which upon contact with the author was confirmed to offer no further relevant data. Ten remaining articles met all inclusion criteria for this review (40, 46-50, 105-108). Three of the ten included articles were produced from the one study, the Fremantle Diabetes Study (40, 47, 106). Hand searching for articles reporting the Fremantle Diabetes Study identified one further study for inclusion (109). Therefore, 11 articles were included, and four of those reported in the Fremantle Diabetes Study.

2.4.2 Characteristics of included studies

A summary of study characteristics is included in table 2.2. All studies included both an Aboriginal and Torres Strait Islander cohort and one other non-Indigenous cohort. Two studies did not report sample sizes (49, 50). Of the remaining studies sample sizes ranged from 51 (108) to 1,237 (47). Regions studied include Cairns and Townsville in Queensland reported in four studies (48, 105, 107, 108), Tennant Creek and Darwin in the Northern Territory (46, 49), one state-wide study in Western Australia (50) and one study in Fremantle (published as four papers) (40, 47, 106, 109). Most studies were audits of previously collected data (46, 48-50, 107, 108) with the exception of one study (105) which collected data at the time of occasion of service in hospital inpatients. Audit data included three specific hospital audits (48, 49, 108), one high risk foot clinic audit (107), one audit of a dialysis unit (105) and one audit of amputation data for the state of Western Australia (WA) (50).

The Fremantle Diabetes Study consisted of a series of cross-sectional studies conducted as two phases between 1993 to 1996 and 2008 to 2011 (40, 47, 106, 109). Participants in the Fremantle Diabetes study were recruited from centres of health care provision within the same zip code defined region of the city of Fremantle. Centres included but were not limited to: inpatient and outpatient hospital clinics; primary care and specialist physicians; allied health services; and pharmacies. Findings are presented in table 2.2.

Table 2.2. Summary of included studies

Study	Design	Location	n. of ATSI (as % of sample)	Findings
Commons (46)	Prospective single sample review of consecutive inpatients with diabetes-related foot infections	Darwin, NT	144 (81.4)	Indigenous people had a greater incidence of admission (RR: 5.1; 95%CI: 3.8 to 7.0), were younger (mean difference: 11.1 years; $p < 0.001$), and more likely to undergo major amputations (RR: 4.1; 95%CI: 1.6 to 10.7), and minor amputation (RR: 6.2; 95%CI: 3.5 to 11.1). Non-multi resistant methicillin resistant staphylococcus aureus was present in more wounds for Indigenous people than non-Indigenous patients (44.7% vs. 20.6%; OR: 3.1; 95%CI: 1.5 to 6.4), whereas <i>P. aeruginosa</i> presence was significantly less (15.8% versus 46.0%; OR: 0.22; 95%CI: 0.11 to 0.45). Rate of known peripheral vascular disease was lower among Indigenous people (13.2% vs. 34.9%; $p=0.001$). Rate of prior amputation among indigenous people was higher (33.3% vs. 19.0%; $p=0.043$). There was no important difference in prevalence of osteomyelitis between ATSI (36.0%) and non-ATSI (34.9%).
Ewald (49)	Clinical audit of two hospitals in Alice Springs and Tennant Creek	Tennant Creek, NT	Not reported	Indigenous people made up 89% of individuals with foot complications and 91% of separations for diabetes-related foot but comprised only 38% of the total regional population.
Gilhotra (105)	Clinical audit of Dialysis Centre	Townsville, QLD	113 (51.8)	Indigenous status was independently associated with lower limb amputation (OR: 4.98; 95%CI: 1.3 to 19.23; $p=0.02$) in people with end-stage renal failure on dialysis.
Norman (50)	Clinical audit of all lower limb amputations in WA	WA, state wide	Not reported	Among people 25 to 49 years of age with diabetes, major amputations were 38 times more likely and minor amputations 27 times more likely in ATSI than non-ATSI. 98% of amputations in Indigenous people were associated with diabetes.
O'Rourke (48)	Clinical audit of 143 diabetes mellitus-related major amputations between 1998 and 2008	Cairns Base Hospital, QLD	74 (51.7)	ATSI people accounted for 51.7% of the 143 major diabetes-related amputations performed yet comprised about 9.6% of the regional population. PAD was diagnosed in 48.6% of ATSI and 11.6% of non-ATSI who underwent amputation. The mean age at the time of amputation was 56.3 years for ATSI, 14 years younger than that for non-ATSI. Pressure ulcers necessitated amputation in 4.1% of ATSI and 4.3% of non-ATSI.

Study	Design	Location	n. of ATSI (as % of sample)	Findings
Rodrigues (107)	Clinical audit of people attending the high risk foot clinic	Townsville, QLD	23 (17.8)	In people with diabetes-related foot ulcers, Indigenous ethnicity was independently associated with lower limb amputation (OR: 3.1; 95%CI: 1.17 to 9.16; p=0.001). The mean age at amputation was similar between ATSI (mean yrs 62.6; SD 12.5) and non-ATSI (mean yrs 62.0; SD 11.5).
Steffen (108)	Clinical audit of 51 patients admitted to with diabetes-related foot complications that required surgical intervention	Cairns Base Hospital, QLD	29 (56.9)	Indigenous people accounted for 57% of audit cases yet comprised 13% of the regional population. Mean age at surgical intervention was 9.5 years younger in ATSI than non-ATSI people (56.5 vs. 66.0).
Baba (40)	Series of longitudinal observational studies	Fremantle, WA	120 (4.3)	Aboriginality was independently associated with a foot ulcer at baseline in pooled phase samples (OR: 4.8; 95%CI: 1.7-13.7; p=0.004).
Davis (109)			18 (2.2)	At baseline in people with type 2 diabetes, there were no statistically significant differences between ATSI and non-ATSI in prevalence of neuropathy (41.2% vs. 32.9%; p=0.45); PAD (16.7% vs. 29.5%; p=0.30) or foot ulceration (5.6% vs. 1.2%; p=0.22).
Davis (47)			Baseline = 37 (3.0)	In 1,237 people with type 2 diabetes, Aboriginal background was identified as an independent risk factor for neuropathy (OR: 3.7; 95%CI: 1.17-11.70; p=0.03)
Davis (106)			Phase 1 = 19 (2.3) Phase 2 = 106 (11.8)	At baseline in phase 1, there were no statistically significant differences between ATSI and non-ATSI in prevalence of peripheral sensory neuropathy (38.9% vs. 33.6%; p=0.62) or PAD (15.8% vs. 29.7%; p=0.31). At baseline in phase 2, there were statistically significant differences between ATSI and non-ATSI in the prevalence of peripheral sensory neuropathy (48.5% vs. 63.3%; p=0.005) and PAD (30.7% vs. 21.5%; p=0.04).

ATSI: Aboriginal and Torres Strait Islander; RR: Rate ratio; OR: Odds ratio; PAD: Peripheral Arterial/Vascular Disease; T2DM: Type 2 Diabetes Mellitus, QLD: Queensland, WA: Western Australia, NT: Northern Territory

2.4.3 Rates of foot complications in reported populations

Thematic analysis of extracted data from included studies relating to specific foot complications including amputation, peripheral neuropathy, peripheral arterial disease (PAD), ulceration and infection is shown in table 2.4. Rates of amputation were consistently higher in Aboriginal and Torres Strait Islander cohorts than in non-Indigenous cohorts (46, 48, 50, 105, 107). The greatest difference was reported by Norman et al. (50). In their clinical audit of all lower limb amputations in WA there was a 38 fold higher rate of major lower limb amputation and a 27 fold higher rate of minor amputation among Aboriginal and Torres Strait Islander Peoples 25 to 49 years of age with diabetes (50). Aboriginal and Torres Strait Islander Peoples were also more likely to be admitted to hospital for diabetes-related foot ulcerations (46) and to require surgical intervention for diabetes-related foot complications (four times greater for major amputation and six times greater for minor amputations) (108). Findings of the Fremantle Diabetes Study were inconsistent between study phases, possibly due to different study populations and study timing, and due to the small proportion of Aboriginal and Torres Strait Islander Peoples included. Pooling of participants from baseline in both phases found that Aboriginality was independently associated with foot ulcer (OR: 4.8; 95% confidence intervals [CI]: 1.7-13.7; $p=0.004$) (106). Two studies referred to the population of the geographical region they were examining at the time of publication as a benchmark to establish that Aboriginal and Torres Strait Islander Peoples experienced the majority of foot complications while comprising a minority of the regional population (49, 108). Complications examined in both studies included infection and amputation. In studies that reported rates of foot complications alongside regional populations, Aboriginal and Torres Strait Islander Peoples experienced the majority of foot complications while comprising a minority of the regional population (49, 108).

2.4.4 Quality appraisal

The STROBE tool was used to summarise completeness of reporting, which varied across studies. All included studies reported study setting and location, eligibility criteria and number of individual participants (Table 2.3). Despite this, in most studies demographic information specific to the sample of included Aboriginal and Torres Strait Islander Peoples was not provided. This limits generalisability of the findings. Papers reporting the Fremantle Diabetes Study (40, 47, 106, 109) were generally more completely reported. Among other papers, quality of reporting tended to be better in recent publications. Underreporting of methods and sample description may in some cases be due to the brevity of the publications. This is particularly true of Norman et al, which, despite containing important data, was published as a letter to the editor.

Table 2.3. STROBE Methodological Appraisal

		Baba 2015	Commons 2015	Davis 2007	Davis 2008	Davis 2012	Ewald 2001	Gilhotra 2016	Norman 2010	O'Rourke 2013	Rodrigues 2016	Steffen 1998
Title and abstract	a) Indicate the study's design with a commonly used term in the title or the abstract											
	b) Provide in the abstract an informative and balanced summary of what was done and what was found											
Introduction: Background/ rationale	Explain the scientific background and rationale for the investigation being reported											
Introduction: Objectives	State specific objectives, including any prespecified hypotheses											
Methods: Study design	Present key elements of study design early in the paper											
Methods: Setting	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection											
Methods: Participants	Give the eligibility criteria, and the sources and methods of selection of participants											
Methods: Variables	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable											
Methods: Data sources/ measurement	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group											
Methods: Bias	any efforts to address potential sources of bias											

		Baba 2015	Commons 2015	Davis 2007	Davis 2008	Davis 2012	Ewald 2001	Gilhotra 2016	Norman 2010	O'Rourke 2013	Rodrigues 2016	Steffen 1998
Methods: Study size	Explain how the study size was arrived at											
Methods: Quantitative variables	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why											
Methods: Statistical methods	a) Describe all statistical methods, including those used to control for confounding											
	b) Describe any methods used to examine subgroups and interactions											
	c) Explain how missing data were addressed											
	d) If applicable, describe analytical methods taking account of sampling strategy											
	e) Describe any sensitivity analyses											
Results: Participants	a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed											
	b) Give reasons for non-participation at each stage											
	c) Consider use of a flow diagram											
Results: Descriptive data	a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders											
	b) Indicate number of participants with missing data for each variable of interest											
Results: Outcome data	Report numbers of outcome events or summary measures											
Results: Main results	a) Give unadjusted estimates and, if applicable, confounder-adjusted											

		Baba 2015	Commons 2015	Davis 2007	Davis 2008	Davis 2012	Ewald 2001	Gilhotra 2016	Norman 2010	O'Rourke 2013	Rodrigues 2016	Steffen 1998
	estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included											
	b) Report category boundaries when continuous variables were categorized											
	c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period											
Results: Other analyses	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses											
Discussion: Key results	Summarise key results with reference to study objectives											
Discussion: Limitations	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias											
Discussion: Interpretation	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence											
Discussion: Generalisability	the generalisability (external validity) of the study results											
Other information: Funding	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based											

Key: Green shading: done; red shading: not done; yellow: unclear; blank: not applicable.

Table 2.4. Thematic summary of included study findings

Themes	Study	Key Findings
Amputation	Commons (46)	Indigenous people had a greater incidence of major amputations (RR: 4.1; 95%CI: 1.6 to 10.7), and minor amputation (RR: 6.2; 95%CI: 3.5 to 11.1). Rate of prior amputation among indigenous people was higher (33.3% vs. 19.0%; p=0.043).
	Ewald (49)	Indigenous people made up 89% of individuals with foot complications and 91% of separations for diabetes-related foot but comprised only 38% of the total regional population.
	Gilhotra (105)	Indigenous status was independently associated with lower limb amputation (OR: 4.98; 95%CI: 1.3 to 19.23; p=0.02) in people with end-stage renal failure on dialysis.
	Norman (50)	Among people 25 to 49 years of age with diabetes, major amputations were 38 times more likely and minor amputations 27 times more likely in ATSI than non-ATSI. 98% of amputations in Indigenous people were associated with diabetes.
	O'Rourke (48)	ATSI people accounted for 51.7% of the 143 major diabetes-related amputations performed yet comprised about 9.6% of the regional population. The mean age at the time of amputation was 56.3 years for ATSI, 14 years younger than that for non-ATSI.
	Rodrigues (107)	Indigenous ethnicity was independently associated with lower limb amputation (OR: 3.1; 95%CI: 1.17 to 9.16; p=0.001). The mean age at amputation was similar between ATSI (mean yrs 62.6; SD 12.5) and non-ATSI (mean yrs 62.0; SD 11.5).
	Steffen (108)	Indigenous people accounted for 57% of audit cases yet comprised 13% of the regional population. Mean age at surgical intervention was 9.5 years younger in ATSI than non-ATSI people (56.5 vs. 66.0).
PAD	Commons (46)	Rate of known peripheral vascular disease was lower among Indigenous people (13.2% vs. 34.9%; p=0.001)
	O'Rourke (48)	PAD was diagnosed in 48.6% of ATSI and 11.6% of non-ATSI who underwent amputation.
	Davis (106)	At baseline in people with type 2 diabetes, there were no statistically significant differences between ATSI and non-ATSI in prevalence of); PAD (16.7% vs. 29.5%; p=0.30) At baseline in phase 1, there were no statistically significant differences between ATSI and non-ATSI in prevalence of PAD (15.8% vs. 29.7%; p=0.31). At baseline in phase 2, there were statistically significant differences between ATSI and non-ATSI in the prevalence of PAD (30.7% vs. 21.5%; p=0.04).
Peripheral neuropathy	Davis (109)	At baseline in people with type 2 diabetes, there were no statistically significant differences between ATSI and non-ATSI in prevalence of neuropathy (41.2% vs. 32.9%; p=0.45);
	Davis (47)	In 1,237 people with type 2 diabetes, Aboriginal background was identified as an independent risk factor for neuropathy (OR: 3.7; 95%CI: 1.17-11.70; p=0.03
	Davis (106)	At baseline in phase 1, there were no statistically significant differences between ATSI and non-ATSI in prevalence of peripheral sensory neuropathy (38.9% vs. 33.6%; p=0.62)
Ulceration	O'Rourke (48)	Pressure ulcers necessitated amputation in 4.1% of ATSI and 4.3% of non-ATSI.
	Rodrigues (107)	In people with diabetes-related foot ulcers, Indigenous ethnicity was independently associated with lower limb amputation (OR: 3.1; 95%CI: 1.17 to 9.16; p=0.001).
	Baba (40)	Aboriginality was independently associated with foot ulcer at baseline in pooled phase samples (OR: 4.8; 95%CI: 1.7-13.7; p=0.004).
Infection	Commons (46)	Non-multi-resistant methicillin resistant S. aureus was present in more wounds for Indigenous people than non-Indigenous patients (44.7% vs. 20.6%; OR: 3.1; 95%CI: 1.5 to 6.4), whereas P. aeruginosa presence was significantly less (15.8% versus 46.0%; OR: 0.22; 95%CI: 0.11 to 0.45).

2.5 Discussion

Based on the limited data that are currently available, our review has demonstrated higher rates of both diabetes-related foot ulcer and lower limb amputation in Aboriginal and Torres Strait Islander Peoples compared to the non-Indigenous population. This finding was consistent across all geographical areas included in this review (i.e. regional and rural areas in Queensland and the Northern Territory as well as Western Australia). Aboriginality was shown to be an independent risk factor for DFD resulting in a three to fivefold increased likelihood (105, 107), and sixfold increased relative risk (46) of a lower limb amputation and fivefold increased likelihood of foot ulcer (40) as detailed in table 2.4. Similarly, Aboriginal and Torres Strait Islander Peoples had a fourfold increased likelihood of peripheral neuropathy compared to a non-Indigenous population (47).

Consistently, Aboriginal and Torres Strait Islander Peoples were shown to experience higher rates of amputation than their non-Indigenous counterparts, despite making up a smaller proportion of the populations. O'Rourke et al. (48) reported that in a region where Aboriginal and Torres Strait Islander Peoples comprised less than 10% of the regional population, they accounted for more than half of all amputations. Norman et al (50) when examining trends in amputation for arterial disease or diabetes-related separations, found that of individuals 25 to 49 years of age with diabetes, Aboriginal and Torres Strait Islander people were 38 times more likely than non-Indigenous Australians to undergo a major amputation and 27 times more likely to undergo a minor amputation. The increased risk of lower limb amputation among Aboriginal and Torres Strait Islander people was also found among people with end-stage renal failure on dialysis (105).

In the Fremantle Diabetes study, Aboriginality was independently associated with neuropathy (47) and foot ulceration (40). This is consistent with findings of several other studies in the review, including an independent association between Aboriginality and increased risk of progression of foot ulcer to amputation by O'Rourke et al. (48), and increased risk of hospitalisation with diabetes-related foot infection for Aboriginal and Torres Strait Islander people (46). Of people admitted to hospital with diabetes-related foot infections, Aboriginal and Torres Strait Islander people were reported to be younger, and at greater risk of minor and major amputations than non-Indigenous Australians, despite no significant difference in peripheral vascular disease or osteomyelitis (46).

Similar findings were reported for Indigenous populations in New Zealand, Canada and United States of America. In Canada, for example, Indigenous Canadians experience diabetes and its complications at a higher prevalence and at a younger age than non-Indigenous Canadians

(110). Compared to non-Indigenous Canadians, Indigenous Canadians are four times more likely to have diabetes and 16 times more likely to experience DFD (110). In New Zealand, Maori people are more likely than people of other ethnicities to have lower limb amputation secondary to type 2 diabetes, even after adjusting for demographic variables (44). Differences in rates of diabetes-related foot complications between Indigenous and non-Indigenous populations in high income countries discussed above may be a result of historical (and in some parts, continuing) social exclusion and discrimination, reduced health care literacy and access, modifiable lifestyle factors, and lack of culturally appropriate screening and early intervention programs.

A commonly reported finding was that amputation occurs considerably earlier among Aboriginal and Torres Strait Islander populations than their non-Indigenous peers. For example, Norman et al (50) reported Aboriginal and Torres Strait Islander people aged 25 to 49 years had a 27 times higher risk of incurring a minor diabetes-related lower limb amputation. One possible explanation may be that as well as experiencing a higher rate of type two diabetes compared to their age match non-Indigenous peers (51), Aboriginal and Torres Strait Islander populations from a young age (youth aged 12-15) were found to be up to 57% more likely to have poor diet, increased BMI and be smokers (51). The increased prevalence of such lifestyle risk factors are known to be associated with the increased prevalence of diabetes-related lower limb complications (including hospitalisations, surgery and amputation).

Despite evidence that the prevalence of diabetes is higher, growing faster and causing more hospitalisation within the Aboriginal and Torres Strait Islander community (51, 91) there is little published evidence on specific interventions programs for this community. The evidence that is available reports health practitioner knowledge about diabetes-related lower limb complications in rural and remote areas is low, and the ability to determine early stage risk of lower limb complication among broad populations with diabetes in these regions is poor (66). This is of significant relevance to the Aboriginal and Torres Strait Islander population as our review indicates that communities in rural and remote areas were found to experience the greatest rates of amputation (48-50, 108).

Current evidence supports the use of culturally appropriate intervention to increase short to medium term knowledge of diabetes among ethnic minorities (65). There are a number of examples of new services that have improved access to diabetes care service and patient outcomes in Aboriginal and Torres Strait Islander communities in Australia. These share common characteristics, including community consultation in the development, implementation and ongoing management of the service; involvement of Aboriginal Health Workers, and a focus on self-management and patient participation in health through improved health literacy

(62, 68, 69). While there are also several foot care programs that have been developed to target prevention of foot complications in Aboriginal and Torres Strait Islander populations, there has been limited published evaluation of the success of these in reducing rates of foot complications (57, 58). Our review findings highlight an urgent need for culturally appropriate foot care intervention programs to be comprehensively evaluated, and for effective programs to be widely implemented to reduce rates of DFD and associated morbidity and mortality in Aboriginal and Torres Strait Islander Peoples. As called for by the Close the Gap Progress and Priorities Report of 2015, a much greater focus on access to appropriate primary health care services (including early diagnosis, intervention and education) is required to improve health and life expectancy for Aboriginal and Torres Strait Islander Peoples (92).

2.5.1 Limitations

This review aimed to report data on the prevalence of DFD in Aboriginal and Torres Strait Islander Peoples compared to that of non-Indigenous Australians. While we performed an exhaustive search for relevant literature, other forms of publications (e.g. government reports) were not included in this review. Furthermore, the purpose of this review was to compare rates of DFD in Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians, therefore while there are some data relating to Aboriginal and Torres Strait Islander people only, these were not included as without comparable regional data these studies would not add to the findings of this paper. This review has highlighted the limited data that are currently available comparing DFD in Aboriginal and Torres Strait Islander Peoples and non-Indigenous populations in Australia. Available data mainly focuses on amputation rates and there is little information relating to other DFD e.g. Charcot neuroarthropathy and peripheral arterial disease. As the data from the retrieved studies were specific to several geographical regions in Australia (i.e. Western Australia, Northern Territory and Queensland) the results of this review are not necessarily generalisable nationally. Nevertheless, these findings do highlight consistently high rates of DFD in Aboriginal and Torres Strait Islander Peoples across several geographic regions and the need for related research at a national level to better inform future health care practice.

The quality of research and reporting in studies included in the systematic review varied. Longitudinal studies tended to collect data for more variables and were therefore better able to identify factors associated with DFD. For some audits, data summaries were limited to descriptive statistics. Future research should include detailed sample descriptions, careful description of how DFD is diagnosed and statistical measures of spread. Importantly, for audits comparing Aboriginal and Torres Strait Islander and non-Indigenous populations, researchers should state the proportion of people within the health system of unknown Aboriginal and Torres Strait Islander /non-Indigenous status.

2.6 Conclusion

Aboriginal and Torres Strait Islander Peoples experience substantially more DFD than non-Indigenous Australians. This disparity is seen clearly in rates of foot ulceration and amputation. In the limited available comparative data, we found Aboriginal and Torres Strait Islander Peoples had between a 3-6 fold increased likelihood of both foot ulcer and minor or major amputation and that these occurred at a younger age. There are a lack of nationwide data relating to DFD in Aboriginal and Torres Strait Islander Peoples, and most data focuses on amputation rates with little information available regarding specific types of diabetes-related foot complications. Greater knowledge of the breadth and depth of this critical problem is required to fully inform implementation of effective evidence-based culturally appropriate screening and intervention programs.

2.7 Declarations

2.7.1 Funding

The primary author is in receipt of a PhD scholarship funded by the Lowitja Institute.

2.7.2 Authors' contributions

MW: performed all searches, wrote up the review

FH: assisted in the review process to included articles and edited review

VC: edited drafts of completed review

SM: completed final review and edit

2.7.3 Acknowledgement

The Lowitja Institute.

Chapter 3

Where do we stand? The availability and efficacy of diabetes-related foot health programs for Aboriginal and Torres Strait Islander Peoples: a systematic review.

Vivienne Chuter^{1,2}, Matthew West¹, Fiona Hawke¹, Angela Searle¹

¹School of Health Sciences, Faculty of Health, University of Newcastle, PO Box 127 Ourimbah, NSW, 2258, Australia

²Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, PO Box 127 Ourimbah, NSW 2258, Australia

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*At stages throughout this chapter (and its associated appendix – appendix 1) we have abbreviated Aboriginal and Torres Strait Islander to – ATSI. This has only been done in figures or tables where it would not otherwise fit. We respectfully acknowledge the importance of referring to this community as Aboriginal and Torres Strait Islander Peoples.

3.1 Abstract

3.1.1 Background

Aboriginal and Torres Strait Islander Australians experience considerably higher rates of diabetes and diabetes-related foot disease and amputations than non-Aboriginal Australians. Therefore there is a need to identify aspects of Aboriginal and Torres Islander focussed foot health programs that have had successful outcomes in reducing diabetes-related foot disease. Wider knowledge and implementation of these programs may help reduce the high burden of diabetes-related foot disease experienced by Aboriginal and Torres Strait Islander Australians.

3.1.2 Methods

PubMedD, Informit Indigenous collection, CINAHL, SCOPUS, the Cochrane Library and grey literature sources were searched to 28th August 2018. We included any published reports or studies of stand-alone diabetes-related foot care interventions, programs, services, educational resources or assessment of these interventions, designed for Aboriginal and Torres Strait Islander Peoples.

3.1.3 Results

Thirteen studies detailing interventions in the Northern Territory, New South Wales, Queensland and Western Australia met the inclusion criteria. Five reports described delivery of podiatry services while the other eight investigated educational and training programs. Half of the reports related to aspects of the Indigenous Diabetic Foot Program which provides culturally appropriate foot education and training workshops for health care providers. One article reported quantitative data related to clinical patient outcome measures.

3.1.4 Conclusion

No state- or nation-wide foot health programs for prevention of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples were identified. One program achieved high adherence to the national guidelines regarding timing of podiatric review treatments through use of an evidence based foot risk classification tool and provision of services in a culturally appropriate centre.

3.2 Introduction

Diabetes mellitus is one of the fastest growing chronic diseases in the world (111). Aboriginal and Torres Strait Islander Australians experience four times the rate of diabetes compared to non-Aboriginal Australians, with an overall incidence of 13% (112), and rates as high as 42% reported in some remote communities (113). As the leading cause of lower limb amputation, and with high rates of associated mortality, diabetes-related foot disease (DFD) is a major, but poorly recognised health care burden in Australia, estimated to cost in excess of \$1.6 billion annually (114, 115). Evidence demonstrates Aboriginal and Torres Strait Islander Australians have a three to six fold increased risk of DFD including neuropathy, foot ulcer and lower limb amputation compared to non-Aboriginal Australians (50, 116).

Consequently the National Health and Medical Research Council Guidelines for the prevention of foot complications in diabetes state that ‘Until adequately assessed all Aboriginal and Torres Strait Islander people with diabetes are considered to be at high risk of developing foot complications and therefore will require foot checks at every clinical encounter and active follow-up’ (117). International guidelines suggest that up to 85% of diabetes-related amputations could be prevented with early detection of problems and appropriate treatment (118). Despite the evident need for effective preventative foot care in this population, available data indicate poor engagement with existing preventative care services in contrast to high rates of related hospitalisation and amputation (50, 52, 116).

A number of examples of culturally safe services for Aboriginal and Torres Strait Islander communities in Australia have increased access to combined diabetes care services and improved patient outcomes (62, 68, 69, 119-122). These share common characteristics, including community consultation in the development, implementation and ongoing management of the service; involvement of Aboriginal Health Workers (AHW); and a focus on self-management and patient participation in health through improved health literacy. For example the Goorie Diabetes Complication and Assessment clinic runs across four sites in Casino, New South Wales, and was implemented following extensive community consultation, and included establishment of a multidisciplinary care team including Aboriginal Health Workers (62). This clinic significantly increased first time and recurrent attendances at the service. Similarly, the Better Living Diabetes project was developed in consultation with the local community by the Goondir Aboriginal and Torres Strait Islander Corporation for Health Services in Dalby, Queensland (68). The project provides clinical services and education to people with diabetes and includes training in self-management and risk assessment. High uptake of the service and continual community support for the project further demonstrates the success of a service that is customised to meet community need.

There is an obvious and urgent need to identify similarly successful standalone foot health programs for the prevention of DFD in Aboriginal and Torres Strait Islander Peoples.

3.3 Methods

An electronic database search of PubMed (using Lit.search <https://www.lowitja.org.au/litsearch> from the Lowitja Institute which was developed as a search tool for Aboriginal and Torres Strait Islander health articles), Informit Indigenous collection, CINAHL, SCOPUS, and the Cochrane Library was conducted from database inception to 28th August 2018. Additional hand searches of grey literature sources were also conducted including of the Lowitja Institute, Menzies School of Health Research, Australian Indigenous HealthInfoNet (www.healthinfonet.ecu.edu.au), Services for Australian Rural and Remote Allied Health (www.sarrah.org.au), and the Australia Institute of Health and Welfare (<http://www.aihw.gov.au/>). Reference lists of included studies, clinical guidelines and review articles were also searched. Authors of included studies and reports were contacted where intentions of further evaluation was stated, and, where information was provided, it has been included in this review. The PubMed search strategy as generated from the Lowitja Institute is detailed in appendix 1. Inclusion criteria were any published reports of stand-alone diabetes-related foot care interventions, programs, services, educational resources or assessment of these interventions, designed for Aboriginal and Torres Strait Islander Peoples. Interventions were excluded if foot care was embedded within a broader health program due to likelihood of variability in the extent and reporting of the foot care component, and, the confounding effect of the broader health care program on foot specific outcomes. Foot care services not designed specifically for Aboriginal Australians were also excluded. One reviewer conducted the electronic searches (AS). Titles and abstracts were independently assessed by two reviewers (AS and VC). Disagreements were resolved by consensus and a third reviewer where necessary (MW).

Extraction of the study data and assessment of the methodological quality of the included studies was conducted by two authors (AS and VC) using the Observational Study and Qualitative Study Appraisal Checklists designed by Health Evidence Bulletins – Wales (123). These checklists are designed for critical appraisal of observational and qualitative studies and were selected as they include a small number of key domains, are simple checklists rather than scales and were developed using a variety of literature sources (124).

3.4 Results

The database and literature search resulted in a total of 1305 citations of which 75 were appropriate for full text review (figure 3.1). After review, 13 articles met the inclusion criteria (table 3.1), and 62 studies were excluded (appendix 1). The methodological quality of the included articles is detailed in table 3.2 and table 3.3. Five articles were reports providing overviews of services provided or materials produced so quality assessment was not considered appropriate (125-129). Of the remaining articles, two were qualitative studies (57, 58) and six were cohort or cross-sectional studies (70, 90, 130-133). All of the studies provided detailed information regarding the population studied and aims of the investigations. One of the studies reviewed mainly hospital-based renal dialysis patients, which could make comparison to wider community-based populations difficult (90). None of the trials reported any cost information related to development or implementation of the interventions.

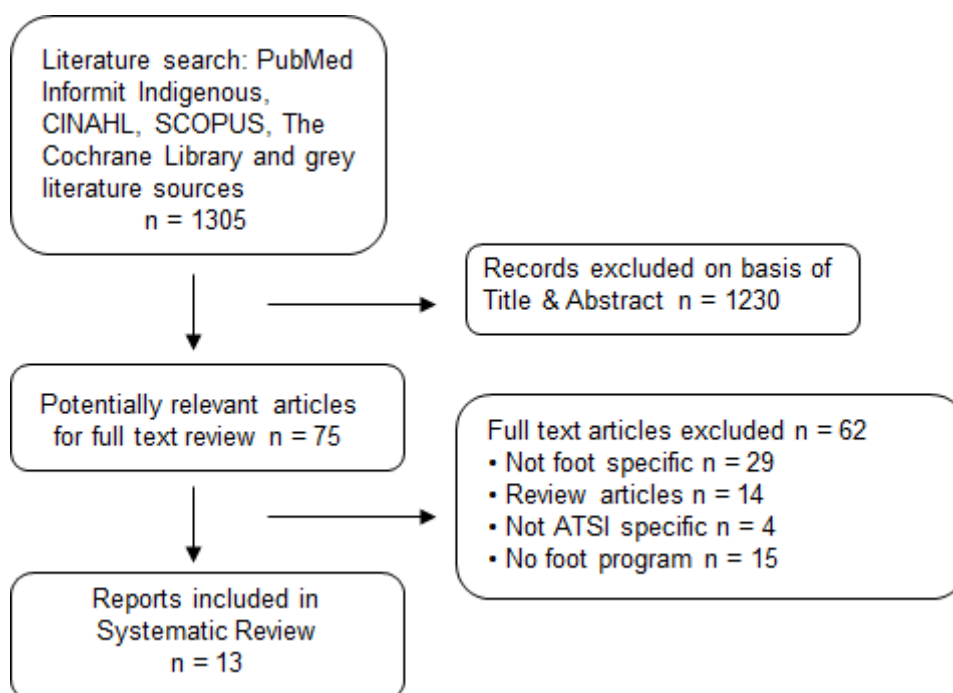


Figure 3.1. Flowchart diagram of systematic review inclusion and exclusion.

ATSI: Aboriginal and Torres Strait Islander, Combined programs: diabetes or chronic disease programs with a foot health component, review articles: including guideline documents and systematic reviews, no foot program: health interventions without a foot health component

The thirteen articles detailed foot programs which were conducted in New South Wales (NSW), Queensland (QLD), Western Australia (WA) and the Northern Territory (NT) with the majority in rural, regional or remote areas (table 3.1). Five of the articles described delivery of podiatry services to Aboriginal communities (70, 126, 127, 129, 130, 134), three described the development of specific foot education resources (58, 125, 128), and the remaining five

assessed foot educational and training programs (57, 90, 131-133). Seven of the thirteen reports described aspects of the Indigenous Diabetic Foot Program (IDFP) (57, 90, 126, 128, 131-133).

Table 3.1. Included reports

Author, program & location	Program type	Program description & staffing	Reported outcomes	Culturally safe aspects
<p>Bandaranaike, 2010 (90)</p> <p>Stamping out diabetic foot in the Pilbara, Western Australia</p> <p>Pilbara, WA</p>	Conduct & assess training program	<p>Staff training in IDFP at Port Hedland Hospital Dialysis unit and four Western Desert communities in March-April 2009.</p> <p>Diabetes clients were provided with equipment and taught self-management practices by the program coordinator and staff who attended the workshop. Aims were to: (1) evaluate how the IDFP can be adapted for use in the Pilbara; and (2) evaluate the impact of the program in Aboriginal populations by assessing knowledge and self-management practices pre and post implementation.</p> <p>Program was implemented by a physiotherapist, podiatry student and diabetes educator.</p>	<p>Workshop activities and practical applications rated highly by attendees.</p> <p>Knowledge scores improved post course. (IDPF knowledge mean score increased from pre 2.8 to post 5.0, IDPF mean behaviour score increased from pre 1.6 to post 5.0, n not reported)</p> <p>Completed DART forms had good inter-rater reliability with podiatrist.</p> <p>Clients reported better access to podiatry services, delivered in a culturally appropriate manner.</p> <p>Clients did not use all of the equipment provided (thongs, soap, mats).</p>	Focus on working within the communities needs and building relationships.
<p>Ballestas, 2014 (70)</p> <p>Moorditj Djena (Strong Feet)</p> <p>Perth, WA</p>	Service delivery & education	<p>Aboriginal podiatry and diabetes outreach program. Aim: to identify, manage and prevent foot complications from chronic disease and to improve diabetes self-management.</p> <p>Implemented in 2011 in conjunction with the local Aboriginal community, the Perth Aboriginal Medical Service, and the WA Department of Health.</p> <p>Fixed clinic locations include community centres, an Aboriginal health service, Medicare Locals, a hospital, a health unit office, and a mobile podiatry van.</p> <p>Referrals from GPs, hospitals, community health centres, word of mouth, self and community referrals</p> <p>Staff consists of a coordinator, podiatrists, diabetes educator, AHW.</p>	<p>Attended by 702 clients (by 2013). 14.5% of Indigenous adults in region had attended.</p> <p>3500 occasions of service.</p> <p>High community regard reported.</p> <p>Clinical outcomes evaluation underway with hospital data linkage pre & post enrolment in program.</p>	<p>Community collaboration.</p> <p>Aboriginal staff.</p> <p>Cultural awareness training.</p> <p>Accessible clinics & transport arrangements.</p>

Author, program & location	Program type	Program description & staffing	Reported outcomes	Culturally safe aspects
Blatchford, 2015 (130) Albury Wodonga Aboriginal Health Service NSW	Service delivery	Podiatry services implemented in an Aboriginal Health service in 2011. Clients had Texas Diabetic Foot Risk evaluation, and incidence of new foot complications recorded. Retrospective audit of DM Type 2 clients for 26 months (n=70). Aim was to identify client's foot risk status and determine if review appointments met national evidence-based timeframe guidelines.	70% attendance at appointments. 94% meet national guidelines for foot assessments.	At ACCHS. Drop in appointments. Transport provided.
Cherbourg Regional Aboriginal and Islander Community Controlled Health Service. Outreach Magazine, 2016 (129) QLD	Service delivery & education	Initiation of fly-in podiatry service 20 times/year at ACCHS. Number of Annual Diabetes Neurovascular Foot Assessment. Works with local GP for referrals to vascular, renal or neurological specialists, dietitian, diabetes educator or exercise physiologist. Part of medical students training program.	Reports of lower number of clients requiring treatment of diabetes-related foot and leg ulcers or amputation dressings. Decrease in number of acute problems. 80 clients consistently attend annual assessment.	At ACCHS. Good community support.
Connors, 2008 (131) Who stops the footrot? Interviews with Aboriginal health workers trained in IDFP Regional and remote Qld communities	Assess program	Protocol paper describing two-day IDFP workshop followed by telephone questionnaires and evaluation of DART forms. Aim is to determine if the IDFP is an effective method of teaching AHWs how to screen diabetes-related clients for foot problems and referral onto other health professionals. 15 AHWs participated in the program.	Nil reported to date	IDFP developed for Indigenous clients and staff.
Coombes, 2015 (126, 134) A Roving podiatrist North East & West of Alice Springs, NT	Service delivery and education	Development & evaluation of outreach podiatry services for 26 weeks a year, based on the IDFP, in 14 NT communities since 2009. Aim is to maximise availability of podiatry services and upskilling of clinic staff to manage foot problems between podiatrist visits. Services provided by podiatrist and Indigenous podiatry assistant.	Number of clients increased by 167%. Annual foot check percentages increased to 70-90% of community. Increased community engagement. Increased use of protective footwear.	Using IDFP. Male/female team. Indigenous assistant. Emphasis on relationship with communities.

Author, program & location	Program type	Program description & staffing	Reported outcomes	Culturally safe aspects
<p>Radowski, 2011 (132)</p> <p>Implementing the Indigenous Diabetic Foot Project in the lower gulf of Australia</p> <p>Rural and remote north-west Qld</p>	Assess training program	<p>A Two-day workshop to train seven AHWs in using the IDFP.</p> <p>Aim is for AHWs to pre-screen diabetes-related feet, recognise ulcer risk and recognise foot problems that require medical attention or treatment by a podiatrist.</p>	<p>All participants could complete the screening techniques.</p> <p>DART forms now used in assessment of diabetes clients.</p>	Using IDFP.
<p>Schoen, 2010 (57)</p> <p>Health promotion resources for Aboriginal people</p> <p>Perth & rural towns, WA</p>	Assess program	<p>A series of six focus group discussions in March-May 2008 with 60 Aboriginal people including Elders, AHWs, community members, and Aboriginal students.</p> <p>Sites included an Elders club in Perth, two rural townships and the Aboriginal Health Training College in Perth.</p> <p>Aim was to determine what materials, medium and foot care messages are preferred by comparison of items produced by IDFP, Healthy Living NT and Derbarl Yerrigan Health Service.</p>	<p>Unanimous support for the IDFP paper-based diabetes foot care education booklet and posters.</p>	<p>Aboriginal reference group provided guidance for the project.</p> <p>Aboriginal and non-Aboriginal interviewer.</p> <p>Reciprocity involving an exchange between the researchers and the participants.</p>
<p>Schoen, 2016 (125)</p> <p>Diabetes foot care education movies for Aboriginal people: Bran nue leg & Deadly</p> <p>Kimberley, WA</p>	Develop education program	<p>Documented production of two movies available online or as DVDs. Aim is to improve health literacy and encourage clinic attendance.</p> <p>https://vimeo.com/69131503</p> <p>https://vimeo.com/85494467</p> <p>Bran nue leg aimed at people at risk of developing diabetes. Deadly (and not in a good way) is aimed at people living with an amputation. Part of a High Risk foot intervention program.</p>	<p>Initial release so no reported outcomes.</p>	<p>Produced with Goolarri Media Enterprises and local community members.</p>

Author, program & location	Program type	Program description & staffing	Reported outcomes	Culturally safe aspects
<p>Townsend, 2012 (133)</p> <p>Evaluation of the NSW Indigenous Diabetic Foot Program for health workers</p> <p>Lower Mid North Coast, NSW</p>	Assess training program	<p>One day IDFP workshop for 11 AHWs with pre, post & 6 month post workshop knowledge questionnaire.</p> <p>Aim was to evaluate the effectiveness of the IDFP by testing AHWs perceptions of the education workshop and integration of the screening tools into clinical practice.</p>	<p>Increase in referrals to podiatrist & knowledge scores post workshop.</p> <p>55% implemented DART form but no patient workshops run.</p> <p>Occasions of service increased from 7% to 11%.</p>	Using IDFP.
<p>Turner, 2006 (127)</p> <p>Podiatry Outreach, Yirrkala Health Centre</p> <p>East Arnhem Land, NT</p>	Service delivery and education	<p>Single day visiting podiatry outreach clinic in April 2005.</p> <p>Aim was to bring a number of health professionals from outside the clinic to address the numerous aspects of diabetes.</p> <p>Presentation on the day provided to clinic staff regarding diabetes foot health, treatment protocols and client education.</p> <p>Staff present included a podiatrist, diabetes educator (for AHWs and clinic staff), nutritionist and nurse.</p> <p>Screening, risk assessment and education provided to Aboriginal community members with diabetes</p>	<p>Collation of diabetes clients onto chronic disease register.</p> <p>Increased awareness of diabetes in the community (not quantifiably measured).</p>	<p>At Aboriginal Health centre.</p> <p>AHWs performing screening</p> <p>Transport to clinic arranged.</p>
<p>Warnock, 2004 (128)</p>	Develop program	<p>Education programs for both Health Workers and Aboriginal clients with diabetes.</p> <p>Educational card set, videos.</p> <p>Health promotion media and slogans.</p> <p>Components of program include learning: (i) how to care for feet, (ii) how to check feet, (iii) finding pulses on the foot, (iv) using a monofilament (v) understanding the difference between high risk and low risk feet, (vi) how to teach clients the basics of self-care, (vii) completing a DART form, (viii) referral process for a high risk foot.*details combined from a number of sources including presentations and published reports</p>	<p>AHWs more confident in providing education and screening.</p> <p>Increase in AHW knowledge levels up to 6 months post course.</p> <p>Increased referrals from AHWs to podiatrists.</p>	Presented to local focus groups

Author, program & location	Program type	Program description & staffing	Reported outcomes	Culturally safe aspects
<p>Watson, 2001 (58)</p> <p>Diabetic foot care: developing culturally appropriate educational tools</p> <p>Darwin, East Arnhem, Katherine, NT</p>	Develop education tools	<p>Series of focus groups, telephone calls and mail-outs to help develop a culturally sensitive visual educational tool on foot care for people with diabetes.</p> <p>Attendees included nurses, GPs, AHWs, cross cultural liaison officers and Indigenous Australians with diabetes.</p> <p>Aim is to develop a tool that provides information on control of diabetes, prevention of foot complications and encouragement to seek advice early.</p>	<p>Decision to develop a picture based flip chart.</p> <p>Nil reported to date</p>	<p>In collaboration with Indigenous Australians and health professionals.</p>
<p>WA: Western Australia, GP: General Practitioner, NSW: New South Wales, DM: diabetes mellitus, ACHHS: Aboriginal Community Controlled Health Services, %: percentage, QLD: Queensland, DVD: digital video disc, NT: Northern Territory, AHW: Aboriginal Health Workers, IDFP: Indigenous Diabetic Foot Program, DART: Diabetic foot Assessment of Risk Test form</p>				

Table 3.2. Methodological quality of included studies – cohort, case-control, and cross-sectional studies

Criterion	Health Evidence Bulletins - Wales: Questions to assist with the critical appraisal of an observational study e.g. cohort, case-control, cross-sectional. (Type IV evidence)		Ballestas 2014 (70)	Bandaranaike 2010 (90)	Blatchford 2015 (130)	Connors 2008 (131)	Radowski 2011 (132)	Townsend 2012 (133)
A. What is this paper about?	1. Is the study relevant to the needs of the project?		Y	Y	Y	Y	Y	Y
	2. Does the paper address a clearly focussed issue in terms of:	The population studied?	Y	Y	Y	Y	Y	Y
		(Case-control only) Is the case definition explicit and confirmed?	na	na	na	na	na	na
		The outcomes considered?	Y	Y	Y	Y	Y	Y
		Are the aims of the investigation clearly stated?	Y	Y	Y	Y	Y	Y
B. Do I trust it?	3. Is the choice of study method appropriate?		Y	Y	Y	Y	Y	Y
	4. Is the population studied appropriate?	(Cohort study) Was an appropriate control group used – i.e. were the groups comparable (Case-control study) Were the controls randomly selected from the same population as the cases?	N	N	N	N	N	N
	5. Is confounding and bias considered?	Have all possible explanations of the effects been considered?	N	N	Y	Y	Y	Y
		(Cohort study) Were the assessors blind to the different groups?	na	na	na	na	na	na
		(Cohort study) Could selective drop-out explain the effect?	Y	Y	N	N	N	N
		(Case-control study) How comparable are the cases and controls with respect to confounding factors?	na	na	na	na	na	na

Table 3.2. Methodological quality of included studies – cohort, case-control, and cross-sectional studies

Criterion	Health Evidence Bulletins - Wales: Questions to assist with the critical appraisal of an observational study e.g. cohort, case-control, cross-sectional. (Type IV evidence)		Ballestas 2014 (70)	Bandaranaike 2010 (90)	Blatchford 2015 (130)	Connors 2008 (131)	Radowski 2011 (132)	Townsend 2012 (133)
		(Case-control study) Were interventions and other exposures assessed in the same way for cases and controls?	na	na	na	na	na	na
		(Case-control study) Is it possible that overmatching has occurred in that cases and controls were matched on factors related to exposure?	na	na	na	na	na	na
	6. (Cohort study) Was follow up for long enough	Could all likely effects have appeared in the time frame?	Y	N	Y	N	N	Y
		Could the effects be transitory?	N	Y	N	Y	Y	Y
		Was follow up sufficiently complete?	N	N	Y	N	N	N
		Was dose response shown?	na	na	na	na	na	na
C. What did they find?	7. Are tables/graphs labelled and understandable?		na	Y	Y	na	na	Y
	8. Are you confident with the author's choice and use of statistical methods, if employed?		na	na	Y	na	na	Y
	9. What are the results of this piece of research? Are the author's conclusions adequately supported by information cited?		Y	N	Y	N	N	Y
D. Are the results relevant locally?	10. Can the results be applied to the local situation? Consider differences between the local and study populations which could affect the relevance of the study		Y	N	Y	N	Y	Y
	11. Were all important outcomes/results considered?		N	N	Y	N	N	Y

Table 3.2. Methodological quality of included studies – cohort, case-control, and cross-sectional studies

Criterion	Health Evidence Bulletins - Wales: Questions to assist with the critical appraisal of an observational study e.g. cohort, case-control, cross-sectional. (Type IV evidence)	Townsend 2012 (133)	Radowski 2011 (132)	Connors 2008 (131)	Blatchford 2015 (130)	Bandaranaike 2010 (90)	Ballesteras 2014 (70)
	12. Is any cost information provided?	N	N	N	N	N	N
	13. Accept for use as further Type IV evidence?	Y	Y	Y	Y	Y	Y

Table 3.3. Methodological quality of included studies – qualitative studies

Criterion	Health Evidence Bulletins - Wales: Additional questions to assist with the critical appraisal of a qualitative study.		Schoen 2016 (57)	Watson 2001 (58)
A. What is this paper about?	1. Is the study relevant to the needs of the project?		Y	Y
	2. Does the paper address a clearly focussed issue? Are the aims of the investigation clearly stated?		Y	Y
B. Do I trust it?	3. Is the choice of a qualitative method appropriate?	What was this study exploring (eg behaviour/reasoning/beliefs)? Do you think a quantitative approach could have equally/better addressed this issue?	Y	Y
	4. Was the author's position clearly stated?	Has the researcher described his/her perspective? Has the researcher examined his/her role, potential bias and influence?	N	N
	5. Was the sampling strategy clearly described and justified?	Check to see whether: • the method of sampling is stated or described • the investigators sampled the most useful or productive range of individuals and settings relevant to their question • the characteristics of those included in the study are defined (and are comparable to the wider population)	Y	Y
	6. Was there an adequate description of the method of data collection given?	• Is the method of data collection described and justified? • How the data were collected (e.g. audiotape/videotape/field notes)? • If interviews were used, were the questions pre-tested? • If observation was used, is the context described and were observations made in a variety of circumstances?	Y	N
	7. Were the procedures for data analysis / interpretation described and justified?	Check to see whether: • a description is given of how the themes and concepts were identified in the data • the analysis was performed by more than one researcher • negative/discrepant results were taken into account • the data were fed back to the participants for comment	Y	Y
	8. What are the primary findings?	Consider whether the results: • address the research question • are likely to be clinically important	Y	Y

	9. Are the results credible?	<p>Were sequences from the original data presented (e.g. quotations) and were these fairly selected?</p> <ul style="list-style-type: none"> • Is it possible to determine the source of the data presented (e.g. numbering of extracts)? • How much of the information collected is available for independent assessment? • Are the explanations for the results plausible and coherent? • Are the results of the study compared with those from other studies? 	N	N
D. Are the results relevant locally?	10. Can the results be applied to the local situation?	Consider differences between the local and study populations (e.g. cultural, geographical, ethical) which could affect the relevance of the study.	Y	Y
	11. Were all important outcomes/results considered?		Y	Y
	12. Accept for further use?		Y	Y

3.4.1 Delivery of podiatry services

Moorditj Djena is an Aboriginal podiatry and diabetes outreach program implemented in 2011 in metropolitan Perth, WA, which was initially funded as part of the Australian Federal Government's 'Closing the Gap' program (70, 135). The program's aim is to identify, manage and prevent foot complications and to improve diabetes self-management. Culturally secure treatment is offered in community venues as well as two customised mobile vans. Staff include AHWs, podiatrists and diabetes educators. An initial review of the program describes the number of clients seen, occasions of service, percentage of local Aboriginal clients with diabetes seen by the clinic (14.5%), and staff perceptions of the program.

One study outlines the findings from a retrospective 26 month (2012 to 2014) clinical audit undertaken at the Albury-Wodonga Aboriginal Health Service (AHS) in NSW (130). Podiatry services only commenced at the health service in 2011 and the audit's aim was to determine if evidence-based standards for podiatry services based on the patients' risk classification were being met. In the sample population (n=729) a high rate (94%) of adherence to the national guidelines regarding podiatric review timeframes was found. The authors suggested that the excellent outcomes may be due to provision of services according to national guidelines, in a culturally safe manner, alongside flexible arrangements such as drop in appointments and access to transport services (130).

The establishment of podiatry outreach services in remote communities is described by three reports (126, 127, 129). The Yirrkala Health Centre in East Arnhem Land NT, organised an inaugural Diabetes Day in 2005 to coincide with a visit from a podiatrist and AHW specialising in diabetes education (127). Clients received podiatry services on the day and were registered for recall according to their risk status, and both staff and clients received diabetes-related foot education. Another two reports detail the establishment of visiting podiatry services (for 26 weeks a year) to fourteen remote communities to the east and west of Alice Springs NT (126, 134). The program, which started in 2009, is based on the IDFP and is funded by the NT Primary Healthcare Network's (PHN) Medical Outreach Indigenous Chronic Disease Program. A podiatrist and an Aboriginal podiatry assistant provide general podiatry services, foot health checks, and education in foot first aid, diabetes-related foot care and footwear. Between 2014 and 2017, activity report data from the NT PHN Outreach Services demonstrated the number of patients receiving podiatric care increased by 167% (134). The increased attendance rate is anecdotally credited to the close relationships the team built with each community, in conjunction with a personalised and targeted approach to encouraging people to attend clinics and self-manage their foot health. A similar visiting podiatry service was established by the

Cherbourg Regional Aboriginal and Islander Community Controlled Health Service in QLD, with funding provided by the Australian Government Rural Health Outreach Fund (129). The podiatrist visits twenty times a year and also encourages attendance for an annual diabetes neurovascular foot assessment. The program is supported by the medical community with the local general practitioner (GP) providing follow-up care and referrals to specialists as required.

3.4.2 Development of foot educational resources

The Indigenous Diabetic Foot Program (IDFP) is the most widely used template for delivery of diabetes-related podiatry services to Aboriginal and Torres Strait Islander Peoples. The IDFP was developed in QLD in 2005 to provide culturally appropriate foot education for Aboriginal Australians and training workshops for AHWs and podiatrists regarding diabetes-related foot screening (128, 136). The education resources developed for clients are mostly visual aids (posters, a CD ROM, videos and an educational card set), which feature Aboriginal feet and stories. Resources for AHWs and podiatrists include a Diabetic Foot Assessment of Risk (DART) form, a self-care education model for use with clients, and advice on referral pathways if required. The DART form requires assessment of the foot (pulses, sensation, foot lesions and deformities, amputations or scars), assessment of client self-care practices (awareness of the need for foot care, wearing footwear, and ability for self-care), assessment of an overall risk classification and a date for future foot review.

The development of culturally sensitive visual educational resources for Aboriginal Australians are described by two studies (58, 125). Two diabetes foot care movies ('Bran nue leg' and 'Deadly (and not in a good way)') were produced as part of a larger High Risk Foot intervention in WA (125). An Aboriginal media company and local Kimberly community members were involved in production of the movies, ensuring the message was delivered in a culturally sensitive manner. The aim was to improve health literacy related to at-risk feet, and encourage early presentation to health services for foot problems by Aboriginal Australians in the Kimberley. The report described the recent development and release of the movies and we did not identify any follow up report of the evaluation or effectiveness of the movies. Another study details the processes behind the creation of a foot care educational tool for Aboriginal and Torres Strait Islander Peoples in the NT (58). The preferred educational resource, a graphical flip-chart, was determined following a workshop and a series of focus groups with health professionals (including general practitioners, nurses, and AHWs) and Aboriginal Australians with diabetes. Again, the study was published prior to the release of the materials, and assessment of the effectiveness of the tool was not identified in this review.

3.4.3 Assessment of foot educational and training programs

Assessment of aspects of the IDFP is described by five reports (57, 90, 131-133). One study conducted focus groups with 60 Aboriginal Elders, health workers, students and nurses, to determine their preferred messages and media for communication of diabetes foot care information (57). The paper-based resources produced by the IDFP, with photographs of feet of Aboriginal and Torres Strait Islander Peoples, were the participants' favoured option.

The other four studies describe training and evaluation of AHWs knowledge and capability when using the IDFP (90, 131-133). One report described a protocol for a two-day IDFP workshop in QLD to teach AHWs how to screen for diabetes-related foot problems. Follow up investigations included telephone questionnaires with AHWs, examination of completed DART forms and comparison of completed DART forms versus number of people in the community with diabetes (131). No published assessment of the workshop was identified during this search. Another report describes the evaluation of the IDFP in a hospital site and four remote communities in the Pilbara WA (90). Workshop attendees completed a workshop evaluation form and DART forms completed in the hospital were cross-checked by a podiatrist. Community members were assessed regarding their perceptions of the course as well as knowledge and self-care for diabetes feet. Feedback suggested that the program was culturally safe and improvements were seen in community member's knowledge and self-care pre and post course. An assessment of AHWs perceptions of the IDFP following a one day course and integration of the tools into practice was also conducted on the Lower Mid Coast of NSW (133). The participants had higher knowledge and confidence levels immediately after and six months after the workshop. Just over half (55%) of participants implemented the DART screening form into clinical practice, however none had implemented a 'Look after your feet workshop', which is one of the patient education components of the IDFP. While an increase in the number of Aboriginal people attending the podiatrist was also reported, this could not be attributed to the effects of the training as the number of referrals from course attendees was not tracked. The final report describes a two-day IDFP workshop run in the Lower Gulf area in QLD to train AHWs in screening diabetes-related feet (132). Following the training, the AHWs implemented the DART form as a standard for all clients with diabetes.

3.5 Discussion

The aim of this review was to systematically evaluate the current literature to determine the availability and effectiveness of stand-alone foot health programs for the prevention of DFD in Aboriginal Australians. While national and state governments have developed general Aboriginal and Torres Strait Islander health plans and strategies, no state- or nation-wide foot health programs for prevention of DFD were identified in the literature. Benefits of existing foot care services for Aboriginal and Torres Strait Islander peoples are therefore largely restricted to the area/s in which they are delivered. Of the thirteen reports that met the inclusion criteria (table 3.1), one detailed quantitative data related to clinical patient outcome measures following implementation of the program (130). The most widely used program, the IDFP (Indigenous Diabetic Foot Program), has been assessed with regard to workshop attendee capability and client perceptions of the educational material provided. Evaluation of the IDFP's impact in terms of patient outcomes and rates of DFD complications is yet to be undertaken/published (136).

Despite years of research, Aboriginal and Torres Strait Islander Peoples still have worse health outcomes than non-Aboriginal Australians. A key criticism of the research to date, both in Australia and in Indigenous populations of other countries, is a high concentration of descriptive research regarding populations, risks and measures, rather than a focus on assessment of the efficacy of interventions to close the health outcome gap (137, 138). To enable an intervention to be successfully and widely implemented by front-line clinicians it must meet rigorously designed methodological standards, it must have been tested for its effectiveness and reproducibility, and it must be easily accessible in peer reviewed literature (138). While six of thirteen reports (46%) in this review do describe interventions, only one (8%) of the reports (130) describes patient-based clinical outcomes following implementation of a podiatry service. Overall, methodological quality of the studies that were eligible to be assessed was mixed. Lack of robust assessment of outcome data, including comparison to control data in relation to patient outcomes, was common to all studies. In addition, reporting of economic analysis related to development or implementation of the interventions was not provided in any study. Lack of documented follow-up evaluation of interventions, similar to that seen in the stand-alone foot programs in this review, has been described previously. A report investigating the implementation of 1082 Australian Indigenous health, cultural and education programs, found only 8% of programs were evaluated (139). Additionally, in contrast to non-Aboriginal health interventions, the majority of the reports included in this review were published in non-peer reviewed grey literature. These factors make it challenging for clinicians and researchers to locate and implement best practice evidence in relation to foot health programs for the prevention of DFD in Aboriginal and Torres Strait Islander Peoples.

Although assessment of clinical outcomes following implementation of foot health strategies has not been commonplace in the past, which seems to be changing. The current lack of evidence regarding successful components of Aboriginal focussed foot health programs in reducing DFD has been clearly recognised by those working in clinical areas. Programs and assessments that are currently underway have incorporated clinical and cost outcomes as part of their implementation plans. In WA the Moorditj Djena program (70) has recently conducted an internal review, the results of which will be published upon completion (private correspondence). The review includes a data linkage project to examine participant outcomes pre- and post-enrolment in the program. In particular, they examined the population reach of the program, the reach in high-risk settings, occasions of service versus comorbidity, and the number and duration of hospitalisations for diabetes-related conditions. NSW Health is currently in the planning stages of a Healthy Deadly Foot initiative (private correspondence). It has the potential to be the largest foot health program for Aboriginal and Torres Strait Islander Peoples implemented to date. One metropolitan local health district (Central Coast), three rural and regional local health districts (Hunter New England, Illawarra Shoalhaven, Western NSW), and one speciality network (St. Vincent's Health Network) have committed to the project. Goals include the development of AHW roles in local health districts and Aboriginal communities, delivery of appropriate cultural and clinical support, encouraging more Aboriginal and Torres Strait Islander people to train as podiatrists and an evaluation strategy to examine the outcomes of the project. In addition, in 2018, the authors of this report embedded an Aboriginal and Torres Strait Islander foot health clinic into the undergraduate podiatry program at the University of Newcastle. The clinic, led by an Aboriginal podiatrist and AHW, provides prevention and management services for diabetes-related foot complications for Aboriginal and Torres Strait Islander Peoples in the local community. It also provides clinical placement to all undergraduate podiatry students as a mechanism to increase cultural awareness in the future podiatry workforce. The service is currently undergoing clinical and educational outcome evaluation for peer-reviewed publication. This includes evaluation of service utilisation with historical control data for the broader clinical service, effectiveness of diabetes education for improving client knowledge of diabetes self-care, and post-placement changes in self-perceived confidence in provision of culturally safe care in undergraduate students.

The results of this review should be viewed in light of several limitations. Although this review was designed to be comprehensive with a robust search on relevant databases, the search strategy may not have located all Australian health initiatives involving DFD specifically delivered for Aboriginal and Torres Strait Islander Peoples. Many of these reports are located in grey literature sources and structured search engines are not available. Additionally, this review only describes programs where reports regarding the development, implementation, or

effectiveness of initiatives were publically available. It is likely that programs exist that have not been published in any form; this is particularly probable where these involve individual practitioners, or are in small service delivery models.

3.6 Conclusions

No state- or nation-wide foot health programs for prevention of DFD in Aboriginal and Torres Strait Islander Peoples were identified by this review. One report, a clinical audit of podiatry services offered at a NSW AHS, provided data supporting the clinical effectiveness of the program. The authors describe a high rate of adherence to the national guidelines regarding timing of podiatry appointments which may be related to classification of patients according to evidence based risk status and provision of services in a culturally safe manner. More data regarding aspects of successful Aboriginal and Torres Strait Islander foot programs should soon become available with planning and assessment of programs already underway in both WA and NSW.

3.7 Declarations

3.7.1 Funding

This research was supported by funding from the School of Health Sciences, University of Newcastle.

3.7.2 Authors' contributions

VC and FH conceived the study. AS conducted the electronic searches. AS, VC and MW assessed the abstracts and included articles. All authors revised and provided significant input to the final manuscript. All authors read and approved the final manuscript.

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Chapter 4

Foot health of Aboriginal and Torres Strait Islander Peoples in regional and rural NSW, Australia

Matthew West¹, Sean Sadler¹, Fiona Hawke¹, Shannon E. Munteanu^{2,3}, Vivienne Chuter^{1,4}

¹Discipline of Podiatry, University of Newcastle, Ourimbah, NSW, 2258, Australia

²Discipline of Podiatry, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria 3086 Australia

³La Trobe Sport and Exercise Medicine Research Centre, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria, 3086, Australia

⁴Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, Newcastle, NSW, 2308, Australia

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4.1 Abstract

4.1.1 Background

Foot health of Aboriginal and Torres Strait Islander Peoples' has not been established. Additionally, studies have shown that there is a lack of engagement of this population with general preventive foot care services. The aim of this study was to establish foot health in Aboriginal and Torres Strait Islander people attending two recently developed, culturally safe podiatry services in rural and regional New South Wales (NSW), Australia. Secondly the relationship between self- perceived foot health and some medical and demographic characteristics was investigated.

4.1.2 Methods

This descriptive cross-sectional study included participants attending the culturally safe foot health care services managed by the University of Newcastle on the Central Coast or in Wellington, both located in NSW, Australia. At the consultation, participants completed the Foot Health Status Questionnaire (FHSQ) with the assistance of an Aboriginal health care worker, underwent basic vascular and neurological screening, and podiatric treatment.

4.1.3 Results

A total of 111 Aboriginal and Torres Strait Islander Peoples (48 from the Central Coast, and 63 from Wellington) were included. FHSQ scores for pain (75.7 ± 26.8), function (80.2 ± 25.2), footwear (53.9 ± 33.4), and general foot health (62.0 ± 30.9) were generally good, but below the optimal score of 100. The presence of diabetes ($n = 39$ of 111 participants or 35.1%) was associated with lower levels of self-perceived foot function ($r = -0.20$, $n = 107$, $p = 0.04$).

4.1.4 Conclusion

We found that community-based foot health care services that are culturally safe are utilised by Aboriginal and Torres Strait Islander Peoples not currently at high risk of foot complications. This supports the use of culturally safe foot care services to improve engagement with preventative foot care. Future research should continue to be driven by Aboriginal and Torres Strait Islander Peoples and investigate ways to implement additional screening measures and undertake prospective evaluation of the impact of such services on health related outcomes in these communities.

4.2 Introduction

Aboriginal and Torres Strait Islander Peoples have a five-to-six-fold increased likelihood of developing foot complications including foot ulcer and amputation compared to non-Indigenous Australians (48, 49, 108, 116). Similarly, this population experiences a four-fold increase in risk of peripheral neuropathy, and are more likely to have peripheral arterial disease but less likely to have had it diagnosed (48, 49, 108). This problem is exacerbated in rural and regional Australia where there is limited health care service availability and poor engagement with existing services (48, 52). Clustering of health risk factors, including disproportionately high rates of diabetes, greater risk of vascular disease, reduced socioeconomic circumstances, reduced health literacy, lack of access to culturally safe care, poor engagement with preventative health care services, and lifestyle factors including high rates of smoking and poor nutrition have been proposed to increase the risk of foot complications in this population even further (67).

Despite the documented high rates of foot complications in Aboriginal and Torres Strait Islander Peoples in tertiary healthcare settings throughout Australia, there are remarkably little data describing foot health at a community level. The available evidence indicates there is poor engagement with early intervention foot care services (48, 52). Individuals typically seek help once a foot problem is present and often of a complex nature e.g. foot ulceration or infection, and this contributes to high rates of hospitalisation and amputation (50, 52, 140). The lack of descriptive data relating to foot health status in this population at a community level limits our understanding of service provision needs. Additionally, the paucity of available data also limits our understanding of Aboriginal and Torres Strait Islanders Peoples' perceptions of health and illness, which may be a key driver in their health seeking behaviours. For example, previous research in an Aboriginal population in remote Arnhem Land found that community members' concepts of health related to whether they could carry out daily activities and live with their family, regardless of diagnosis of disease (64).

Therefore, the primary aim of this study was to determine the point prevalence of foot health of Aboriginal and Torres Strait Islander Peoples presenting to culturally safe podiatry services in a rural and a regional community of New South Wales (NSW), Australia. Secondly, we aimed to explore the association between demographic variables (age and sex), smoking status (never or past/current), diabetes status (present or absent) and foot health.

4.3 Methods

The University of Newcastle Human Research Ethics Committee (H-2018-0035) granted ethics approval and the Aboriginal Health and Medical Research Council approved the project (1376/18) both of which are available in appendix 2. Written informed consent was obtained from all participants at the start of the consultation.

4.3.1 Participants and settings

This descriptive cross-sectional study recruited Aboriginal and Torres Strait Islander People aged 18 years and older presenting to one of two culturally safe foot care services between March 2018 and July 2019. One of the clinics is located at Wyong hospital, which is on the Central Coast of NSW, approximately 100 kilometres north of Sydney, Australia. The other clinic is located in Wellington, which is a town in inland NSW and is approximately 360 kilometres North West of Sydney, Australia. Both clinics are managed by the University of Newcastle, Discipline of Podiatry and are designed to be culturally safe community clinics that are led by an Aboriginal Podiatrist, supported by Aboriginal Health Worker, and provide student placements. In being culturally safe, these clinics are designed to create an environment that is considerate of the spiritual, physical, social, and emotional world view of Aboriginal and Torres Strait Islander people, thereby creating a clinical experience which is conducive to, and supportive of, the specific needs of this community (72). Additionally, the approach to management of patients within these clinics is one that recognises the importance of culture, family, and community for Aboriginal and Torres Strait Islander people. The services provide a mix of podiatric clinical care and health promotion with a focus on diabetes-related foot disease (DFD) and prevention education. The Central Coast service operates on a weekly basis from the University of Newcastle Podiatry Clinic, and the Wellington Service via an Outreach program which occurs 3 to 4 times per year in a local Aboriginal community facility. The latter service operates as a drop-in clinic without any formal appointment times.

4.3.2 Participant characteristics

Participant characteristics were self-reported by participants on a generic questionnaire developed by the authors for this study and included age, sex, smoking status (never or past/current), and diabetes mellitus status (present or absent).

4.3.3 Measurement of foot health

Following measurement of participants' characteristics, their foot health was measured through the use of a (i) patient reported outcome measure, the Foot Health Status Questionnaire (FHSQ), and (ii) clinical assessment. A Nottingham Assessment of functional foot care is being used as part of linked research being conducted by the authors however this was not collected in this population.

4.3.3.1 Foot Health Status Questionnaire

Foot-specific health-related quality of life was evaluated using the FHSQ. The FHSQ is a 13-item questionnaire used to evaluate foot health across four domains (pain, function, footwear and general foot health) and can be accessed in full online via the FHSQ website (141). Questions in each domain are scored using a 5-point Likert scale. Responses were then transformed into domain scores, that ranged from 0 (worst foot health) to 100 (best foot health). The FHSQ (141) is a valid questionnaire that has shown high retest reliability (142). The FHSQ was not specifically designed for Aboriginal and Torres Strait Islander Peoples and may not consider how cultural differences might influence responses. To limit the potential impact of this an Aboriginal health care worker was present to assist participants if they had difficulty understanding the questions.

4.3.3.2 Clinical foot assessment

Clinical foot assessment was then conducted and involved neurological and vascular assessment of both feet and was performed by registered podiatrists with relevant clinical experience. Neurological assessment was performed via the 10-site monofilament test using a 5.07 Semmes-Weinstein monofilament (143). An abnormal result was defined as a participant identifying less than seven out of ten sites on any foot (144). Vascular assessment was performed via a Doppler assessment of the dorsalis pedis and posterior tibial arteries (145), using a bi-directional hand-held Doppler (Hadeco[®] ES-100V3 8 mHz). An abnormal result was defined as the presence of monophasic waveforms for either artery of the left or right foot (146). Multiphasic waveforms were considered normal. Studies have demonstrated that both monofilament (143) and Doppler waveform assessment (146) have acceptable levels of reliability.

4.3.4 Statistical analyses

Data were entered into Microsoft Excel and the FHSQ software (version 1.03) and then exported to the statistical package for the social sciences (SPSS) program (version 25.0

Chicago, Illinois, USA) for analysis. For continuous data, data were assessed for normality prior to inferential analysis. For descriptive analysis, means and standard deviations are reported for continuous variables, and frequency and percentages for dichotomous variables.

Correlations were performed to determine the level of association between demographic factors (age and sex), smoking status (never or past/current), and diabetes status (present or absent) for each of the FHSQ domains. The strength of the correlation was interpreted as small ($r=0.10$ to 0.29), moderate ($r=0.30$ to 0.49), and large ($r=0.50$ to 1.0) (147). A standard linear regression was performed to determine the proportion of variance in each domain of the FHSQ attributed to a significantly ($p<0.05$) correlated independent variable. Assumptions for the analyses were met.

4.4 Results

4.4.1 Participants

A total of 111 Aboriginal Australians, 48 from the Central Coast and 63 from Wellington enrolled in this study (table 4.1). These figures represent approximately 0.4% and 5.6% of the total number of Aboriginal and Torres Strait Islander people living in the Central Coast and Wellington areas.

Table 4.1. Participant characteristics

	Central Coast	Wellington	Total group
Age, mean (SD)	53.9 (15.3)	51.3 (17.0)	52.5 (16.3)
Not reported by participant, n (% of total)	1 (0.9%)	9 (8.1%)	10 (9.0%)
Sex			
Female, n (% of total)	20 (41.7%)	37 (58.7%)	57 (51.4%)
Male, n (% of total)	28 (58.3%)	25 (39.7%)	53 (47.7%)
Not reported by participant, n (% of total)	0 (0.0%)	1 (1.6%)	1 (0.9%)
Smoking status			
Never, n (% of total)	20 (41.7%)	21 (33.3%)	41 (36.9%)
Past or current, n (% of total)	28 (58.3%)	29 (46.0%)	57 (51.4%)
Not reported by participant, n (% of total)	0 (0.0%)	13 (20.7%)	13 (11.7%)
Diabetes status			
No diabetes, n (% of total)	28 (58.3%)	40 (63.5%)	68 (61.3%)
Diabetes, n (% of total)	20 (41.7%)	19 (30.1%)	39 (35.1%)
Not reported by participant, n (% of total)	0 (0.0%)	4 (6.4%)	4 (3.6%)

4.4.2 Foot health assessment

Findings from the foot health assessments are shown in table 4.2. The vascular and neurological status of a number of participants is unknown because some participants chose not to have the assessments performed or only had part of the assessments conducted (table 4.2).

All FHSQ domain scores were notably less than the optimum score of 100 (table 4.2), with the footwear and general foot health domains being lowest. There were no statistically significant differences in FHSQ domain scores between regions. Additionally, there were no differences in rates of overt peripheral arterial disease or peripheral neuropathy between the regions (table 4.2).

Table 4.2. Foot health assessment

	Central Coast mean \pmSD (range)	Wellington mean \pm SD (range), n=111	Total group mean \pm SD (range), n=111
FHSQ, pain	77.5 \pm 27.3 (0-100)	74.4 \pm 26.5 (0-100)	75.7 \pm 26.8 (0-100)
FHSQ, function	83.1 \pm 21.1 (25-100)	78.0 \pm 27.9 (0-100)	80.2 \pm 25.2 (0-100)
FHSQ, footwear	58.3 \pm 31.7 (0-100)	50.7 \pm 34.6 (0-100)	53.9 \pm 33.4 (0-100)
FHSQ, general foot health	66.9 \pm 30.6 (0-100)	58.3 \pm 30.8 (0-100)	62.0 \pm 30.9 (0-100)
Monofilament			
Normal ¹ , n (% of total)	42 (87.5%)	21 (33.3%)	63 (56.8%)
Abnormal ² , n (% of total)	2 (4.2%)	2 (3.2%)	4 (3.6%)
Missing, n (% of total)	4 (8.3%)	40 (63.5%)	44 (39.6%)
Doppler			
Normal ³ , n (% of total)	38 (79.2%)	22 (34.9%)	60 (54.1%)
Abnormal ⁴ , n (% of total)	2 (4.2%)	2 (3.2%)	4 (3.6%)
Missing, n (% of total)	8 (16.6%)	39 (61.9%)	47 (42.3%)

¹Defined has $\geq 7/10$ both feet. ²Defined has < 7 on one foot or more. ³Defined has no monophasic waveform. ⁴Defined has one or more monophasic waveform/s.

4.4.2.1 Associations between participant characteristics and FHSQ domains

Being female was significantly associated with lower scores on the footwear domain ($r = 0.29$, $n = 110$, $p < 0.01$). The presence of diabetes was associated with lower levels of self-perceived foot function ($r = -0.20$, $n = 107$, $p = 0.04$) (table 4.3).

Table 4.3. Pearson correlation between each FHSQ domain and participant characteristics

	Foot Pain	Foot Function	Footwear	General foot health
Age, n=101	-0.04	-0.17	-0.09	0.10
Sex, n=110	0.17	0.15	0.29**	-0.04
Diabetes, n=107	-0.18	-0.20*	-0.15	-0.01
Location, n=111	-0.06	-0.10	-0.11	-0.14
Smoking, n=98	-0.003	-0.05	0.17	-0.10

4.4.2.2 Regression analysis

For the footwear domain, female sex was able to predict 9.0% of the variance in the score for this domain (r^2 0.09, $p < 0.01$, beta coefficient 0.29). Linear regression demonstrated that the presence of diabetes predicted 4.0% of the variance in the function domain score (r^2 0.04, $p = 0.04$, coefficients beta -0.20). No significant associations were found between the variables measured and the foot pain and general foot health domains of the FHSQ.

4.5 Discussion

The primary aim of this study was to describe the point prevalence of foot health of Aboriginal Australians presenting across two culturally safe foot care services in rural and regional NSW, Australia. We found that a high proportion of patients reported having diabetes (Central Coast 41.7%, Wellington 30.1%) and a current or past history of smoking (Central Coast 58.3%, Wellington 46.0%). Foot-specific health-related quality of life, evaluated using the FHSQ, was less than the optimum score of 100, with the footwear and general foot health domains being notably poorer than pain and function domains. The neurological and vascular assessments demonstrated that the rates of clinically overt peripheral arterial disease (Central Coast 4.2%, Wellington 3.2%) and peripheral neuropathy (Central Coast 4.2%, Wellington 3.2%) were low. There were not any regional differences for foot-specific health-related quality of life or overt peripheral arterial disease or peripheral neuropathy.

Capacity for comparison of the FHSQ data from this current study with previous research is challenging as there are no published data relating to foot-specific health-related quality of life in Aboriginal and Torres Strait Islander Peoples. Much of the existing data investigating FHSQ domains in the general population relate to specific pathologies and the outcome of interventions, for example, treatments for plantar heel pain or foot osteoarthritis (148-151). In the present study, mean scores for the pain, function, footwear, and general foot health domains were all higher than those previously reported in a population of older Australians using podiatry care (152). The comparatively high FHSQ scores for our study population suggests that, on average, participants felt healthy and perceived their feet as healthy and this was consistent with our low rates of abnormal vascular and neurological findings.

Existing data relating to foot health in Aboriginal Australians indicates high rates of disease, including peripheral vascular disease and neuropathy, with many of the studies derived from outcomes from public hospital admissions and high risk foot centres (46, 48, 108). Importantly the findings of this present study should not be considered contradictory to previous research. The high rates and devastating outcomes of foot disease for Aboriginal and Torres Strait Islander Peoples are unequivocal (45, 49, 108, 153). Our research outcomes most likely reflect recruitment from a community-based population and offer insight into the potential

effectiveness of providing community-led, culturally safe health care to reduce morbidity and mortality through early intervention, and of the critical role of accessible prevention and management services.

Lack of engagement of Aboriginal and Torres Strait Islander Peoples with existing preventative foot care services, for example those with diabetes, is common (50, 116) and needs to be improved to successfully reduce foot disease and complications such as amputations (26). A number of barriers to Indigenous populations accessing preventative care have been identified, including poor relationships with health care providers, health care providers' lack of acceptance of the role of family in care provision, and poor community engagement with available services (61, 64, 73, 154). In addition, fatalist beliefs towards one's own health (i.e. that ill-health is unavoidable) and towards Western health service provision (i.e. that accessing health care is only for the very sick and has negative outcomes) has been documented in Australian Aboriginal and Torres Strait Islander Peoples (64). This belief system has been linked to historical and current issues of dispossession and socioeconomic inequality, concern over being removed from family and community for treatment, along with lack of improvement in Aboriginal and Torres Strait Islander health outcomes through a Western model of health care delivery. The results of the current study, showing that foot-specific health-related quality of life health in the sample was, on average, generally good, with low rates of peripheral arterial disease and neuropathy, provide evidence to Aboriginal and Torres Strait Islander communities to refute a fatalistic approach to foot ill-health.

Access to culturally safe health services using Aboriginal health workers provided in spaces that have significance (e.g. cultural or physical) to the local community has been shown to increase utilisation of health care (62, 122, 155). Although a number of initiatives have been developed to provide culturally safe foot care, there has been little evaluation of their effectiveness (140). Our findings support the use of culturally safe service provision within the community to encourage engagement with and early uptake of preventative care in those with chronic disease. However, further research is needed to broaden the understanding of the fundamental foot health care needs of Aboriginal and Torres Strait Islander Peoples, and to establish effective strategies for preventing foot related complications of chronic disease. Importantly, this must be driven by Aboriginal and Torres Strait Islander Peoples so that the services are not only culturally appropriate and safe, but to help encourage and empower other community members to seek out and engage with health care services in the future.

A number of limitations should be considered when interpreting our findings. We only measured a small number of variables related to participant demographics, diagnosed conditions (only diabetes), and vascular and neurological function. Additional data related to participants'

physical characteristics (e.g. height, weight, and waist circumference), diagnosed conditions (e.g. duration, complications, and disease specific levels of severity such as HbA1c), and additional vascular (e.g. toe and ankle brachial indices) and neurological (e.g. graduated tuning fork) assessments would provide further insight into Aboriginal and Torres Strait Islander Peoples' lower limb health. Furthermore, the FHSQ has not been validated in Aboriginal and Torres Strait Islander communities and, although administered with the help of an Aboriginal Health Worker, is a Western mechanism to quantify foot-specific health-related quality of life. Further investigation of Aboriginal and Torres Strait Islander perceptions of foot health and what good health entails is required to continue to develop effective foot complication prevention programs. Finally, the vascular or neurological status of the number of participants (40%) who chose not to have assessments performed or for whom assessments were incomplete or were not the participant's priority is unknown. Although a limitation of the research, this approach was integral to the overarching priority of the clinical services to, first and foremost, develop community trust and engagement. Caution is recommended when attempting to generalise the findings from this study to other Aboriginal and Torres Strait Islander communities, especially those in remote locations, because of potential differences in a number of variables measured and the culturally diverse nature, kinship, and beliefs of these people across all First Nations.

4.6 Conclusion

We found that Aboriginal Australians presenting to recently developed and culturally appropriate podiatry services have relatively high levels of foot health. This suggests that these services provide a unique early opportunity for podiatrists to identify, manage, and implement preventative health care, to minimise the burden of foot complications in this population. Future research should further explore foot health from the perspective of Aboriginal and Torres Strait Islander Peoples and prospectively evaluate the impact of culturally safe foot care services on health outcomes in these communities.

4.7 Declarations

4.7.1 Funding

Lowitja Institute, Larapinta Trail Scholarships, Woodend Foundation: Perpetual Philanthropy.

4.7.2 Authors' contributions

MW, SEM, FH, and VC were involved in designing the study. MW and VC were involved in collecting the data and interpreting the results. SS and VC were involved in data entry and analysis, and interpreting the results. MW, VC, SS, drafted the manuscript. All authors read and approved the final manuscript.

4.7.3 Acknowledgement

We would like to acknowledge and thank the Darkinjung and Wiradjuri communities of the Central Coast and Wellington regions of NSW for their support of, and invaluable contribution to, this research.

Chapter 5

Co-design of a culturally safe foot care service for Aboriginal and Torres Strait Islander Peoples: The Buridja Clinic

5.1 Abstract

5.1.1 Background

Capacity to provide successful foot care programs to prevent diabetes-related foot disease in Aboriginal and Torres Strait Islander communities is limited by both a lack of engagement with mainstream services and the scarcity of available research evaluating these services. Therefore, the aim of this research was to co-design and implement a culturally safe foot care service for Aboriginal and Torres Strait Islander Peoples into the University of Newcastle undergraduate podiatry clinic.

5.1.2 Methods

Using an Indigenous-led co-design approach, the initial stages of design and program inception focused on relationship building with the Aboriginal and Torres Strait Islander community on the Central Coast of New South Wales. The approach was led by a local member of the Aboriginal and Torres Strait Islander community and supported by undertaking informal research yarns with community Elders, family members, the local Aboriginal Land Council, and existing community-controlled health services in the region. The purpose of the yarns was to establish local Aboriginal and Torres Strait Islander perceptions of community foot health needs and priorities. Informal discussions were also held with local public health providers and informal focus groups were run with University of Newcastle (UON) educators and UON Podiatry Discipline clinic staff and researchers.

5.1.3 Results

From February to April 2018, informal yarns and focus groups were undertaken and revealed a number of key findings to designing and implementing culturally safe foot care services in the local community. These findings included a requirement to identify community perceived needs for the service, integrating culturally safe practices into the service, service accessibility, integration of students on placement into the service, maintaining ongoing service provision and community engagement, and confidentiality and data sovereignty. From these findings a foot care service model was developed and implemented as the Buridja clinic.

5.1.4 Conclusion

Through an extensive community consultation process this study established an effective co-design approach to developing and implementing a foot care service embedded in undergraduate

podiatry clinic. Future research is required to evaluate the Buridja Clinic from the perspective of Aboriginal and Torres Strait Islander clients and undergraduate students.

5.2 Introduction

Aboriginal and Torres Strait Islander Peoples are well-known to have disproportionately high rates of diabetes, with the age-standardised disease rates up to four times that of non-Indigenous Australians. Consistent with this, diabetes-related complications are responsible for almost 70% of preventable hospitalisations for chronic conditions for Aboriginal and Torres Strait Islander Peoples, significantly contributing to the seven-fold increase risk of diabetes-related mortality in this population (91, 92).

Diabetes is associated with a life-time incidence of foot ulcer of up to 34% and is the leading cause of amputation (156). Diabetes-related foot disease (DFD), including foot ulcers and amputations, is a significantly under-recognised leading cause of the global hospitalisations and disability burden (157, 158). The limited available evidence demonstrates Aboriginal and Torres Strait Islander Australians have a three to six-fold increased risk of DFD compared to non-Aboriginal Australians (50, 116). In some regions, rates of amputation are up to 38 times higher in Aboriginal Australians than the general population (50). This results in elevated rates of DFD-related hospitalisations and preventable deaths in this population, directly contributing to poor quality of life and reduced life expectancy (46). There is strong evidence that preventative foot care and education can significantly decrease rates of DFD in the general population with up to 85% of diabetes-related amputations considered preventable (159). Lack of engagement of Aboriginal and Torres Strait Islander Peoples with existing preventative foot care services, for example diabetes services, is common and needs to be improved to effectively reduce the current high rates of DFD, including amputations (50, 52). Our recent research has clearly demonstrated the potential for culturally safe care to be well accessed by Aboriginal and Torres Strait Islander Peoples before DFD develop, highlighting the systemic failure of mainstream foot care services (160).

Globally a number of barriers to accessing preventative care among Indigenous populations have been identified. These include poor relationships with health care providers, health care providers' lack of acceptance of the role of family in care provision, poor community engagement with available services and inadequate workforce capacity to deliver culturally safe care (61, 64, 73, 154). Translating across Indigenous populations, successful Indigenous primary health care services share core characteristics all related to recognition and integration of culture. This includes development of clinical services that have a high level of community

participation, are accessible, are staffed by a culturally capable workforce and provide holistic care that promotes the self-determination and empowerment of individuals and the community (161).

In Australia, capacity to provide successful foot care programs to prevent DFD in Aboriginal and Torres Strait Islander communities is limited by a lack of engagement with mainstream services which is linked to historical and current issues of dispossession and socioeconomic inequality, concern over being removed from family and community for treatment, along with lack of improvement in Aboriginal and Torres Strait Islander health outcomes through a Western model of health care delivery (64). Our recent research has clearly demonstrated the potential for culturally safe care to be well accessed by Aboriginal and Torres Strait Islander Peoples before DFD develop (160). While there are several foot care programs that have been developed to target prevention of DFD in Aboriginal and Torres Strait Islander populations, we have shown that there has been little formal evaluation of program acceptability to the community, service utilisation, or for health-based outcomes (140). Consistent with this, there is also a lack of co-ordinated long-term strategy to address deficits in the availability of culturally safe care in the health care workforce (59). Therefore, the aim of this research was to co-design and implement a foot care service for Aboriginal and Torres Strait Islander Peoples on the Central Coast of New South Wales that is integrated in an undergraduate podiatry education program and delivered through the University of Newcastle Podiatry clinic in Wyong Hospital. The Central Coast has a population of approximately 330 000 with the Wyong area ranked four out of ten in the Socio-Economic Index for Area (SEIFA) rating scale placing it in the low range. The Aboriginal and Torres Strait islander populations makes up approximately 4% of the population(162).

5.3 The process of co-designing a culturally safe service

Co-design of health services, where there is an equal partnership approach taken to the development services designed to address health care inequities is strongly represented in Government policy (163). To achieve co-design in a culturally safe manner requires direct engagement with a process of decolonisation that actively addresses power differentials, racism, biases and white privilege (164). Culturally safe co-design requires Aboriginal and Torres Strait Islander, empowerment and expertise to be central to development of strategies to support achieving better Aboriginal and Torres Strait Islander health outcome.

To develop a foot care service for Aboriginal and Torres Strait Islander Peoples on the Central Coast of New South Wales we used an Indigenous-led, co-design approach that involved Aboriginal Elders and community members from Darkinjung country. The was to create a service that integrated with the existing local Aboriginal Medical Service (AMS) providers and other mainstream health care service providers and enhanced overall health care access. Initial stages of design and program inception focused on community relationship building. The approach was led by a local member of the Aboriginal and Torres Strait Islander community (a ‘community champion’) who had developed high levels of community trust and experience in developing relationships required to encourage and maintain community participation.

Aboriginal and Torres Strait Islander perceptions of community foot health needs and priorities were gathered utilising informal research yarns (165), with community Elders and potential participants of the program, family members, the local Aboriginal Land Council and existing community-controlled health services in the area. Yarning is a term many Aboriginal and Torres Strait Islander Peoples use to describe sitting down to talk. Interrelated with First Nations epistemology, connection to Country spirituality, yarning conversation and storytelling shares teaching and learning between Aboriginal and Torres Strait Islander Peoples within and across Communities (166, 167). Research yarning in data collection promotes safety for First Nations Peoples participating in research, as it is central to Indigenous ways, promotes a relaxed and open communication for deep discussion (168), and reduces research power imbalance by having the research team initiate and foster relationships accountable to First Nations participants (166, 168).

Informal discussions were held with health service providers regarding current strategies to deliver care to Aboriginal and Torres Strait Islander people to determine types of services offered to the general community and any specific clinic/ service for Aboriginal and Torres Strait Islander people, and informal discussions were held University of Newcastle (UON) educators and UON Podiatry Discipline clinic staff and researchers to determine the methods for integrating the clinical service into an undergraduate degree. We also had previously undertaken an audit of Central Coast Local Health District Podiatry Service utilisation in the public sector podiatry services to further inform the co-design process (52).

All yarns were led by an Aboriginal researcher and discussions with UON educators, clinicians and researchers led by Aboriginal and non-Indigenous researchers. As data were generated through informal means and through a process of evolving partnerships and conversation, detailed field notes were used to record themes arising from yarns and informal focus groups and discussions. Themes identified were used to develop a clinic framework that was updated

where new themes emerged following each discussion resulting in multiple iterations of the framework developed to until consensus was reached by all the stakeholders.

5.4 Culturally safe service framework

Key themes arising from informal community yarning and through informal discussions related to the service provision included the addressing community perceived needs for the service, integrating culturally safe practices into the service, service accessibility, integration of students on placement in the service, maintaining ongoing service provision and community engagement and confidentiality and data sovereignty.

5.4.1 Developing a culturally safe service

5.4.1.1 Establishing community priorities

Participants of informal yarning circles identified the need for the service to include elements that aligned with the Aboriginal and Torre Strait Islander community's desire to prevent the development of DFD in the local community. Personal narratives of family demonstrated an overwhelmingly negative impact of diabetes on foot health and significant concern over the potential for amputation as a result of diabetes. Self-determination and empowerment of the community to have the knowledge and self-care capacity to actively prevent DFD was a collective community priority for the clinic. Participants also expressed the need to have a role in the management of the clinic and to be involved in education of students. The development of the students' cultural awareness and capability was viewed as part of the community responsibility rather than resting solely with the University.

5.4.1.2 Accessibility

Small numbers of Aboriginal and Torres Strait islander people attending public sector podiatry services was identified from previous research (52). There were also no services identified as being specifically for Aboriginal and Torres Strait Islanders people the public sector services. The proposed location of the clinic in the existing University of Newcastle Podiatry clinic in a hospital setting was a point of concern for community members and there was an identified need to ensure communities member to feel comfortable in the environment. Employment of Aboriginal and Torres Strait Islanders Peoples from the community in the clinic and continuing community participation in development of the services were identified as mechanisms to overcome this.

Transport was a concern of community members, public health service representatives and clinic staff. It was widely recognised across these groups that there were limited parking and transport options available at Wyong Hospital. Low rates of motor vehicle ownership in the Aboriginal and Torres Strait Islander community and the large geographic area comprising the Central Coast along with limited public transport options that required significant walking to and from points of arrival were identified as risks to attendance at the clinic.

5.4.1.3 Service delivery

In relation to the physical delivery of the services, community members articulated strong desire for the service to be more flexible to allow group bookings and to allow time for education in a communal and informal setting. Inclusion of students in the service delivery model was identified as a potential risk to clients' safety by local health providers due to lack of cultural capability as well as developing clinical competencies. The cultural safety of clients of the service in relation to interactions between students and community members were also identified as potential risk to community engagement with the service by education providers and researchers. Due to the small and highly integrated nature of the Aboriginal and Torres Strait Islander community of the Central Coast the potential for even a small number of negative clinic experiences to discourage community participation was widely recognised.

5.4.1.4 Continuity of service provision

A shared concern between community members, the Aboriginal Land Council and existing community-controlled health services in the area was in relation to the continuity of service provision. Research conducted within communities, and as part of University based services was perceived as being unlikely to provide ongoing service model for the community with the service at risk of ceasing when research-based outcomes were achieved. This perception was also identified as being a risk to engagement of individuals in the community and of community organisations with the service. This concern was also identified by UON researchers and clinicians, with the need to provide continuity of service during teaching and non-teaching semesters highlighted.

5.4.1.5 Indigenous data sovereignty

Extensive discussion was conducted in relation to data sovereignty. For community member concerns related to individuals' data being collated into the community's data and ownership of that data being vested exclusively in the University partner. There was a recognised need for dissemination of the data be conducted with agreement from the community via their representatives and for an Aboriginal researcher to lead the research for this project.

5.4.2 Service model implementation

In response to the consultation process a model of clinical service delivery was developed for implementation as the Buridja Clinic. The clinic provides a weekly foot care service to the local Aboriginal and Torres Strait Islander community. The clinic is a free service that focuses on DFD prevention providing diabetes assessments, podiatry treatment, group education of foot care and prevention of DFD as well as access to appropriate footwear and offloading. There is a reciprocal referral system between the local AMS podiatry and health service and the clinic to develop comprehensive care plans for all clients, with the Buridja Clinic meeting podiatry service gaps (e.g. orthotic therapy, group foot health care education, nail surgery) and capacity restrictions of existing services. The clinic has been developed to use an integrated process that provides a collaborative experience between providers (students and clinic staff) and clients (community members) but also among the clients themselves.

To develop a culturally safe model of care, the clinic is led by an Aboriginal podiatrist and Aboriginal Health Worker. The clinic delivery has been developed incorporating pre- and post-appointment yarning circles services. The first yarning circle is led by the Aboriginal Health Worker or Aboriginal podiatrist and serves as a mechanism of introducing the students and community participants. The yarning circle run post-appointment facilitates a communal informal opportunity for culturally responsive health promotion activities and clinic feedback. Group appointments are used allowing family and friends to continue to interact during treatment to encourage open discussion amongst community members, assisting students in understanding lived experience and history sharing and promoting participation by example whereby more hesitant participants can watch those less concerned first before deciding if they wish to participate themselves. Appointments are also structured around two 'intake' times opposed to a traditional rigid individual appointment time. Due to restricted funding for the clinic provision of transport is challenging. A collaborative, patient-driven culturally responsive model of car-pooling was included as a part of the concept design to address transport issues to some extent. This initiative had many unforeseen benefits including fostering a sense of shared responsibility for peers particularly for the 'drivers' and an opportunity to debrief between participants and synergies with the model of 'collective-participation' in service provision.

To ensure ongoing service provision, the Buridja Clinic has been integrated into core courses in the undergraduate podiatry program with all students undertaking day placement in the clinic throughout the final year of the degree. All students complete a cultural awareness workshop prior to attending the placement to mitigate the risk of negative experiences for students or participants in the clinic. The workshop includes a cultural immersion component of the lecture

which involves a local elder from among the community attending to provide a more intensive relationship building opportunity with the aim of eliciting a high degree of shared responsibility for the clinic service provision. Concerns raised about data sovereignty were largely resolved by a willingness to assist the lead researcher, a local Aboriginal community member, who shared ongoing ownership of the collected data and through ongoing community participation oversight of the clinic via a community advisory group. This group is comprised of local community members including Elders, health care providers and participants of the clinic. Continuous evaluation is undertaken of the clinic service via participant feedback surveys, one-on-one interviews with clinic participants and an Aboriginal researcher, yarning circles and student feedback survey as well as through quantifiable data relating to clinic access and occasions of service and via consultation with the community advisory group.

5.5 Discussion

This chapter outlines the processes undertaken in the design and implementation of a culturally safe foot care service for Aboriginal and Torres Strait Islander Peoples that is embedded in an undergraduate podiatry program. Consistent with previous research relating to health service delivery for Aboriginal and Torres Strait Islander Peoples in other healthcare professions, common themes were identified that are central to developing a service that prioritises community engagement. These included undertaking wide-ranging community consultation, involving Aboriginal Health Workers and practitioners connected to their local community, providing flexible and accessible care, and developing a model that is responsive to the community health care priorities and promotes empowerment of the community (161).

Overwhelmingly our community consultation process identified the importance of the Buridja Clinic being led by local Aboriginal and Torres Strait Islander Peoples and the concept of ownership of the clinic to rest with the community members. This perception encompassed clinic design and implementation, the concept of empowerment at individual and community levels through improving health literacy and preventative health care access, and also extended to a collective sense of responsibility around the development of cultural capability in students.

There is worldwide evidence that Indigenous health services that promote concepts of community ownership can improve health outcomes for Indigenous communities (169-172). Often run as community-controlled organisations such as in Australia, they are founded on the priorities and values of those communities and frequently offer comprehensive health care programs that incorporate prevention management and health promotion, while cognisant of the social determinant of the health and well-being of the community (161). The Southcentral

Foundation's Nuka System of Care, based in Anchorage, Alaska, is one such successful Indigenous health program (173). The Nuka System of Care is underpinned by the concept of 'customer-owners' where the Native community works together to improve physical, mental, emotional, and spiritual wellness. The positive impact of the system on healthcare outcomes and community engagement without substantial increases in health care delivery costs represents successful large scale health care reform with enduring benefits to the Indigenous community.

In Australia, there are currently 143 Aboriginal Community Controlled Health Organisations (ACCHOs) running over 300 clinics across the country (169). The clinics are operated by local Aboriginal and Torres Strait Islander communities with greater than 50% of employees identifying as Aboriginal or Torres Strait Islander Peoples. Although there has not yet been a comprehensive exploration of the overarching impact of ACCHOs on health outcomes for Aboriginal and Torres Strait Islander Peoples, there is evidence of improvements in health care seeking and self-perceived individual and community health (174, 175). ACCHOs have also been shown to play a central role in increasing the effectiveness of broader health system through partnerships with other health professionals and organisations (176-179), actively contributing to the development of health policy and research (180, 181), providing employment to both Aboriginal and Torres Strait Islander Peoples and non-Indigenous health professionals, and delivering cultural capability training throughout the health sector (182, 183).

The enormous disparities that currently existing in DFD between Aboriginal and Torres Strait Islander Peoples and their non-Indigenous counterparts highlight the challenges that face the podiatry profession in actively contributing to the national Closing the Gap strategy and supporting the limited resources of ACCHOs. The results of our present research identified key service development principles including the need for wide ranging consultation, ongoing involvement of community members, and provision of flexible, accessible care that meets community needs and priorities and promotes individual and community empowerment. While these are consistent with the development of successful Indigenous health care programs nationally and internationally, our research also highlights that, alongside these principles, is the need for the service to be developed within a local context.

Our findings also identified strong community willingness to be involved in the delivery of cultural capability training to undergraduate podiatry students. Addressing deficits in cultural capability in health graduates is essential to meeting the workforce need (184, 185). Improved health care outcomes for Aboriginal and Torres Strait Islander Peoples requires health professionals to be both clinically, and culturally capable (186). University based immersive clinical training opportunities that are supported by the community as have been embedded in the design of Buridja Clinic offer an effective strategy to drive long-term improvement in

workforce cultural capability and contribute to improving outcomes for Aboriginal and Torres Strait Islander Peoples.

The findings of this study need to be considered in light of several limitations. First and foremost, while the main principles derived from the consultation process were found to be consistent with key requirements of Indigenous health services developed nationally and internationally (161, 169-171), the 08-102 aspects of this research are specific to the local Aboriginal and Torres Strait Islander community of the Central Coasts of New South Wales. The authors strongly advocate for the need to undertake wide ranging, ongoing consultation with individual communities in the development of such services and acknowledge that such consultation requires the development of strong collaborative relationships.

Secondly, as an investigation of the development of a model of foot care service for the local Aboriginal and Torres Strait Islander community, this research cannot be considered a measure of a success of the service. We have previously identified that evaluation of foot care programs and services for Aboriginal and Torres Strait Islander Peoples is lacking (140). As such, while the Buridja clinic has been developed through a co-design process involving the local Aboriginal and Torres Strait Islander community and key Aboriginal organisations, as well as other health service providers, the success of the service from the perspective of Aboriginal and Torres Strait Islander Peoples, Western measures of health care outcomes, and student training in cultural capability is yet to be established.

Finally, although this project used a number of methods to conduct consultation to drive the co-design of the clinic, much of this was through informal yarning. Although extensive field notes were used and participants provided with the opportunity to verify their data, it is possible that some feedback was missed or misinterpreted. Therefore, ongoing involvement of community members in the oversight of the Buridja Clinic will be used to continually evaluate the clinic.

5.6 Conclusion

Through an extensive community consultation process we identified essential elements to developing a culturally safe foot care service embedded in an undergraduate podiatry program. Key design elements determined in the co-design process included; integrating ongoing community consultation; involvement of Aboriginal health workers and practitioners connected to their local community; recognising the role of community in cultural capability training of health students; and, creating a flexible and accessible care model that is aligned with the community health care priorities that empowers community members.

5.6.1 Acknowledgement

We would like to acknowledge and thank the Darkinjung community of the Central Coast region of NSW for their support of, and invaluable contribution to, this research.

Chapter 6

Yarning about foot care: Evaluation of a foot care service for Aboriginal and Torres Strait Islander Peoples

6.1 Abstract

6.1.1 Background

Aboriginal and Torres Strait Islander Peoples have high rates of diabetes-related foot disease including foot ulcer and amputation. There has been limited evaluation of foot care services for Aboriginal and Torres Strait Islander Peoples. This project aimed to evaluate an Aboriginal and Torres Strait Islander foot care service (the Buridja Clinic) embedded in a university podiatry program from a community perspective using culturally appropriate methods.

6.1.2 Methods

This mixed-methods study took place in the Buridja Clinic on the Central Coast of New South Wales, Australia, and included an audit of occasions of service, and review of the Buridja Clinic via research yarns with Aboriginal and Torres Strait Islander clients of the clinic and a written 10-item customised clinic feedback survey. Research yarns were transcribed and analysed thematically. Descriptive analysis of quantitative occasions of use and survey data was undertaken, with the open-ended survey responses thematically analysed.

6.1.3 Results

Total occasions of service across the review period was 538, with a total of 189 individual clients treated. Most common service types were general treatments and diabetes assessments. Nine participants who attended the Buridja Clinic were recruited to the two research yarns. An additional 52 participants who attended the clinic completed the customised clinic feedback survey. Specific clinic design elements including yarning circles and group booking as well as student placement were identified as strengths of the clinic. Participants reported difficulty with transport and restricted opening hours and encouraged increased community engagement by clinic staff.

6.1.4 Conclusion

Evaluation of a foot care service for Aboriginal and Torres Strait Islander Peoples embedded in a university-based podiatry program demonstrated the incorporation of specific service design elements, including yarning circles and group appointments, as well as, student placements encouraged ongoing community engagement with the service. Participants reported improved foot health, greater foot and self-care knowledge, and overall better general health and management as a result of attendance to the clinic. Consideration needs to be given to addressing limited access to transport and flexible operating hours when establishing similar services.

6.2 Introduction

Diabetes is associated with a life-time incidence of foot ulcer of up to 30% and is the leading cause of lower limb amputation (26). Of people undergoing an amputation, half will die within the next five years (187). Aboriginal and Torres Strait Islander populations are known to have disproportionately high rates of diabetes, with the age-standardised disease rates up to four times that of non-Indigenous Australians (91). Consistent with this, diabetes-related complications are responsible for almost 70% of preventable hospitalisations for chronic conditions for Aboriginal and Torres Strait Islander Peoples, with Aboriginality itself increasing likelihood of diabetes-related foot disease (DFD) by five-fold relative to non-Indigenous Australians (50, 92).

Lack of availability of culturally safe foot care services and lack of engagement with Western models of health care delivery have been identified as key contributors to worse DFD in Aboriginal and Torres Strait Islander Peoples (116). Despite the urgent need for effective preventative foot care in this population, our data indicate poor engagement with existing preventative care services, and limited evaluation of Aboriginal and Torres Strait Islander specific foot care services (52, 140).

In 2018 the Buridja Clinic was established in the Discipline of Podiatry at the University of Newcastle (UON) to deliver a culturally safe, foot care service focused on DFD prevention. The clinic was developed in consultation with the local Aboriginal and Torres Strait Islander community, community health care providers and Aboriginal organisations including Darkinjung Local Aboriginal Land Council and Yerin Aboriginal Medical Service, and provides foot assessment, foot care and health promotion to the Aboriginal community free of charge. The clinic is staffed by an Aboriginal Podiatrist, Aboriginal Health Worker and UON podiatry students. All students attend a minimum of three days over their final year of their studies. It has now run for over 2 years as a one day per week community clinic, providing over 500 instances of foot assessment and management, as well as health care education provided via a weekly yarning circle. The clinic is hosted in an established podiatry clinical facility at Wyong Hospital and offers a limited transport service to and from the clinic. Further details of the clinic are documented in Chapter 5. In terms of Western measurements of health care service success including occasions of service delivered, this represents an effective program. However, ongoing dialogue with end-users (clients of the service, community members and health care providers) has identified that these data fail to provide any measure of Aboriginal perspectives of program success. As a result the components of the program that, from a participant and community perspectives, are successful in maintaining long-term engagement with, and participation in, the service are indistinguishable. Clarifying these aspects of the program,

through investigation incorporating more culturally appropriate approaches, is essential to developing an effective clinical model that is translatable across communities. More broadly this represents a largely un-researched aspect of Aboriginal and Torres Strait Islander health care delivery, and one that has been poorly recognized in the development of foot care strategies to combat the significant over-representation of foot complications in this population (140).

Previous research has advocated for research in Indigenous populations to use methods which value the knowledge and experience of Indigenous Peoples (165, 188, 189). Yarning is an Aboriginal and Torres Strait Islander way of storytelling, teaching and learning that is a collaborative dialogical progression (165). Yarning as a research method is defined as being a conversation with a purpose (with similarities to a semi-structured interview) that applies storytelling to collecting information. It requires researchers to build an accountable relationship with participants and to allow story telling that does not necessarily adhere to a research plan or research question and to identify common threads that inform the research topic (188, 189). Yarning has previously been used to investigate community perspectives on Aboriginal healthcare programs (190) and has integrated into the Buridja Clinic as a means of developing a mutual understanding between health care providers and clinic clients, of foot health and foot care. This method of research offers an effective means to undertake a culturally appropriate evaluation of the Buridja Clinic, focusing on Aboriginal perspectives of program success and the impact of the clinic on individual well-being.

The aim of this research was to evaluate the Buridja Clinic from an Aboriginal and Torres Strait Islander perspective using culturally appropriate research methods. Specifically the research aimed to determine success of the Buridja Clinic from the perspective of Aboriginal and Torres Strait Islander clients as end-users of the service, establish the effectiveness of elements within the clinic model, and identify areas of the clinical model requiring further improvement.

6.3 Methods

This mixed methods study took place in the Buridja Clinic on the Central Coast of New South Wales, Australia, and included an audit of occasions of services between March 2018 and April 2021, a written 10-item customised clinic feedback survey, a qualitative review of the Buridja Clinic via research yarns undertake, and. The study was approved by the University of Newcastle ethics committee (H-2018-0035) and the Aboriginal Health and Medical Research Council (1376/18).

6.3.1 Clinical audit

Data relating to occasions of services (total number and service type) was measured across a two year period for March 2018 to March 2020. During this time the clinic operated during the University semester with a limited service provided between semester dates that was operated by staff.

6.3.2 Customised feedback survey

The customised survey was offered to all attendees at the clinic to be completed and submitted anonymously. The survey included three questions relating to number of attendances, types of services accessed, and referral source (e.g. word of mouth, health practitioner referral), six questions relating to their experiences at the clinic with staff, students and the services, and one opened ended question for additional feedback about any aspect of the clinic. The six questions relating to their experience at the clinic required respondents to rate aspects of the clinic on a 5-point Likert scale ranging from 'very good' to 'very poor', 'very likely' to 'very unlikely' or 'very easy' to 'very difficult'. To quantify the responses, the most positive response options (i.e. very good, very likely, and very easy) were allocated a score of 5, while the least positive were scored at 1 (i.e. very difficult, very unlikely, and very poor). Survey data were entered into Microsoft Excel and then exported to the Statistical Packages for Social Sciences (SPSS) (version 25.0 Chicago, Illinois, USA) for analysis and frequencies were calculated. Open-ended responses were manually collated, categorised and code by two researchers. From this key themes and sub themes were identified. The thematic analysis was conducted by an Aboriginal researcher (MW) and crossed checked by a second researcher (VC).

6.3.3 Research yarns

For research yarns, recruitment of participants was conducted using purposive and selective sampling from clients of the Buridja Clinic and their family and community Elders. A snowballing recruitment strategy was used for additional participants identified by those recruited during the initial recruitment phase. Research yarns were conducted in the same space as the weekly yarning circles at the University of Newcastle Podiatry clinic. The research yarns explored the Aboriginal community perspective on the Buridja Clinic (see appendix 3 for questions). This was guided by key topics including: identifying essential elements in the clinical service model that were compatible with community expectations and considered successful or not, and exploring Aboriginal perspectives of program, including how program and participant success should be evaluated. Secondly, the research yarns explored the

participant perceptions on if, and how, the Buridja Clinic had affected their self-perceived foot health and overall well-being. Probes were not used as it has been previously identified that maintaining adherence to the research question or topic can prevent relevant story telling that does not obviously adhere to research questions or academic concepts (167).

Yarning circles were recorded, transcribed verbatim and independently analysed and coded by two researchers (VC and MW) including an Aboriginal researcher. Data were then categorised and coded through several iterations into key themes and sub-themes, identifying similarities and differences within and between the yarning with any emerging patterns identified. Generated codes will be refined from recurring responses and developed into themes for thematic analysis. Over several iterations, new coded material and emerging patterns were discussed at regular intervals and regrouped into key themes and sub-themes, identifying similarities and differences within and between the yarning. These themes were then cross-checked by an Aboriginal researcher (MW) to identify areas of potential bias and to determine the reliability of the data interpretation (191, 192). Prior to data analysis all participants verified their data.

6.4 Results

6.4.1 Clinical audit

Over the time frame of March 2018 to March 2020, 58 clinical sessions were run in the Buridja Clinic and 199 individuals treated. Total occasions of service across the two years was 548. Most common service types were general treatments and diabetes assessments (comprising vascular and neurological testing, and risk classification in a person diagnosed with diabetes). A breakdown of occasions of service is shown in table 6.1. Running as a drop-in service attendance data were not relevant.

Table 6.1. Occasions of service

Service type	2018	2019/20	Total
General treatments	53	72	121
Vascular assessments	28	27	55
Neurological assessments	25	23	48
Diabetes assessments	52	62	108
Biomechanical assessments	15	22	37
Orthotic prescription	10	12	22
Footwear prescription	44	56	100
Nail surgery	2	2	4
Group education sessions	22	21	43
Total occasions of service	251	297	548

6.4.2 Customised survey responses

Fifty-two participants completed the customised survey. The mean number of times (SD) attending the clinic was 3.9 (2.1). Approximately 54% of participants (n=28) found out about the service from word of mouth, 19% (n=10) from referral from another health practitioner, 12% (n=6) from advertising and 15% (n=8) from other sources. Other sources most frequently included community events where the clinic held outreach services including National Aborigines and Islanders Day Observance Committee (NAIDOC week) and Coast Connect days. The most common reasons for visiting the clinic were for general foot care (69%, n=36), diabetes assessment (65%, n=32), diabetes education (23%, n=12), footwear referral (21%, n=11), foot orthoses (10%, n=5) and nail surgery (2%, n=1). Results for questions 4-9 of the survey relating to participants rating their experience of different aspects of the clinic are shown in table 6.2.

Table 6.2. Ratings of participant experience with the Buridja clinic

Survey component	Responses (scores 1-5) (n [5])				
	1	2	3	4	5
Clinic access,			12 (23)	29 (56)	11 (21)
Availability of foot care services			8 (15)	31 (60)	13 (25)
Experience with students		1 (2)	3 (6)	28 (54)	20 (38)
Experience with staff				24 (46)	28 (54)
Quality of care				12 (23)	38 (73)
Likelihood of recommending the clinic				13 (25)	39 (75)

The opened-ended response for feedback identified three main themes, two of which related to access to the clinic and one to clinic services. The two themes relating to clinic access related to transport and scheduling. Specifically participants identified a lack of onsite parking and poor public transport as hindrances to them attending the service. In addition, the restricted hours of

the clinic (one day a week) was identified as preventing family members attending the clinic. Participants noted a preference for an out-of-hours or weekend session as well to allow more family members who were working or at school to attend, as well as the option for the clinic to run at additional community sites.

6.4.3 Research yarns

Two research yarns were conducted which ran for approximately 40 minutes and included a group of five participants and a group of four participants. All participants were clients of the clinic and had regularly attended the clinic over a period of 24 months (more than six occasions of service each). Participants were six women and three men (including three community Elders) with 65% of participants having an existing diagnosis of diabetes. One of the participants was a current smoker, all participants had a past history of smoking. Participant's age ranged from 35 years to 85 years.

Congruence was observed in participant responses across the two yarning circles with no new themes raised in the second yarn. An overview of the themes raised in relation to program success and self-perceived foot health and well-being is provided in table 6.3 below.

Table 6.3. Overview of themes raised in research yarns

Measures of program success	Foot health and overall well-being
<ul style="list-style-type: none"> • Students preparedness for placement <ul style="list-style-type: none"> ○ Student interactions and engagement ○ Cultural sensitivity 	<ul style="list-style-type: none"> • Improved foot health <ul style="list-style-type: none"> ○ Change in self-care habits- general and foot related ○ Change in footwear use
<ul style="list-style-type: none"> • Clinical environment <ul style="list-style-type: none"> ○ Inclusion of culturally safe elements (yarning circles) ○ Presence of Aboriginal health care providers ○ Community engagement by non-Indigenous staff 	<ul style="list-style-type: none"> • Increased use of other health services • Improved health literacy

6.4.3.1 Measures of program success

Overall participants reported they were satisfied with the design of the clinic. Successful elements of the clinic related to interaction with the students, the clinical environment and improved health literacy with recognition of the clinic as helping to reduce their fears of poor health outcomes. There was a strong consensus among participants that the students involved were an integral part of the success of the clinic, and, that this increased their own engagement with the service. Themes relating to the positive role of students in the service included identification of a high level of preparedness for undertaking placement and their active engagement with the clients.

“The pre-course material that were introduced to them before meeting community members is obviously very well structured because that was evident in how they conducted themselves, how they approached the community members, and those conversations and how they engaged. How they treated me and the other people in the room there was a lead up to that for them to be ready to come into that room. So obviously that pre-work must be very good.” [P4]

It was specifically noted that although the individual providing treatment changed many times, participants felt the student body was responsive to the cultural needs of the Aboriginal community and recognised a role for themselves in the student training.

“I found the students to be respectful they were culturally sensitive to us as Aboriginal people which I found to be really good... They wanted to learn, they’d ask a question about your Aboriginality, where you come from and who you were, and that was really interesting because they were learning about us as Aboriginal people.” [P8]

“The students, all the ones that come, they’re all such beautiful people. And every time I go there would be different ones there and they were all lovely.” [P3]

“It’s breaking down the stereotypes... giving us the chance to talk to the students and teach them.” [P5]

Design aspects of the clinic model, such as yarning circles, group appointments, and education sessions, were identified by participants as making them feel more likely to attend and encouraged community engagement.

“It was enjoyable going and meeting up with different people that I knew also and getting to have a yarn to the students and tell them about my life.” [P6]

Participants also identified the role of the clinic in helping them understand their health, and giving them knowledge and understanding to better manage the condition. Participants clearly linked their own health concerns with experiences of their family members. This was particularly profound from family members who had diabetes. Of note, was the universally negative impact diabetes had on the family members of participants. Family members of participants who had suffered negative outcomes served to motivate participants to engage in prevention strategies.

“I’ve had sisters be diabetics and one of my sisters passed away a couple of years ago through diabetes. She was in hospital and going through all sorts of things, but she couldn’t walk around that much because of her diabetes, I like coming here to get everything checked.” [P3]

“I have a brother with bad diabetes, and he has lost a toe and there no way in the world that I want to be in that position. I hope I never get in that position. This clinic has helped me understand the importance of my diet and how to maintain that and to have regular check-ups and ensure I stick to that because of the diabetes and having a number of

people pass because of diabetes and obesity so I'm a lot clearer now about how to maintain my diabetes and my healthy feet, as well as a healthy diet.” [P1]

The importance of engagement in a community context more broadly outside of the clinical environment was consistently identified. A strength of the clinic was the presence of an Aboriginal Podiatrist and Aboriginal Health Worker from the local community.

“It's good to have the clinic, it's good to be able to come here and get sorted out, to have people from our community here and they tell us where we need to go or talk to the doctor.” [P7]

Community engagement also related to non-Aboriginal staff who had an ongoing presence in the clinic and ensuring they are more widely recognised in the Aboriginal and Torres Strait Islander community. The importance of people in the service being linked to that service and being known in the community was highlighted.

“For me some of the non-Indigenous staff that [work with the team at the clinic] is a good way for them to engage a lot better with the community is to be seen out in community maybe not so much in the clinic. But to come along to a local community event and encourage the podiatry program and what it's about and the importance of the podiatry program, more people will come if they get to know them better.” [P2]

“Advertising, definitely advertising putting it out there that whether they're black feet or white feet they need to be looked after. With advertising, 'we walk together' which is one of the things we talk about in reconciliation. So when we have our events even like with NAIDOC.” [P1]

6.4.3.2 Self-perceived foot health and general health

The complex nature of many chronic illnesses combined with the central role of self-care/self-management in the long-term proactive management of many chronic illnesses was recognised by participants in both groups. Further to this, understanding the improvement of health literacy and self-care knowledge among the group as they participated in the program overtime was evident in the comments they expressed.

“It opened my eyes about neuropathy. I think with diabetes we're more worried about blood pressure and sugars and stuff like that and not so much the damage that's happening down a lot lower in our feet.” [P2]

Self-reported improvement foot health was also noted and changes in self-care behaviour in response to attending the clinic. These were consistently reported in relation to footwear changes to try to prevent foot complications.

“It gave me greater understanding of that foot care knowledge everybody should have as a diabetic person and down the roads of wearing good shoes, good quality shoes.” [P6]
“I know what I should be looking for in a shoe now” [P9]

“they helped me find shoes that were good but not like the real expensive ones because they are too much” [P3]

Changes in knowledge of how to treat foot problems and prevent additional complications were also acknowledged including daily foot checks and emollient use.

“I had really, really bad feet....now they are completely cleared up because of knowing how to maintain and look after them.” [P1]

“To check my feet for cuts and little things so you don’t get infections because usually you just don’t bother.” [P6]

“Overall for me to manage my diabetes and keep it at 4’s n 5’s [Blood Sugar Levels, mmol] means then I have good feet...And the moisturising of the harder skin on your feet to make it better.” [P8]

Participants also reported changes in their health care seeking behaviour. This included increased likelihood of visiting health care providers for preventative health care, for example where clients hadn’t directly been referred on, they were motivated to engage more with their primary health physician.

“I think the diabetes management is a bit better than it was, and I need to see my doctor and get up to date medications.” [P2]

In addition to greater motivation to seek preventative health care, participants also reported increased likelihood of them advising other family members to use preventative health care, and increased likelihood of them attending other health practitioners they were referred to from the Buridja Clinic.

“I had one test and one leg was warm and one cold and a letter was written to my doctor to check that out and it was discovered I had a bakers cyst and they did a full ultrasound on it.” [P1]

“They were worried about my skin at the clinic and sent me to have it checked and I had to get some stuff cut-off. Now the whole family has gone and got checked.” [P9]

6.5 Discussion

This study is one of the first to investigate Aboriginal perceptions of success of a podiatry service designed for Aboriginal and Torre Strait Islander Peoples alongside review of service utilisation (140). The clinical audit data extracted as part of this research demonstrated sustained engagement of community members with the service over the period of the audit. The high use of diabetes assessments and general treatment is consistent with high rates of diabetes in the community (193) and with DFD prevention through preventive treatment and improved self-care capacity being a priority for the local Aboriginal and Torres Strait Islander community.

Further to evidence of consistent service use that was aligned with community expectation of the Buridja Clinic, this research has provided insights into elements of service that contribute to perceived success by the community. Consistent with previous research this present study supports the essential role of local community involvement in the design and development of the clinic and in staffing of the clinic and the need for a shift away from traditional service model structure to create a culturally safe foot care service. Interestingly, our study findings also demonstrated a positive response by community members to the integration of undergraduate podiatry students into the clinical service delivery model. The strong positive feedback on this element of the Buridja Clinic was noteworthy, with this seen by participants as both an opportunity for them to generate change in perception of Aboriginal and Torres Strait Islander Peoples and health outcomes, and part of their own role in the clinic. This may have contributed to an increased sense of ownership of, and engagement with, the clinic.

Lack of access to culturally safe general health care, and limited service delivery with related health workforce pressures, including difficulty recruiting health graduates to rural positions and their limited self-perceived cultural capability in health care delivery are key contributors to poorer health outcomes for Aboriginal and Torres Strait Islander Peoples (194). There has been very limited evaluation of the effectiveness of university-based training on students' cultural capability outcomes for health graduates in any form, but particularly in relation to clinical placements (140, 195). Studies of the effectiveness of cultural awareness and cultural capability programs in Aboriginal and Torres Strait Islander populations and Indigenous populations globally have shown inconsistent results (195-197). There is evidence that inclusion of programs focussed on Indigenous health can increase student preparedness for undertaking work with Indigenous peoples, and may generate increased commitment to improving health outcomes for this population in the future (197, 198). Beyond this, to the authors' knowledge, there is a paucity of evidence evaluating the involvement of health students in delivering health services for Aboriginal and Torres Strait Islander Peoples from a community perspective. Our findings of student placement in the Buridja Clinic as being a strength of the service highlights the potential for university-based health programs to improve the cultural capability of graduates and produce enduring change in the capacity of health care workforce to provide culturally safe care.

The outcomes of our study highlight the importance of a multifaceted approach to community engagement to support uptake of health care and health education services in Aboriginal and Torres Strait Islander communities. Increasing community engagement of staff outside the health service via general community events was identified by participants as a way to continue to increase the overall community engagement with the clinic. While community consultation and client consultation is central to the ongoing management of the Buridja Clinic, there is

capacity for much wider consultation and engagement with the broader community that will be important for future growth of the service and to improve community access. This was highlighted through the evaluation process and is consistent with previous research which has shown the importance of maintaining widespread engagement and consultation to improve health care delivery (155).

Engagement with health care services by Aboriginal and Torres Strait Islander Peoples is essential to reducing the current health disparities experienced by this population (155, 199). While we have shown a lack of documented outcomes for foot care services for Aboriginal and Torres Strait Islander Peoples, there are a number of examples of new services that have improved access to general health care and diabetes care services and patient outcomes in Aboriginal and Torres Strait Islander communities in Australia (70, 140, 200, 201). Similar to the Buridja Clinic, these share common characteristics, including community consultation in the development, implementation and ongoing management of the service, involvement of Aboriginal Health Workers, and a focus on self-management and patient participation in health through improved health literacy (70, 200, 201). The results of this present study identified issues related to physical clinic access via transport and restricted operating hours which are consistent with previous findings in cancer patients (74) and remain a challenge for Buridja Clinic to fully address. However, there was also consensus among participants that they were comfortable with the clinic environment indicating it had largely overcome any mistrust of mainstream health care and hospital and clinical environments (74).

Participants also reported clinic attendance improved their knowledge of effective foot care and diabetes management which is significant for the prevention of DFD. Although this was not measured for this present study and relied on self-report it does suggest that this may be achievable with a culturally safe clinic and should be investigated in the future. There is strong evidence that preventative care and education can significantly decrease rates of DFD in the general population (202). Early mitigation of modifiable risk factors such as smoking, poor diet quality, alcohol consumption, hypertension and dyslipidaemia while maintaining appropriate blood glucose control is known to reduce risk of future complications (202). Despite this, prevalence of modifiable risk factors among Aboriginal and Torres Strait Islander Peoples remains high. Other strategies include patient education, implementation of foot checks, objective measures of neurological and vascular health, and early referral to a podiatrist. Again, reported evidence indicates that interaction with early intervention programs and therefore opportunities to educate Aboriginal and Torres Strait Islander cohorts remains low across all regions where rates of amputation are high (48, 52). With Aboriginal and Torres Strait Islander Peoples experiencing lower limb amputation rates up to 38 times higher than those of their age matched, non-Indigenous counterparts, and 98% of lower limb amputations in the population

the result of diabetes the potential impacts of effective foot care education programs on reducing rates of DFD in this population are significant (48-50).

The findings of this research need to be considered in light of the extent of the data collection and the geographical area in which the study was undertaken. The purpose of the study was to identify strengths and weakness of the clinic service model. Clients attending the Buridja Clinic volunteered for the research yarns included in this study. Most participants had attended on a number of occasions suggesting they were happy and engaged with the service. It is likely that this created bias in the responses with them returning to a service that they liked. Nevertheless determining why they liked it is essential to being able to translate this service to other regions. As none of the participants had only attending on a single occasion it is likely that negative feedback regarding the clinic was missed in this aspect of that data collection. In addition, the research yarns were led by an Aboriginal research also involved in the clinic. This may have introduced bias in the responses. However as the researcher is a member of the local community, community members trusted and respected this researcher and this may also have had the effect of them being more likely to provide their criticism, particularly given that Elders were included in very yarning circle.

The data collected through anonymous surveys was more likely to have captured negative experiences, however, the overall positive feedback through this method suggests strong dissatisfaction with the clinic is unlikely. However, this aspect of the study would have potentially been strengthened with additional research yarns undertaken in the community. The feedback in relation to the Buridja Clinic is specific to the Aboriginal and Torres Strait Islander community on the Central Coast of New South Wales. It is well established that in addition to consulting with Aboriginal Torres Strait Islander communities and services in the establishment of new health care services is vital. However, services also need to be tailored to specific needs and preferences of individual communities. Therefore while, specific elements of the Buridja Clinic that worked well including design aspects and inclusion of students were identified in this study, implementation of these elements into other communities would require prior community consultation and engagement.

6.6 Conclusion

Evaluation of a foot care service for Aboriginal and Torres Strait Islander Peoples embedded in a university-based podiatry program demonstrated the incorporation of specific service design elements, including yarning circles and group appointment, as well as, student placements encouraged ongoing community engagement with the service. Participants reported improved foot health, greater foot and self-care knowledge, and overall better general health and

management as a result of attendance to the clinic. Consideration needs to be given to addressing limited access to transport and flexible operating hours when establishing similar services.

6.7 Declarations

6.7.1 Funding

Larapinta trail scholarships, Lowitja Institute, Woodend Foundation: Perpetual Philanthropy

6.7.2 Authors' contributions

MW, FH, and VC were involved in designing the study. MW and VC were involved in collecting the data and interpreting the results. MW and VC were involved in data entry and analysis, and interpreting the results. VC, MW, SS, FH, and SEM drafted the manuscript. All authors read and approved the final manuscript.

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Chapter 7

Effect of a culturally safe student placement on students' understanding of, and confidence with, providing culturally safe podiatry care

Matthew West¹, Sean Sadler¹, Fiona Hawke¹, Shannon E. Munteanu^{2,3}, Vivienne Chuter^{1,4}

¹Discipline of Podiatry, University of Newcastle, Ourimbah, NSW, 2258, Australia

²Discipline of Podiatry, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria 3086 Australia

³La Trobe Sport and Exercise Medicine Research Centre, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria, 3086, Australia

⁴Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, Newcastle, NSW, 2308, Australia

This study has been submitted to the *Journal of Foot and Ankle Research*

7.1 Abstract

7.1.1 Background

For university-based podiatry education there are little data available documenting the delivery method and impact of Aboriginal and Torres Strait Islander health curricula or the use of, and outcomes from, immersive clinical placements generally or specific to podiatry practice. Therefore, the primary aim of this study was to evaluate the effect of undertaking clinical placement in a culturally safe podiatry service for Aboriginal and Torres Strait Islander Peoples on podiatry students' understanding of, and confidence with, providing culturally safe podiatry care.

7.1.2 Methods

Final year University of Newcastle undergraduate podiatry students attending a culturally safe Aboriginal and Torres Strait Islander student clinic at a local hospital were purposively recruited to participate. Students completed a custom-made and pilot tested cultural awareness and capability survey before and after placement. Survey domains were determined from a principle component analysis. These included understanding of power relationships, the interrelationship between culture and self-perceived health and the importance of culture in clinical practice and access to health care and student confidence with providing culturally safe care. The Wilcoxon Signed Rank test was used to compare pre-placement scores on each domain of the survey to the post-placements scores. Effect sizes were calculated and interpreted as small (0.1–0.29), medium (0.3–0.49), and large (≥ 0.5).

7.1.3 Results

This study recruited 58 final year University of Newcastle podiatry students to complete baseline and follow-up surveys. For all domains in the survey statistically significant ($p < 0.05$) increases in post-placement scores were recorded. The effect size for each domain were medium to large.

7.1.4 Conclusion

This study demonstrated that an immersive student placement at a culturally safe podiatry clinic significantly improves students' understanding of, and confidence with, providing culturally appropriate care to Aboriginal and Torres Strait Islander Peoples. This study provides foundation evidence of the role that such placements have on developing students' cultural capability in a tertiary health care setting, and will help inform future curricula development at both educational institutions and health services, as well as, form the basis for ongoing research.

7.2 Introduction

Cultural capability in an allied health care setting has the goal of delivering culturally aware and safe care to every patient regardless of race, ethnicity, culture, or language proficiency (71). Cultural capability for health practitioners refers to the acquisition of skills, knowledge, and behaviours that have a grounding in, and respectful understanding of, Aboriginal and Torres Strait Islander Peoples' culture and history (203). Cultural capability is a key mechanism to overcome inequalities in health care access and is a determinant of health related outcomes for Aboriginal and Torres Strait Islander Peoples (59).

Both institutional and practitioner biases are known to significantly contribute to the health disparities between Indigenous and non-Indigenous populations globally (204, 205). Further to health care service design and provision influencing culturally safe and appropriate care, is the role of both institutions and organisations in providing curricula for effective cultural capability training (82). Addressing deficits in cultural capability in health graduates is essential to preparing workforce ready health professionals. A number of barriers to wide-ranging, continuous, and compulsory cultural capability training within both undergraduate and postgraduate health professional programs have been identified. For example, a lack of flexibility in pedagogical approaches to curriculum development and lack of resources to promote strong community engagement with existing programs have been identified (82, 83). Addressing these barriers is important because recent research has demonstrated the quality of undergraduate curricula to have a profound impact on entry-level health professional learners (84). Improved health care outcomes for Aboriginal and Torres Strait Islander Peoples requires health professionals to be both clinically and culturally capable (186).

There is little research evaluating the effectiveness of cultural training programs for health professionals, with the few studies identified demonstrating no significant improvements in knowledge and attitudes of health professionals, while other lower quality studies found a small benefit (195). Relatively few studies have documented immersive approaches that promote community engagement and interaction, or specifically integrate participants in health care delivery, particularly in undergraduate student populations (195). Internationally, there has been limited research performed across a number of health professionals, with a mix of either individual or combined online and face to face sessions being evaluated, with studies finding a small positive relationship between cultural capability training and improved patient outcomes (196). Several national studies have demonstrated some measure of success with improving students' understanding of, and attitudes towards, Aboriginal and Torres Strait Islander health and self-perceived preparedness for practising in Indigenous communities and advocating for

improved health outcomes (195, 197). For university-based podiatry education there are little data available documenting the delivery method and impact of Aboriginal and Torres Strait Islander health curricula or the use of, and outcomes from, immersive clinical placements generally or specific to podiatry practice. While there are a number of podiatry programs for Aboriginal and Torres Strait Islander people in Australia (140), programs that do include podiatry students do so as part of a large allied health professional team with no in-depth evaluation of the experience from the perspective of podiatry students (90), or the role of such programs in podiatry student cultural capability training.

Therefore, to evaluate the effect of an immersive clinical placement on self-perceived cultural awareness and capability, a student placement program for all final year podiatry students at the University of Newcastle in a University-led podiatry service for Aboriginal and Torres Strait Islander people was developed. The primary aim of this study was to evaluate the effect of undertaking clinical placement in a culturally safe podiatry service for Aboriginal and Torres Strait Islander Peoples on students' understanding of, and confidence with, providing culturally safe podiatry care.

7.3 Methods

7.3.1 Design and participants

Final year University of Newcastle undergraduate podiatry students attending a culturally safe Aboriginal and Torres Strait Islander student clinic at Wyong hospital, located on the Central Coast, between Sydney and Newcastle, NSW, Australia, were purposively recruited to participate.

7.3.2 Clinical placement

The clinic has been developed as a culturally safe clinic for the Aboriginal and Torres Strait Islander community on the Central Coast of New South Wales, Australia. The clinic is led by an Aboriginal Podiatrist, supported by Aboriginal Health Worker, and provides student day placements throughout both teaching semesters. In being culturally safe, the clinic is designed to create an environment that is considerate of the spiritual, physical, social, and emotional world view of Aboriginal and Torres Strait Islander people, thereby creating a clinical experience which is conducive to, and supportive of, the specific needs of this community (72). Additionally, the approach to management of clients within this clinic is one that recognises the importance of culture, family, and community for Aboriginal and Torres Strait Islander people.

The clinic is managed by the University of Newcastle, Discipline of Podiatry, and operates a weekly foot care service for Aboriginal and Torres Strait Islander people. The clinic provides a range of podiatry care and health promotion services, with a focus on diabetes-related foot disease (DFD) and prevention education. Final year students undertake a block mode delivery (single session) orientation program delivered by an Aboriginal podiatrist and an Aboriginal Elder from the local community before being rostered through the clinic. Students recruited to the present study were in the final year of the program in 2018 and 2019, and participated in a minimum of four day placements in the clinic over the first and second semesters of the academic year. During these clinic sessions they provided podiatry assessments and management, health promotion and participated in yarning circles with clinic clients. Following the placement they completed a reflective journal relating to their experiences in the clinic. Successful completion of the placement program and associated placement reflection was a compulsory part of the clinical placement program. Students had additional opportunity to undertake voluntary placements at other related community events and outreach clinics run for Aboriginal and Torres Strait Islander Peoples throughout the year.

7.3.3 Procedure

Final year undergraduate students attending the placement completed the cultural awareness and capability survey (Cultural Capability for Podiatry Students) after their orientation session but before undertaking any clinical placement and following the 4 days of placement over the two semesters. The second survey completion was approximately 7 to 8 months later according to their day placement roster and directly after their final day placement finished.

7.3.3.1 Cultural capability for podiatry students survey

As part of this research a customised survey was developed to measure change aspects of students' self-perceived cultural awareness and capability. The survey was developed drawing on existing survey literature, and utilising a participatory action approach (206). This involved a multi-stage process including initial systematic exploration and analysis of evidence and establishment of contextual relevance through review of existing literature, and Aboriginal education and podiatry education expert review (207). Testing for feasibility and relevance, and appropriateness/comprehension of the survey was undertaken with 10 final year Podiatry students. Thematic analysis of feedback provided at each stage of this process was used to refine the survey. Principle component analysis was then undertaken to identify subscales within the survey for pre-post comparison. Prior to principle component analysis, the suitability of survey data for factor analysis was assessed. Inspection of the correlation matrix of individual question responses at baseline revealed the presence of several coefficients above 0.3, indicating

commonality between sections of the survey. Additionally, the Kaiser-Meyer-Olkin value exceeded 0.6 and the Bartlett's Test of Sphericity reached statistical significance. All of which support the use of principle component analysis (208). To aid interpretation of components within the survey, oblique rotation of factors using Oblimin rotation was performed. The number of components extracted was based on Kaiser's criterion (eigenvalue above 1) (209) and inspection of the scree plot (with components below the 'elbow' rejected) (210). The internal consistency of final components was investigated using Cronbach's alpha coefficient, with values above 0.7 representing acceptable reliability (211).

Principle component analysis revealed the presence of five components with eigenvalues exceeding 1, explaining 23.7%, 21.1%, 12.5%, 7.4%, and 6.2% of the variance respectively (211). Inspection of the scree plot revealed a change (elbow) between components 4 and 5, therefore, four components were retained (210). The four component solution explained a total of 64.7% of the variance. To aid in the interpretation of these four components, Oblimin rotation was performed. The rotated solution revealed substantial loading of individual variables mostly on single components. The correlation between each component was weak with values ranging from $r=0.02$ to $r=0.35$ (see appendix 4 for component correlation matrix), suggesting each component is measuring different aspects of the survey. Questions from the survey that fit into each component can be found in appendix 4. Pattern and structure matrices for the principle component analysis with Oblimin rotation of the four factor solution can be found in table 7.1. Cronbach's alpha coefficient for component 1 (0.87), component 2 (0.81), component 3 (0.79), and component 4 (0.76) exceeded 0.7, suggesting acceptable internal consistency of the subscales (211) (table 7.1).

The final survey included 17 statements with respondents asked to consider how likely they are to agree or disagree with each statement on a 5-point Likert scale ranging from 'strongly agree' to 'strongly disagree' (appendix 4). The survey covers four domains of cultural awareness and capability: 1) *Level of understanding of power relationships*; 2) *Level of understanding of the interrelationship between culture and self-perceived health*; 3) *Level of understanding of the importance of culture in clinical practice and access to health care*; and 4) *Level of confidence with providing culturally safe care*.

Table 7.1. Pattern and structure matrices for principle component analysis with Oblimin rotation of four factor solution

Survey Question	Pattern Matrix				Structure Matrix				Communalities
	Component				Component				
	1	2	3	4	1	2	3	4	
Q15	0.858	0.061	-0.088	-0.082	0.829	0.074	0.105	-0.010	0.707
Q16	0.848	-0.047	0.109	0.053	0.879	-0.084	0.297	0.157	0.790
Q17	0.837	-0.006	0.094	0.080	0.866	-0.052	0.278	0.169	0.765
Q14	0.785	0.023	0.059	-0.135	0.784	0.008	0.238	-0.045	0.635
Q7	-0.066	0.873	0.197	-0.148	-0.020	0.822	0.197	0.147	0.736
Q6	0.249	0.826	-0.187	0.064	0.231	0.851	-0.124	0.386	0.809
Q4	-0.171	0.660	-0.065	0.136	-0.158	0.703	-0.099	0.351	0.545
Q5	0.327	0.549	-0.119	0.294	0.343	0.658	-0.048	0.525	0.633
Q8	-0.061	0.530	0.086	0.287	-0.001	0.631	0.071	0.465	0.474
Q12	-0.032	0.033	0.864	-0.033	0.156	0.035	0.857	-0.073	0.739
Q10	0.016	0.039	0.783	-0.048	0.184	0.046	0.787	-0.083	0.625
Q11	0.178	0.012	0.751	0.074	0.353	-0.027	0.788	0.068	0.659
Q9	-0.069	0.240	0.728	-0.179	0.079	-0.185	0.721	-0.122	0.586
Q13	0.114	0.125	0.519	0.250	0.254	0.028	0.536	0.203	0.361
Q2	-0.081	-0.061	-0.049	0.821	-0.004	-0.348	-0.090	0.835	0.712
Q3	-0.023	-0.054	0.061	0.794	0.076	-0.334	0.034	0.809	0.660
Q1	0.001	-0.044	-0.025	0.729	0.073	-0.300	-0.045	0.745	0.557

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 8 iterations Note: major loadings per component are bolded.

7.3.4 Statistical analysis

Survey data were entered into Microsoft Excel and then exported to the statistical packages for social sciences program for analysis (version 25.0 Chicago, Illinois, USA). Data were assessed for normality using histograms, boxplots, and the Shapiro-Wilk test with appropriate parametric or nonparametric analyses performed.

The Wilcoxon Signed Rank test was used to compare pre-placement scores on each domain of the survey to the post-placements scores. Effect sizes were calculated using Microsoft Excel and reported using the z value statistic divided by the square root of N (cases \times 2) with the size of the effect interpreted according to Cohen (212): 0.1–0.29 = small effect; 0.3–0.49 = medium effect; ≥ 0.5 = large effect.

7.4 Results

This study recruited 58 final year University of Newcastle podiatry students to complete baseline surveys and follow up surveys over two years (March 2018 and October/November 2018 and March 2019 and October/November 2019). The recruited participants included 31 female students and 27 male students. The average number of day placements undertaken in the clinic at completion of the survey was 3.9. The age of participants was not collected.

7.4.1 Change in survey domain scores

Domain 1: Level of understanding of power relationships (survey questions 1 to 3)

The median score on component 4 increased from pre-placement ($Md = 13.00$) to post-placement ($Md = 14.00$), $z = -5.47$, $p < 0.001$, with a large effect size ($r = 0.51$) (table 7.2).

Domain 2: Level of understanding of the interrelationship between culture and self-perceived health (survey questions 4 to 8)

The median score on component 2 increased from pre-placement ($Md = 19.00$) to post-placement ($Md = 22.00$), $z = -6.36$, $p < 0.001$, with a large effect size ($r = 0.59$) (table 7.2).

Domain 3: Level of understanding of the importance of culture in clinical practice and access to health care (survey questions 9 to 13)

The median score on component 3 increased from pre-placement ($Md = 23.00$) to post-placement ($Md = 24.00$), $z = -4.16$, $p < 0.001$, with a medium effect size ($r = 0.39$) (table 7.2).

Domain 4: Level of confidence with providing culturally safe care (survey questions 14 to 17)

The median score on component 1 increased from pre-placement ($Md = 11.00$) to post-placement ($Md = 17.00$), $z = -6.58$, $p < 0.001$, with a large effect size ($r = 0.61$) (table 7.2).

Table 7.2. Pre-placement and post-placement scores for each domain of the survey. All values are median (IQR) unless otherwise specified.

Domain (number of questions, max score)	N	Pre- placement score	Post- placement score	Score change (% of pre-placement score)	Z	P	Effect size
1 (3, 15)	58	13.00 (11.00 to 14.00)	14.00 (13.00 to 14.00)	1.00 (7.69%)	-5.47	<0.001	$r = 0.51$ (large effect)
2 (5, 25)	58	19.00 (17.00 to 20.00)	22.00 (21.00 to 23.00)	3.00 (15.79%)	-6.36	<0.001	$r = 0.59$ (large effect)
3 (5, 25)	58	23.00 (21.00 to 24.00)	24.00 (22.00 to 25.00)	1.00 (4.35%)	-4.16	<0.001	$r = 0.39$ (medium effect)
4 (4, 20)	58	11.00 (9.75 to 15.00)	17.00 (16.00 to 18.00)	6.00 (54.55%)	-6.58	<0.001	$r = 0.61$ (large effect)

7.5 Discussion

The primary aim of this study was to evaluate the effect of a culturally immersive student placement on students' understanding of Aboriginal and Torres Strait Islander health, and confidence with providing culturally safe podiatry care to a community-based population of Aboriginal and Torres Strait Islander people. We found that the placement significantly improved students' understanding of multiple aspects of cultural capability (e.g. understanding of culture, history and interrelationship with health and health care delivery), and level of confidence with providing culturally appropriate and safe podiatric care. This study provides foundation evidence of the role that such placements have on developing students' cultural capability in a tertiary health care setting, and will help inform future curricula development at both educational institutions and health services, as well as, form the basis for ongoing research.

To the authors' knowledge, this is the first study to evaluate the effect of an immersive student placement on undergraduate podiatry students' self-perceived cultural capability in an Australian setting, making comparison with existing literature challenging. Existing studies typically evaluate a suite of training methods (e.g. online, lecture setting, group work, and placements), and are primarily focused on both Indigenous populations of countries other than Australia and experiences of other health professions such as medicine and nursing (79-81). Likewise, studies within Australia have only considered the effect more broadly from the perspective of multiple allied health professions, with discipline specific evaluations (such as podiatry) lacking (140, 195). However, findings are generally consistent with our research in that participants' awareness, understanding, and confidence with providing culturally appropriate health care improves following exposure to culturally appropriate and safe learning. Specifically, the current study has identified that an immersive, hands-on student placement experience is an effective delivery mechanism for improving undergraduate podiatry students' understanding of the role that culture has on Aboriginal and Torres Strait Islander Peoples' perceptions of health and health care (domains 2 and 3). Additionally, this placement resulted in significant improvements in students' understanding of the importance of and responsibility that they and all health professionals have in creating an environment that enables Aboriginal and Torres Strait Islander people to feel safe and respected (domain 1).

Students' confidence with providing culturally appropriate communication and management strategies for effective engagement with and continuity of care of Aboriginal and Torres Strait Islander people were also found to significantly improve following this placement (domain 4). This ability to engage with, and ensure, Aboriginal and Torres Strait Islander people form an integral part of the holistic approach to health care is a vital step in developing trust with such

services. Additionally, existing literature supports this shared approach to knowledge and understanding of Aboriginal and Torres Strait Islander health needs has an integral step in developing intercultural partnerships (213, 214). These types of partnerships have been shown to be fundamental to empowering Indigenous communities to take control of their health (215), and for health services to adapt from Western models of care to service design and delivery that recognises the role of culture, family, and community in Aboriginal and Torres Strait Islander Peoples' health (64). This renewed approach, in which Aboriginal and Torres Strait Islander people are a central part in the design and delivery of health care, may help close the gap in a number of health inequities.

Globally a number of barriers to accessing preventative care among Indigenous populations have been identified, including poor relationships with health care providers, health care providers' lack of acceptance (or appreciation) of the role of family in care provision, and poor community engagement with available services (61, 64, 73, 154). The positive impact of placement in a culturally safe podiatry clinic placements demonstrated by this present study highlights this as a potential long-term strategy to address deficits in availability of culturally safe care, with the capacity to generate large scale positive change in the future podiatry workforce. Similarly, the capacity for translation of comparable clinical training initiatives across tertiary allied health training is significant. Lack of understanding culturally safe care delivery and practitioner bias are key barriers to engagement with, and uptake of, health care by Aboriginal and Torres Strait Islander communities (61, 64, 73). Producing graduate clinicians considerate of the role of culture, family, and community in Aboriginal and Torres Strait Islander Peoples' perception of their own health and health care is crucial to successfully reducing the burden of disease for this population.

The following limitations of this study should be considered when interpreting our findings. We only included a small number of undergraduate podiatry students from one Australian University that participated in a limited number of clinical sessions. The survey used to evaluate the placement assessed students' own perceptions of aspects of their cultural capability. Assessment of the experiences of clients in the clinic did not comprise part of this study and change in specific knowledge or behaviours was not evaluated. Nevertheless, these findings provide a preliminary understanding of the effect that these types of placements have on cultural capability learning and will help inform future research. Additionally, it is important to highlight that patient-centred health-related outcomes were not evaluated as part of this study, and it is currently unknown if the same placement results in improved health related outcomes for these communities. Caution is advised when comparing this study's findings with existing literature, or attempting to generalise to other Aboriginal and Torres Strait Islander

communities, due to the culturally diverse nature, kinship, and beliefs of Indigenous peoples across all First Nations of Australia and other countries.

7.6 Conclusion

This study found that students, who participated in an immersive placement at a culturally safe podiatry clinic, had significant improvements in their understanding of, and confidence with, providing culturally appropriate care to Aboriginal and Torres Strait Islander Peoples. Educational institutions should consider these findings as part of the suite of methods to deliver cultural capability training to undergraduate allied health professional students. Future research should continue to assess the role of such placements on cultural capability training in larger sample sizes, investigate if such programs are transferrable to practising health professionals, as well as, prospectively evaluate the impact of clinicians' improved cultural capability on Aboriginal and Torres Strait Islander Peoples' engagement with health services and health-related outcomes.

7.7 Declarations

7.7.1 Funding

Lowitja Institute, Woodend Foundation: Perpetual Philanthropy

7.7.2 Authors' contributions

MW, SEM, FH, and VC were involved in designing the study. MW and VC were involved in collecting the data and interpreting the results. SS and VC were involved in data entry and analysis, and interpreting the results. SS, MW, VC drafted the manuscript. All authors read and approved the final manuscript.

7.7.3 Acknowledgement

We would like to acknowledge and thank the Darkinjung community of the Central Coast region of NSW for their support of, and invaluable contribution to, this research.

Chapter 8

Conclusion

8.1 Purpose of this thesis

This thesis had the overarching aims of establishing the foot health of Aboriginal and Torres Strait Islander Peoples in the local Central Coast community, and developing methods to improve access to, and delivery of, culturally safe foot care. This thesis is presented as a series of reviews and studies aiming to address six specific research aims. Each of these aims attempts to address key aspects related to Aboriginal and Torres Strait Islander foot health. Below are each of the thesis aims with how each chapter has addressed each specific aim. This is followed by a summary of each of the chapters in this thesis, including their main findings, strengths, limitations, and directions identified for future research.

8.2 Aim 1

The first aim of this thesis was to establish the scope of current literature relating to the nature and extent of diabetes-related foot complications in Aboriginal and Torres Strait Islander Peoples compared to the broader Australian community (chapter 2). To address this aim we conducted a systematic literature review to evaluate studies reporting rates of diabetes-related foot disease for Aboriginal and Torres Strait Islander Peoples compared to non-Indigenous Australians.

8.2.1 Summary of findings

The systematic review included 11 studies and found that Aboriginal and Torres Strait Islander Peoples experience substantially more diabetes-related foot disease, including significantly higher rates of ulceration and amputation, than non-Indigenous Australians. Specifically, it was demonstrated that Aboriginal and Torres Strait Islander Peoples had between a 3-6 fold increased likelihood of both foot ulcer and minor or major amputation and that these occurred at a younger age. The review also identified that most available data focused on amputation rates with little information available regarding specific types of diabetes-related foot complications. Additionally, data were only available for specific sections of the country with locations such as New South Wales and Victoria having no available published data for rates of diabetes-related foot disease between Aboriginal and Torres Strait Islander Peoples and non-indigenous Australians.

8.2.2 Strengths

This systematic review is the first to collectively compare known available data on rates of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples across Australia.

The findings from this systematic review help to build a better understanding of the foot health of Aboriginal and Torres Strait Islander Peoples. Furthermore the review has highlighted a number of gaps relating to the lack of data on a number of different diabetes-related foot complications, such as Charcot neuroarthropathy and peripheral arterial disease, and a number of regions where no known published data exists.

8.2.3 Limitations

This systematic review aimed to report on the prevalence of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples compared to that of non-Indigenous Australians. While we performed an exhaustive search for relevant literature, other forms of publications (e.g. government reports) were not included in this review. Furthermore, the purpose of this review was to compare rates of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians, therefore while there are some data relating to Aboriginal and Torres Strait Islander people only, these were not included as without comparable regional data these studies would not add to the findings of this paper. As the data from the retrieved studies were specific to several geographical regions in Australia (i.e. Western Australia, Northern Territory and Queensland) the results of this review are not necessarily generalisable nationally.

8.2.4 Future research

The gaps in the literature that this systematic review has highlighted provide justification for future research to attempt to establish rates of diabetes-related foot disease and specific conditions across multiple geographic area in Australia, including in New South Wales. In addition there is an urgent need to report across a greater breadth of diabetes-related foot complications to ensure there is established prevalence data across the scope of diabetes-related foot disease in local Aboriginal and Torres Strait Islander Peoples.

8.3 Aim 2

The second aim of this thesis was to establish the nation-wide availability and effectiveness of currently available foot care services and programs for Aboriginal and Torres Strait Islander Peoples (chapter 3). To address this aim we conducted a systematic literature review to determine the availability and effectiveness of stand-alone foot health programs for the prevention of diabetes-related foot disease in Aboriginal and Torres Strait Islander Peoples.

8.3.1 Summary of findings

This systematic review included 13 studies detailing interventions in the Northern Territory, New South Wales, Queensland, and Western Australia. An overwhelming amount of the available research considers and reports on the participants' response to tools, resources, and strategies developed as a part of such programs as opposed to the impact programs have on participants' health. While national and state governments have developed general Aboriginal and Torres Strait Islander health plans and strategies, no state- or nation-wide foot care programs for prevention of diabetes-related foot disease were identified in the literature.

8.3.2 Strengths

This systematic review provides a summary of the available foot care services for Aboriginal and Torres Strait Islander Peoples. These data provide important information for which aspects of programs were effective from the perspective of participants, however, data on the programs' effectiveness for health related outcomes remains relatively underexplored. This therefore provides a foundation from which similar foot care services can be developed in areas currently lacking such culturally safe programs, and highlights a need for program effectiveness to be evaluated in terms of clients' health related outcomes.

8.3.3 Limitations

Although this review was designed to be comprehensive with a robust search on relevant databases, it is possible that not all diabetes-related foot disease programs for Aboriginal and Torres Strait Islander Peoples were identified. This is because many of these reports are located in grey literature sources and structured search engines are not available. Additionally, this review only describes programs where reports were publicly available. It is likely that programs exist that have not been published in any form. Furthermore, only services that were 'standalone' (i.e. not part of larger multidisciplinary programs) were eligible.

8.3.4 Future research

Future research should refer to the findings from this systematic review to help establish foot care problems, however, should also attempt to measure program effectiveness in terms of health related outcomes and to do so in Aboriginal and Torres Strait Islander communities where culturally safe foot care programs do not exist. There are several successful diabetes programs that have been implemented suggesting that inclusion of foot care services to existing multidisciplinary models of care may offer additional opportunities to more effectively deliver culturally safe care which can be leveraged from existing community relationships

8.4 Aim 3

The third aim of this thesis was to determine the self-perceived foot health status of community-based Aboriginal and Torres Strait Islander Peoples in regional and rural New South Wales, Australia (Chapter 4). To address this aim we conducted a descriptive cross-sectional study in which Aboriginal and Torres Strait Islander Peoples presenting to culturally-safe podiatry services in a rural and a regional community of New South Wales completed the foot health status questionnaire. Additionally, and in order to better understand the foot health of these communities, we explored the relationship between reported demographic and medical factors and self-perceived foot health.

8.4.1 Summary of findings

We found that Aboriginal and Torres Strait Islander Peoples presenting to recently developed and culturally safe podiatry services on the Central Coast and in Wellington, New South Wales, have similarly high levels of self-perceived foot health and relatively low levels of overt peripheral arterial disease and peripheral neuropathy. The relatively high levels of foot health are likely reflective of the community based population included and should not be considered as contradictory evidence to previous studies in high risk populations that have demonstrated significantly worse levels of foot health in Aboriginal and Torres Strait Islander Peoples.

8.4.2 Strengths

This is the first known study to document the self-perceived foot health of a community-based population of Aboriginal and Torres Strait Islander Peoples on the Central Coast and in Wellington, New South Wales, Australia. This study demonstrated that Aboriginal and Torres Strait Islander people in the general community have relatively good levels of foot health and that foot care services, that are culturally appropriate, offer a unique and early opportunity for podiatrists to identify, manage, and implement preventative foot care.

8.4.3 Limitations

In this cross-sectional study we primarily aimed to determine the self-perceived foot health of Aboriginal and Torres Strait Islander Peoples. However, the foot health status questionnaire has not been validated in Aboriginal and Torres Strait Islander communities and, although administered with the help of an Aboriginal Health Worker, is a Western mechanism to quantify foot-specific health-related quality of life. Additionally, and while a small number of quantitative assessment techniques (such as the monofilament and Doppler waveform analysis)

were performed, further neurological and vascular assessments would have provided greater insight into Aboriginal and Torres Strait Islander Peoples' foot health. Finally, the generalisability of these findings is largely limited to those communities in which it was conducted. This is because of potential differences in a number of variables measured and the culturally diverse nature, kinship, and beliefs of these people across all First Nations.

8.4.4 Future research

Future research should continue to explore Aboriginal and Torres Strait Islander foot health with additional quantitative assessments. Quantitative assessment should include measures of prevalence of specific diabetes-related foot conditions as well as alternate measures of aspects of foot health and foot care. These include measures of health literacy for example relating to diabetes-related foot care, measures of modifiable risk factors for example, physical activity and nutrition in those with diabetes and diabetes-related foot disease, and well as other perspectives of the impacts of foot health, or poor foot health, for example in relation to health related quality of life. In addition, determining self-perceived foot health in Aboriginal and Torres Strait Islander Peoples not attending foot care services needs to be undertaken. Future research should also attempt to develop a culturally safe method for Aboriginal and Torres Strait Islander Peoples to determine their self-perceived foot health.

8.5 Aim 4

The fourth aim of this thesis was to develop a foot care service for Aboriginal and Torres Strait Islander Peoples that is community-led, promotes sustained community engagement, and contributes to long-term improvement in access to culturally safe foot care (Chapter 5). To address this aim we firstly undertook an Indigenous-led community consultation process. This was supported by a combination of informal research yarns and interviews with key local health and University of Newcastle educators and researchers.

8.5.1 Summary of findings

Through an extensive community consultation process this study established an effective co-design approach to developing a foot care service embedded in an undergraduate podiatry program. Key design elements included; integrating ongoing community consultation; involvement of Aboriginal health workers and practitioners connected to their local community; recognising the role of community in cultural capability training of health students; and, creating a flexible and accessible care model that is aligned with the community foot care priorities.

8.5.2 Strengths

This study is strengthened by the extensive community consultation process and is the first culturally appropriate foot care service to be embedded in an undergraduate podiatry clinic in Australia. Additionally, the Buridja Clinic has been structured to ensure ongoing community involvement and oversight, a key determinant of levels of engagement and uptake of Aboriginal and Torres Strait Islander Peoples with health care services. The establishment of this clinic has the potential to effect meaningful change for a number of the significant and disproportionate foot-related health inequalities that exist between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians.

8.5.3 Limitations

While the main principles derived from the consultation process were found to be consistent with key requirements of Indigenous health services developed nationally and internationally, the community driven aspects of this research are specific to the local Aboriginal and Torres Strait Islander community of the Central Coast of New South Wales. Additionally, this study aimed to design and implement a culturally safe foot care clinic, and therefore the outcomes from this study should not be considered as a measure of success of the clinic in terms of its ability to positively affect health related outcomes of users or its effectiveness as a culturally capability training program. Finally, this study used methods such as informal yarning and interviews as part of the community consultation process. Although extensive field notes were used and participants provided with the opportunity to verify their data, it is possible that some feedback was missed or misinterpreted.

8.5.4 Future research

Before future research can be undertaken, ongoing involvement of community members in the oversight of the Buridja Clinic is required to ensure it maintains alignment with the foot health priorities of clients and continues to empower local Aboriginal and Torres Strait Islander Peoples to seek out and engage with the Buridja Clinic. Future research should aim to evaluate the effectiveness of the clinic from the perspective of end-users (Aboriginal and Torres Strait Islander Peoples), and investigate its capacity to provide cultural capability training for undergraduate podiatry students. In addition the effectiveness of translation of the key elements of this service to new services needs to be investigated.

8.6 Aim 5

The fifth aim of this thesis was to undertake a multifaceted evaluation of a community led foot care service including service utilisation, as well as, the acceptability of the service from the perspective of the Aboriginal and Torres Strait Islander clients (chapter 6). To address this aim we undertook a mixed methods study which included an audit of occasions of services for the clinic, and both a qualitative and quantitative review using research yarns and a customised survey respectively.

8.6.1 Summary of findings

The clinical audit, for the period from March 2018 and November 2019, identified 538 occasions of service and 189 individual clients treated in the Buridja Clinic. As part of the audit, the most common service types for the Buridja Clinic were general treatments and diabetes assessments. This study also recruited nine clients to participate in two research yarns and 52 clients to complete an anonymous customised clinic feedback survey. These methods of evaluation identified that specific clinic design elements including yarning circles and group booking, as well as, student placement were strengths of the clinic. Additionally, participants reported improved foot health, greater foot and self-care knowledge, and overall better general health and management as a result of attendance to the Buridja Clinic. However, participants reported difficulty with transport and restricted opening hours, and encouraged increased community engagement by clinic staff to improve the Buridja Clinic service.

8.6.2 Strengths

This study is strengthened through the use of a number of different methods to evaluate the Buridja clinic. Specifically, the multifaceted approach of a clinical audit, research yarns, and survey feedback provide a well-rounded evaluation of the clinic from the perspective of end-users – Aboriginal and Torres Strait Islander Peoples. This approach has helped ensure the Buridja clinic operates with a number of key principles, such as ongoing community consultation and integration of the local community in cultural capability training, which are critical to ensuring increased engagement with the foot care service and continuity of care for the local Aboriginal and Torres Strait Islander community.

8.6.3 Limitations

The purpose of the study was to identify strengths and weakness of the Buridja Clinic. However, due to participants volunteering for the research yarns, and most participants attending the clinic on a number of occasions, there is the possibility that some negative

feedback may have been missed. Additionally, the findings of this research, including feedback about the Buridja Clinic, are specific to the Aboriginal and Torres Strait Islander community on the Central Coast of New South Wales, therefore limiting this study's generalisability. Finally, while a number of self-perceived health outcomes were measured through the customised survey, these data were retrospective, subject to recall bias, and are unable to determine if the Buridja Clinic impacts foot related health outcomes over time.

8.6.4 Future research

Ongoing evaluation, using the same methods, of the Buridja Clinic from the perspective of Aboriginal and Torres Strait Islander Peoples is required to ensure effective engagement and continuity of care of these communities. Additionally, prospective and objective evaluation of the effect the Buridja Clinic has on Aboriginal and Torres Strait Islander foot health is required to identify if this service model is part of the solution to addressing the significant foot-related health inequalities between Aboriginal and Torres Strait Islander Peoples and non-Indigenous Australians.

8.7 Aim 6

The sixth and final aim of this thesis was to evaluate the effect of undertaking clinical placement in a culturally safe podiatry service for Aboriginal and Torres Strait Islander Peoples on podiatry students' cultural capability. To address this aim, undergraduate podiatry students completed a customised cultural capability for podiatry students' survey before and after their immersive placement in the Buridja Clinic.

8.7.1 Summary of findings

We found that the placement significantly improved students' understanding of multiple aspects of cultural capability (e.g. understanding of culture, history, and their interrelationship with health and health care delivery), and level of confidence with providing culturally appropriate and safe podiatric care.

8.7.2 Strengths

To the authors' knowledge, this is the first study to evaluate the effect of an immersive student placement on undergraduate podiatry students' self-perceived cultural capability in an Australian setting. This study provides foundation evidence of the role that such placements have on developing podiatry students' cultural capability in a tertiary health care setting. Additionally, the findings from this study can be used to help inform future curricula development at both educational institutions and health care organisations.

8.7.3 Limitations

We only included a small number of undergraduate podiatry students from one Australian University that participated in a small number of clinical sessions. While this study demonstrated that there were significant improvements in a number of aspects of students' cultural capability, it is important to highlight that patient-centred health-related outcomes were not evaluated. Therefore it is unknown if the improved cultural capability of students affected health related outcomes for Aboriginal and Torres Strait Islander Peoples attending the clinic.

8.7.4 Future research

Future research should continue to assess the role of such placements on cultural capability training in larger sample sizes, investigate if such programs are transferrable to practising health professionals and other allied health professions, as well as, prospectively evaluate the impact of clinicians' improved cultural capability on Aboriginal and Torres Strait Islander Peoples' engagement with health services and health-related outcomes. Additionally, educational institutions should consider these findings as part of the suite of methods to deliver cultural capability training to undergraduate podiatry students to increase the capacity for the health future workforce to provide culturally safe care.

8.8 Concluding statement

This thesis has highlighted the paucity of data relating to diabetes-related foot health outcomes in Aboriginal and Torres Strait Islander people. The little existing evidence shows disproportionately high rates of diabetes-related foot disease for this population and urgent need for more effective methods to support improved outcomes. This research has also shown that efforts to date have been disjointed and lack wide implementation or evaluation. Generating substantial and significant change in foot health for this population requires both workforce change and health care delivery change. This research has shown that Aboriginal people and

health professional students alike connect with culturally safe foot care. Education and service provision are key elements to *Closing the Gap* for diabetes-related foot disease and need to be harnessed to achieve this.

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Appendix 1 Supplementary documentation for chapter 3

Table App 1.1. PubMed search strategy as generated from the Lowitja Institute

((Diabetes mellitus[mh] AND (((australia[mh] OR australia*[tiab]) AND (oceanic ancestry group[mh] OR aborigin*[tiab] OR indigenous[tw])) OR (torres strait* islander*[tiab])) AND medline[sb]) OR ((Diabet*[tiab] OR ((type 1[tiab] OR type I[tiab] OR type 2[tiab] OR type II[tiab]) AND diabet*[tiab]) OR gestational diabet*[tiab] OR prediabet*[tiab] OR pre diabet*[tiab]) AND (((au[ad] OR australia*[ad] OR australia*[tiab] OR northern territory[tiab] OR northern territory[ad] OR tasmania[tiab] OR tasmania[ad] OR new south wales[tiab] OR new south wales[ad] OR victoria[tiab] OR victoria[ad] OR queensland[tiab] OR queensland[ad]) AND (aborigin*[tiab] OR indigenous[tiab])) OR (torres strait* islander*[tiab])) NOT medline[sb]))) AND (program OR strategy OR plan OR promotion OR course OR educat* OR treatment OR intervention OR therapy OR improve* OR clinic OR workshop OR manage* OR project)

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Collaborative for Healthcare Analysis and Statistical Modelling (CHASM), The University of Western Sydney. First Edition: Fourth Iteration December 2017	High Risk Foot: Geographical Inequities, Importance of Different Diagnosis Groups, Forecast Hospitalisations, and Access to Services	Analysis and predictions regarding high risk foot admissions in WA to inform clinical service planning and service evaluation for podiatry services.	Review
Bailie, R. S., et al. (2004)	A multifaceted health-service intervention in remote Aboriginal communities: 3-year follow-up of the impact on diabetes care. Med J Aust 181(4): 195-200	Examine the trends in processes of diabetes care and in participant outcomes after an intervention in two remote regions of Australia. Including foot sensation, reflexes, pressure and infections.	Not foot specific
Bailie, R., et al. (2007)	Improving organisational systems for diabetes care in Australian Indigenous communities. BMC Health Serv Res 7: 67.	Two annual cycles of assessment, feedback workshops, action planning, and implementation of system changes in 12 Indigenous community health centres. Including 3 monthly foot checks.	Not foot specific
Bergin, S. M., et al. (2013)	Australian Diabetes Foot Network: practical guideline on the provision of footwear for people with diabetes. J Foot Ankle Res 6(1): 6.	Guidelines.	Not specific ATSI
Browne, J., et al. (2014)	Feltman: evaluating the acceptability of a diabetes education tool for Aboriginal health workers. Aust J Prim Health 20(4): 319-322.	'Feltman', a life-sized felt body showing the main organs involved in the digestion and metabolism of food, and the main parts of the body affected by diabetes.	No foot program
Burrow, S. and K. Ride (2016)	Review of diabetes among Aboriginal and Torres Strait Islander people. Australian Indigenous HealthInfoNet.	This review discusses the issues of prevention and management of diabetes, and provides information on relevant programs, services, policies and strategies.	Review
Canuto, K., et al. (2017).	Aboriginal and Torres Strait Islander health promotion programs for the prevention and management of chronic diseases: a scoping review protocol. JBI Database of Systematic Reviews & Implementation Reports 15(1):10-14	Identifies and describes the existing research on health promotion programs and activities focusing on modifying risk factors and/or improving the management of chronic diseases.	Review

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Charles, J. (2015)	An evaluation and comprehensive guide to successful Aboriginal health promotion." Australian Indigenous Health Bulletin 16(1)	Examines and evaluates a report on an Aboriginal health promotion program on: its effectiveness in reducing injury, poor foot health, smoking, alcohol consumption and improved diet.	Not foot specific
Chung, F., et al. (2014)	Diabetes clinic attendance improves diabetes management in an urban Aboriginal and Torres Strait Islander population. Aust Fam Physician 43(11): 797-802.	Retrospective clinical audit of adult patients with type 2 diabetes who attended Winnunga Nimmityjah Aboriginal Health Service in Canberra including foot checks.	Not foot specific
Clement, Z. (2011).	Diabetic Foot Ulcer Management: Clinical and Cost Effectiveness of Vacuum Assisted Closure Therapy. Aboriginal and Islander Health Worker Journal 35(2): 5-8.	Systematic review.	Not ATSI
Connors, C. (2011).	Chronic disease in the Northern Territory (NT): Improving aboriginal health through a systems approach. Intern Med 41(s2).	Population systems approach to screening and management of chronic disease.	Review
Cooper, J., et al. (2007)	Partnership approach to Indigenous primary health care and diabetes: a case study from regional New South Wales. Aust J Rural Health 15(1): 67-70	The Goorie Diabetes Complication and Assessment Clinic including foot checks.	Not foot specific
Coyle, M. E., et al. (2013)	Self- management activities in diabetes care: A systematic review. Australian Health Review 37(4): 513-522.	Self-management activities including adherence to medication, self-monitoring of blood glucose, dietary changes, physical activity and foot care.	Not ATSI
Cribbes, M. and K. Glaister (2007)	'It's not easy' - caring for Aboriginal clients with diabetes in remote Australia. Contemporary Nurse: A Journal for the Australian Nursing Profession 25(1-2): 163-172	Personal perspective of caring for clients with diabetes on a remote Aboriginal community in the Northern Territory. The purpose of the paper is to highlight the dilemmas faced by health care professionals as they endeavour to make a real change to the alarming health status of the Indigenous people of Australia.	Review
D'Abbs, P., et al. (2008)	Implementing a chronic disease strategy in two remote Indigenous Australian settings: A multi-method pilot evaluation. Australian Journal of Rural Health 16(2): 67-74	Evaluation of framework for monitoring implementation of The North Queensland Indigenous Chronic Disease Strategy including foot checks.	Not foot specific
Davis, S., et al. (2015)	How good are routinely collected primary healthcare data for evaluating the effectiveness of health service provision in a remote Aboriginal community? Rural & Remote Health 15(4): 1-9.	Effectiveness of management system in the delivery of health services to the Fitzroy Valley in the Kimberley region of Western Australia.	No foot program

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Eades, S., et al. (2014)	Baseline evidence practice gap for type 2 diabetes care among Aboriginal Australians in a cluster randomised controlled trial. BMC Health Serv Res 14(Suppl 2): P33-P33.	Examine the effectiveness of a tailored model in achieving adherence to best practice clinical guidelines for Type 2 diabetes in Aboriginal Community Controlled Health Organisations.	Not foot specific
Forbes, M. P., et al. (2013)	Impacts and outcomes of diabetes care in a high risk remote Indigenous community over time: implications for practice. Aust J Prim Health 19(2): 107-112.	Determines diabetes care processes and intermediate clinical outcomes in a remote primary care service in 2009 compared with 2004 including foot checks.	Not foot specific
Gibson, O., et al. (2016)	The South Australian Aboriginal Diabetes Strategy 2017 – 2021. Adelaide, Wardliparingga Aboriginal Research Theme, South Australian Health and Medical Research Institute	State-wide response to diabetes and guide potential health care reforms for diabetes and related conditions including foot complications.	Review
Gibson, O. R. and L. Segal (2015)	Limited evidence to assess the impact of primary health care system or service level attributes on health outcomes of Indigenous people with type 2 diabetes: a systematic review. BMC Health Serv Res 15: 154	Systematic review.	Review
Harch, S., et al. (2012)	Management of type 2 diabetes: A community partnership approach. Aust Fam Physician 41(1-2): 73-76.	Evaluation of a new model of partnership care using an audit cycle and including foot checks.	Not foot specific
Harris, C. and O. Curtis (2005)	Supporting Self- management of Diabetes in Aboriginal People Living with Diabetes through a 5 Day Residential Camp. Aboriginal and Islander Health Worker Journal 29(3): 4-11.	Developed, trialled and evaluated a culturally appropriate model of disease self-management in a group of Aboriginal people with established diabetes.	No foot program
Harvey, P. W., et al. (2013)	Chronic condition management and self-management in Aboriginal communities in South Australia: outcomes of a longitudinal study. Australian Health Review 37(2): 1-1.	Processes and outcomes of chronic condition management and self-management strategies implemented in three Aboriginal communities in South Australia.	No foot program
Heiss, E. (2000)	Aboriginal Diabetes Program. Aboriginal and Islander Health Worker Journal 24(5): 30-31.	Aboriginal Diabetes program with an aim to improve health care in Aboriginal and Torres Strait Islander people who have, or are at risk, of diabetes in the areas of access to medical care, control of diabetes and education about healthy lifestyles.	Not foot specific
Hotu, C., et al. (2018)	Impact of an integrated diabetes service involving specialist outreach and primary health care on risk factors for micro- and macrovascular diabetes complications in remote Indigenous communities in Australia. Aust J Rural Health.	Integrated diabetes service involving specialist outreach and primary health care teams targeting risk factors for micro- and macrovascular diabetes complications in three remote Indigenous Australian communities.	No foot program

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Hoy, W. E., et al. (2006)	Setting up chronic disease programs: Perspectives from Aboriginal Australia. Ethnicity and Disease 16(SUPPL. 2): S2-73 - S72-78.	Perspectives on setting up programs to improve management of hypertension, renal disease, and diabetes in high-risk populations in remote Australian Aboriginal settings.	No foot program
Jones, S., et al. (2011)	The foot book : a manual for Aboriginal health workers about common foot problems, how to recognise them and what to do about them (3 rd edition)	The foot book was originally designed for use as a reference book for Aboriginal Health Workers undertaking the foot care workshop designed by the Uni SA / Nunkuwarrin Yunti Foot Project Team.	Not foot specific
King, M., et al. (2013)	Issues that impact on Aboriginal health workers' and registered nurses' provision of diabetes health care in rural and remote health settings. Aust J Rural Health 21(6): 306-312.	Identify issues that compromise the clinical practice of rural and remote Aboriginal health workers and registered nurses who undertook an accredited Australian Diabetes Educators Association diabetes course.	No foot program
King, M. and K. Wilson (1998)	Aboriginal Projects Undertaken in South Australia. Aboriginal and Islander Health Worker Journal 22(6): 24-27	Construction of a flip-chart entitled 'Diabetes and Pregnancy' and why Aboriginal health workers should consider undertaking an Australian Diabetes Educators course.	No foot program
Kit, J. A., et al. (2003)	Chronic disease self-management in Aboriginal communities: Towards a sustainable program of care in rural communities. Aust J Prim Health 9(2-3): 168-176	Developed and trialled new program tools and processes for goal setting, behaviour change and self-management for Aboriginal people with diabetes.	No foot program
Kowanko, I., et al. (2012)	Chronic Condition Management Strategies in Aboriginal Communities: Final Report 2011. Adelaide, Flinders University and the Aboriginal Health Council of South Australia.	Final report of a project called 'Chronic Condition Management Strategies in Aboriginal Communities' conducted during 2008-2011.	Not foot specific
Larkins, S., et al. (2015)	Responses of Aboriginal and Torres Strait Islander Primary Health-Care Services to Continuous Quality Improvement Initiatives. Front Public Health 3: 288	Examined trends in quality of care for Indigenous primary health-care services participating in continuous quality improvement cycles.	No foot program
Liaw, S. T., et al. (2011)	Successful chronic disease care for Aboriginal Australians requires cultural capability. Australian & New Zealand Journal of Public Health 35(3): 238-248	Reviewed the literature to determine the attributes of culturally appropriate healthcare to inform the design of chronic disease management models for Aboriginal patients in urban general practice.	Review
Longstreet, D. A., et al. (2005)	Improving diabetes care in an urban Aboriginal medical centre. Aust J Prim Health 11(3): 25-31.	Improve the detection, monitoring, and medical care of Indigenous patients with diabetes in an urban Aboriginal medical centre, including foot checks.	Not foot specific
Mak, D. B., et al. (2004)	So far and yet so close: quality of management of diabetes in Australian and Canadian Indigenous communities." Aust J Rural Health 12(5): 206-209	Compared quality of clinical management of Indigenous people with diabetes in remote areas of Australia and Canada.	Review

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Maple-Brown, L. J., et al. (2004)	Diabetes care and complications in a remote primary health care setting. <i>Diabetes Res Clin Pract</i> 64(2): 77-83	A population survey of risk factors for diabetes and cardiovascular disease and diabetes prevalence.	Not foot specific
Marley, J. V., et al. (2012)	Quality indicators of diabetes care: an example of remote-area Aboriginal primary health care over 10 years. <i>Med J Aust</i> 197(7): 404-408	Described service characteristics of Derby Aboriginal Health Service and documented diabetes management activities and intermediate clinical outcomes for Aboriginal patients with type 2 diabetes.	No foot program
Matthews, V., et al. (2014)	Duration of participation in continuous quality improvement: a key factor explaining improved delivery of Type 2 diabetes services. <i>BMC Health Serv Res</i> 14: 578	Examined variation in quality of Type 2 diabetes service delivery in over 100 Aboriginal and Torres Strait Islander primary health care centres participating in a wide-scale CQI project over a decade.	Not foot specific
McCalman, J., et al. (2016)	The effectiveness of implementation in Indigenous Australian healthcare: an overview of literature reviews. <i>Int J Equity Health</i> 15(47).	Analyses Aboriginal and Torres Strait Islander Australian health implementation reviews to examine the research question: What is the effectiveness of implementation, as reported in the Indigenous Australian health implementation literature?	Review
McDermott, R. A., et al. (2001)	Improving diabetes care in the primary healthcare setting: a randomised cluster trial in remote Indigenous communities. <i>Med J Aust</i> 174(10): 497-502.	Evaluates a system for improving diabetes care in remote indigenous communities.	Not foot specific
McDermott, R., et al. (2003)	Sustaining better diabetes care in remote indigenous Australian communities. <i>BMJ</i> 327(7412): 428-430.	Three year follow up clinical audit of 21 primary healthcare centres where local indigenous health workers used registers, recall and reminder systems, and basic diabetes care plans, supported by a specialist outreach service.	Not foot specific
McDermott, R. A., et al. (2004)	Diabetes care in remote northern Australian Indigenous communities. <i>Med J Aust</i> 180(10): 512-516	Clinical audit from diabetes registers in 21 remote primary healthcare centres.	Not foot specific
McDermott, R. and L. Segal (2006)	Cost impact of improved primary level diabetes care in remote Australian indigenous communities. <i>Aust J Prim Health</i> 12(2): 124-130	Reports direct costs and downstream savings of improved quality of diabetes services, compared to usual care, in the primary care setting in a high risk remote Indigenous Islander population.	Not foot specific
McDermott, R. A., et al. (2007)	Diabetes in the Torres Strait Islands of Australia: better clinical systems but significant increase in weight and other risk conditions among adults, 1999-2005. <i>Med J Aust</i> 186(10): 505-508	Assessed changes in clinical indicators of adults diagnosed with diabetes.	Not foot specific

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
McDermott, R. A., et al. (2015)	Community health workers improve diabetes care in remote Australian Indigenous communities: results of a pragmatic cluster randomized controlled trial. BMC Health Serv Res 15(1): 1-8.	Evaluated the effectiveness of a community-based health-worker led case management approach to the care of Indigenous adults with poorly controlled type 2 diabetes in primary care services in remote northern Australia.	Not foot specific
McNamara, B. J., et al. (2011)	Type 2 diabetes in Indigenous populations: quality of intervention research over 20 years. Prev Med 52(1): 3-9.	Evaluates the quantity and methodological quality of published intervention research on Type 2 and gestational diabetes in the Indigenous populations of Australia, Canada, New Zealand, and the United States from 1989 to 2008.	Review
Mobbs, R., et al. (2003)	The chronic disease self-management project at Katherine West Health Board Aboriginal Corporation in the Northern Territory: A report of the first year. Aust J Prim Health 9(2-3): 160-167	One year review of the Chronic Disease Self-Management Demonstration Project (CDSM) which commenced in April, 2002.	No foot program
Nguyen, H. D., et al. (2016)	Management of diabetes in Indigenous communities: lessons from the Australian Aboriginal population. Intern Med J 46(11): 1252-1259.	Discusses strategies to address the large disparities in life expectancy between Indigenous and non-Indigenous Australians	Review
Panaretto, K. S., et al. (2013)	Prevention and management of chronic disease in Aboriginal and Islander Community Controlled Health Services in Queensland: A quality improvement study assessing change in selected clinical performance indicators over time in a cohort of services. BMJ Open 3(4).	Evaluated clinical healthcare performance in Aboriginal Medical Services in Queensland.	No foot program
Pearce, S., et al. (2005)	The Better Living Diabetes Project. Aboriginal and Islander Health Worker Journal 29(1): 4-6.	Aim: to reduce the health impact of diabetes by educating sufferers and their families and facilitating change in relation to diabetes and lifestyle. Has a focus on education (of project participants and health workers) and delivery of clinical support.	Not foot specific
Regan, T., et al. (2017)	Comparison of Two Sources of Clinical Audit Data to Assess the Delivery of Diabetes Care in Aboriginal Communities. Int J Environ Res Public Health 14(10)	Determined the concordance between data extracted from two Clinical Decision Support Systems regarding diabetes testing and monitoring at Aboriginal Community Controlled Health Services in Australia.	No foot program
Schierhout, G., et al. (2016)	Improvement in delivery of type 2 diabetes services differs by mode of care: a retrospective longitudinal analysis in the Aboriginal and Torres Strait Islander Primary Health Care setting. BMC Health Serv Res 16(1): 560	Clinical audit of clients with Type 2 diabetes collected as part of a wide-scale CQI program implemented between 2005 and 2014 in 162 Aboriginal and Torres Strait Islander health centres.	Not foot specific

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Schoen, D. E., et al. (2016)	Improving rural and remote practitioners' knowledge of the diabetic foot: findings from an educational intervention. J Foot Ankle Res 9: 26	High Risk Foot intervention including an electronic risk tool with clinical decision Support, Multidisciplinary Foot Ulcer Telehealth Clinic, Aboriginal diabetes foot care education brochures and movies.	Not just ATSI
Si, D., et al. (2005)	Assessing health centre systems for guiding improvement in diabetes care. BMC Health Serv Res 5: 56.	Assesses the status of systems for chronic illness care in Aboriginal community health centres.	Combined
Si, D., et al. (2006)	Aboriginal health workers and diabetes care in remote community health centres: a mixed method analysis. Med J Aust 185(1): 40-45	Three year follow up to assess the effect of employing Aboriginal health workers (AHWs) on delivery of diabetes care in remote community health centres.	Combined
Si, D., et al. (2008)	Describing and analysing primary health care system support for chronic illness care in Indigenous communities in Australia's Northern Territory - use of the Chronic Care Model. BMC Health Serv Res 8: 112-112	A mail-out survey to collect information on material, financial and human resources relating to chronic illness care in 12 Indigenous communities in Australia's Northern Territory.	Review
Si, D., et al. (2010)	Assessing quality of diabetes care and its variation in Aboriginal community health centres in Australia. Diabetes Metab Res Rev 26(6): 464-473	Clinical audits during 2005 -2009 to assess quality of diabetes care and its variation among Aboriginal community health centres in Australia.	Not foot specific
Simmons, D. (2003)	Impact of an integrated approach to diabetes care at the Rumbalara Aboriginal Health Service. Intern Med J 33(12): 581-585	Describes the effectiveness of an integrated primary–secondary care diabetes clinic on metabolic control among Indigenous patients in a rural community.	No foot program
Spurling, G. K., et al. (2013)	Implementing computerised Aboriginal and Torres Strait Islander health checks in primary care for clinical care and research: A process evaluation. BMC Medical Informatics and Decision Making 13(1)	Describes the rationale, implementation and anticipated benefits of computerised Aboriginal and Torres Strait Islander health checks in one primary health care setting.	Not foot specific
Stoneman, A., et al. (2014)	Quality improvement in practice: improving diabetes care and patient outcomes in Aboriginal Community Controlled Health Services. BMC Health Serv Res 14: 481.	Describes the evaluation of care of patients with type 2 diabetes mellitus and features of effective continuous quality improvement in ACCHSs in the remote Kimberley region of north Western Australia.	Not foot specific
Wong, M., et al. (2005)	Perspectives on clinic attendance, medication and foot-care among people with diabetes in the Torres Strait Islands and Northern Peninsula Area. Aust J Rural Health 13(3): 172-177.	Descriptive study collecting qualitative data in three key areas of diabetes self-care, namely attending appointments at the clinic, monitoring blood glucose levels and taking medication and foot-care.	Review

Table App 1.2. Table of excluded studies

Author	Title	Description	Type
Wardliparingga Aboriginal Research Unit at SAHMRI (South Australian Health and Medical Research Institute)	The Aboriginal Diabetes Study. https://aboriginaldiabetes.com/	Aims to improve the delivery of diabetes care to Aboriginal people and find solutions to better treat Type 2 Diabetes and prevent complications. Commenced in June 2015. Due for completion in December 2019.	Not foot specific

Appendix 2 Supplementary documentation for chapter 4

HUMAN RESEARCH ETHICS COMMITTEE



Notification of Expedited Approval

To Chief Investigator or Project Supervisor: Associate Professor Viv Chuter
Cc Co-investigators / Research Students: Doctor Fiona Hawke Mr Matthew West
Re Protocol: Improving foot health outcomes for Aboriginal Australians with diabetes
Date: 20-Mar-2018
Reference No: H-2018-0035
Date of Initial Approval: 20-Mar-2018

Thank you for your Response to Conditional Approval (minor amendments) submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under Expedited review by the Ethics Administrator.

I am pleased to advise that the decision on your submission is Approved effective 20-Mar-2018.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal Certificate of Approval will be available upon request. Your approval number is H-2018-0035.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants. You may then proceed with the research.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for Monitoring of Progress, Reporting of Adverse Events, and Variations to the Approved Protocol as detailed below.

PLEASE NOTE:

In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

Monitoring of Progress

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

Reporting of Adverse Events

1. It is the responsibility of the person first named on this Approval Advice to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form (via RIMS at <https://rims.newcastle.edu.au/login.asp>) within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as: Causing death, life threatening or serious disability. Causing or prolonging hospitalisation. Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure. Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include: Participant's study identification number; date of birth; date of entry into the study; treatment arm (if applicable); date of event; details of event; the investigator's opinion as to whether the event is related to the research procedures; and action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

Variations to approved protocol

If you wish to change, or deviate from, the approved protocol, you will need to submit an Application for Variation to Approved Human Research (via RIMS at <https://rims.newcastle.edu.au/login.asp>). Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. Variations must be approved by the (HREC) before they are implemented except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Associate Professor Helen Warren-Forward
Chair, Human Research Ethics Committee

For communications and enquiries:
Human Research Ethics Administration

Research & Innovation Services Research Integrity Unit
The University of Newcastle Callaghan NSW 2308
T +61 2 492 17894
Human-Ethics@newcastle.edu.au

RIMS website - <https://RIMS.newcastle.edu.au/login.asp>

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
Larapinta Trail Challenge/Indigenous Community Health Research Grants(**)	Improving foot health outcomes for Aboriginal Australians with diabetes	Chuter, Viv	G1701487

22nd June 2018

Vivienne Chuter
Associate Professor of Podiatry PO Box 127
Ourimbah NSW 2258 AH&MRC Ethics Committee
02 9212 4777
ethics@ahmrc.org.au

Dear Vivienne Chuter,

HREC Reference number: 1376/18
Project title: Improving foot health outcomes for Aboriginal Australians with diabetes

Thank you for submitting the above research project for ethical review. This project was considered by the AH&MRC Ethics Committee at its meeting held on 19th March 2018 and 30th April 2018.

I am pleased to advise you that the above research project meets the requirements of the National Statement on Ethical Conduct in Human Research (2007) and ethical approval for this research project has been granted by AH&MRC Ethics Committee.

The nominated participating site/s in this project is/are:

University of Newcastle Podiatry Clinic Wyong Hospital

[Note: If additional sites are engaged prior to the commencement of, or during the research project, the Coordinating Principal Investigator is required to notify the AH&MRC HREC. Notification of withdrawn sites should also be provided to the AH&MRC HREC in a timely fashion.

The original documents listed below that were submitted on 2nd February 2018 are approved:

Document	Version	Date
FHSQ	V1.03	28/01/2018
Nottingham assessment of functional footcare PIS clients		
Recruitment flyer Students	V1.0	23/01/2018
Recruitment flyer Clients		
VC01384_Output Form_v1		
Client Feedback Survey		
PIS students	V1.0	
Questionnaire About Your Diabetic Foot Care		
CoverSheet		
Questionnaire About Your Foot Health		

CoverSheet		
Student questionnaire		
Final consent clients	V1.0	28/01/2018
Final consent students	V1.0	28/01/2018
Initial application		30/01/2018
PRR_FHEAM PRC_eview of CHUTER		
VC01384_Protocol_v1		

The amended documents and/or further documents listed below that were submitted are approved:

Document	Version	Date	Date Submitted
Letter		16/05/2018	21/05/2018
PIS Clientsv3	V3.0	20/03/2018	21/05/2018
PIS studnets v2	V3.0	20/03/2018	21/05/2018
Final consent clients conf			21/05/2018
Final consent students conf			21/05/2018
Recruitment flyer Clientsv3			21/05/2018
Student flyer			

[Note: The amended documents supersede the original document version].

Approval of this project from AH&MRC Ethics Committee is valid from 22ND June 2018 to 21st June 2019 subject to the following conditions being met:

- The Coordinating Principal Investigator will immediately report anything that might warrant review of ethical approval of the project.
- The Coordinating Principal Investigator will notify the AH&MRC Ethics Committee of any event that requires a modification to the protocol or other project documents and submit any required amendments in accordance with the instructions provided by the HREC. These instructions can be found at www.ahmrc.org.au/ethics .
- The Coordinating Principal Investigator will submit any necessary reports related to the safety of research participants in accordance with AH&MRC Ethics Committee policy and procedures. These instructions can be found at www.ahmrc.org.au/ethics .
- The Coordinating Principal Investigator will report to the AH&MRC Ethics Committee annually in the specified format and notify the HREC when the project is completed at all sites.
- The Coordinating Principal Investigator will notify the AH&MRC Ethics Committee if the project is discontinued at a participating site before the expected completion date, with reasons provided.

- The Coordinating Principal Investigator will notify the AH&MRC Ethics Committee of any plan to extend the duration of the project past the approval period listed above and will submit any associated required documentation. Instructions for obtaining an extension of approval can be found at www.ahmrc.org.au/ethics .

- The Coordinating Principal Investigator will notify the AH&MRC Ethics Committee of his or her inability to continue as Coordinating Principal Investigator including the name of and contact information for a replacement.

- The Coordinating Principle Investigator will submit the final draft report from the research, and any publication or presentation where data or findings are presented, to the AH&MRC Ethics Committee to be reviewed for compliance with ethical and cultural criteria prior to:

- Any submission for publication; and/or

- Any dissemination of the report

This letter constitutes ethical approval only.

Should you have any queries about the AH&MRC Ethics Committee's consideration of your project please contact Mr Sonny Green. The AH&MRC Ethics Committee Terms of Reference, Standard Operating Procedures, membership and standard forms are available from www.ahmrc.org.au or from the Ethics Coordinator.

The AH&MRC Ethics Committee wishes you every success in your research. Yours faithfully,

Ms Val Keed
Chairperson
AH&MRC Ethics Committee

Appendix 3 Supplementary documentation for chapter 6

Research yarn aims and questions

Key aims

1. The shared understanding of the researchers and participants of the elements that are important to creating a successful foot health program for Aboriginal and Torres Strait Islander Peoples.
2. The role of the Buridja clinic in participants' own perspectives of their foot health and overall well-being.

Questions used for yarning

1. What has been your experience participating in the Buridja health clinic?
2. Are there any aspects of the service that encourage participation among the Aboriginal community?
3. Are there things you would wish to be improved in the future to make the service more effective?
4. Has going to the clinic changes anything about the way you care for your feet and manage your diabetes?
5. Do you feel participation has changed your overall awareness of your health?

The Buridja Clinic... client feedback survey

Thank you for attending the Buridja Clinic. The overarching aim of the clinic is to provide a service that helps you to care for your feet and, to prevent foot complications as a result of diabetes. To help us to continue to improve the clinic we would greatly appreciate you answering the following questions:

1. Approximately how many times have you attended the clinic? _____

2. How did you find out about the service? (please circle)

Referral from another health service

Advertising

Word of mouth

Other (please specify)

3. Which of the following clinic services have you accessed? (please circle)

Diabetes assessment

General foot care

Arch supports

Nail surgery

Footwear referral

Diabetes education session

Other (please specify)

4. How easy did you find it to access the service? This includes making an appointment and getting to the clinic. (Please circle)

Very easy

Easy

Neutral

Difficult

Very difficult

Do you have any suggestions for how we could make accessing the clinic easier for you?

- 5. How would you rate the availability of foot care services in the clinic? (Please circle)**
Very good
Good
Neutral
Poor
Very poor

Do you have any suggestions for additional foot care services you would like us to offer?

- 6. How would you rate your experience with the students in the clinic? (Please circle)**
Very good
Good
Neutral
Poor
Very poor

Do you have any suggestions for how we can improve your experience with the students?

- 7. How would you rate your experience with the staff in the clinic? (Please circle)**
Very good
Good
Neutral
Poor
Very poor

Do you have any suggestions for how we can improve your experience with the staff?

- 8. How would you rate the care you received in the clinic? (Please circle)**
Very good
Good
Neutral
Poor
Very poor

Do you have any suggestions for how we can improve the care we offer in the clinic?

9. How likely are you to recommend the clinic services to your friends and family? (Please circle)

Very likely
Likely
Neutral
Unlikely
Very Unlikely

10. Do you have any other feedback that might improve the clinic?

Thank you for providing us with your feedback. Your responses are important to us and will be used to help improve the service in the future.

Appendix 4 Supplementary documentation for chapter 7

Table App 4.1. Component correlation matrix

Component	1	2	3
1	1.000	-0.020	0.223
2	-0.020	1.000	-0.012
3	0.223	-0.012	1.000
4	0.106	-0.352	-0.028

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Cultural capability for podiatry students survey

The following section contains questions relating to your views on cultural awareness and safety. For each statement please indicate your level of agreement by ticking the corresponding circle.

For each of the following please indicate how much you agree or disagree with the statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I understand the balancing of power relationships and how this relates to the practice of health professionals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. It is the responsibility of the health care provider as the power-holder to create an environment that enables people to feel safe in the presence of the health care provider.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I understand the effect of racism on development of self - identity, and its potential impact within a health context.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I understand the concept of culture and how it relates to identity for Aboriginal and Torres Strait Islander Peoples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am knowledgeable about the health of Aboriginal and Torres Strait Islander Peoples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am knowledgeable about Aboriginal and Torres Strait Islander Peoples history	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I am knowledgeable about the continued impact of historical influences on health and wellbeing of Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I know what constitutes an act of prejudice in a healthcare setting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I would like to know more about Aboriginal and Torres Strait Islander culture.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Being culturally aware is relevant for my clinical work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Cultural safety within hospital policies and practices improves the health outcomes for Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Healthcare services should be modified to better suit the needs of Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I understand the importance of using culturally appropriate forms of communication when interacting with Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I am confident in using culturally appropriate forms of communication when interacting with Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I am confident in applying knowledge of Aboriginal and Torres Strait Islander Peoples. definitions of health and well-being to clinical practice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I am confident in responding sensitively and appropriately to the needs of Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I am confident of providing culturally safe care to Aboriginal and Torres Strait Islander Peoples.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>