1. INTRODUCTION
In Western Australia, Indigenous Australians between 25-49 years with diabetes were 27 times more likely to receive a minor amputation (toe or foot) and 38 times more likely to receive a major amputation (below or above knee) when compared with non Indigenous Australians.\textsuperscript{1} In the Pilbara, complications related to diabetes are the number one avoidable reason for hospitalisation.\textsuperscript{6} Data from the Population Health Profile of the Pilbara reports complications related to diabetes were at a rate of 6,521 per 100 000 as opposed to 873.6 for Western Australia and 728.1 for Australia.\textsuperscript{6} It is common knowledge that kidney failure is a widespread complication from diabetes. Margolis et al\textsuperscript{3} illustrated those with less severe chronic kidney disease were approximately two times more likely to develop a foot ulcer or undergo a lower extremity amputation than those with minimal to no evidence of kidney disease. At the other end of the spectrum, foot ulcers become more frequent with progression to end-stage kidney failure.\textsuperscript{4}

For the purpose of this study diabetes is defined in line with the International Classification of Diseases 10 under endocrine, nutritional and metabolic diseases (E00-E90)\textsuperscript{5}:
- Diabetes mellitus (E10-E14)
  - E10 Type 1 (Insulin-dependent) diabetes mellitus
  - E11 Type 2 (Non-insulin-dependent) diabetes mellitus

Furthermore, diabetic foot is defined as an infection, ulceration and destruction of deep tissues associated with loss of pain sensation and various degrees of peripheral vascular disease in the lower limb.\textsuperscript{6}

There are various factors which contribute towards increased incidence of ulcers and amputation resultant from a diabetic foot in the Aboriginal population. These include pressure relief, which is the most important factor in preventing pressure ulcers.\textsuperscript{7} Diabetic patients with a sensory deficit and circulatory disturbances combined with exposure to prolonged pressure such as when seated cross-legged, are at increased risk for developing an ulcer. Preventive measures including frequent inspection, general measures to diminish pressure, frequent changes of position, and the use of special mattresses may help reduce the risk.\textsuperscript{6} In addition, Jayasinghe et al\textsuperscript{8} showed that walking barefoot is a risk factor for diabetic foot and noncompliance with wearing prescribed footwear is a prominent truth in many Aboriginal communities (Chantelau et al and Knowles et al cited in \textsuperscript{9}). Programs that improve compliance with wearing footwear may reduce the risk of ulceration in this population, associated morbidity, and cost of care (Ramsey et.al cited in \textsuperscript{9}).

The literature strongly supports an early detection and intervention program that facilitates awareness, self management practices, early screening, intervention and appropriate referral and follow-up.\textsuperscript{x,xi,xii,xiii,xiv,xv} Studies have demonstrated success among non Indigenous populations with educational and self management programs in terms of improving foot care behaviour, care given by health providers and reduced lower extremity disease in non insulin dependent diabetic patients.\textsuperscript{xvi}

Currently, several educational resources exist to demonstrate good foot care\textsuperscript{xvi,xviii,xx} however none are culturally appropriate for use among Indigenous populations which is fundamental in ensuring the program is relevant, empowering and self sufficient for its users.\textsuperscript{xxi,xxii,xxiii}

\textbf{a. Background to current project}
The Indigenous Diabetic Foot Program (IDFP) developed in Palm Island, North Queensland by Jason Warnock, is the pilot program for which this program is based.
b. Program aims and objectives
The purpose of this project is to (i) evaluate how the program can be adapted for use with Aboriginal populations in the Pilbara and (ii) evaluate the impact of the program among Aboriginal populations in which it was implemented. The primary objective of the program under evaluation in this paper was to improve awareness about diabetic feet among the participants and to empower them with self management practices.

2. METHODOLOGY

a. Target Population and setting
The target population for the project were Aboriginal people located in the Pilbara region of Western Australia. Participants were recruited to the program from either:
3. the Port Hedland Regional Dialysis Unit at the hospital or a health service in South Hedland (convenience sampling from target rich environment); or
4. resident of one of four Western Desert communities (funding body requirement).

All participants from the Dialysis Unit had a diagnosis of either Type I or Type II diabetes mellitus however in the Western Desert this was not the case as a need for the program was identified regardless of diabetic status.

A representation of staff from ALL locations was required for the training workshop. Unfortunately the staff members from the health service were not able to attend the training and therefore were not able to participate in the program.

a. Sample size
The total number of participants for the study were as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Initial visit</th>
<th>Mid review</th>
<th>Final review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dellay Unit, Port Hedland Hospital</td>
<td>17</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Western Desert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community One</td>
<td>8</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>Community Two</td>
<td>10</td>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>Community Three</td>
<td>8</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Community Four</td>
<td>8</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

a. Data collection with DU; education and self management sessions and initial podiatry review with all participants
b. Reinforcement of self management, education and podiatry review; WD not necessarily same participants as initial visit
c. Post implementation with DU only, WD no pre post implementation data collected, focus on evaluating facilitator perceptions

b. Timeframe
Initial visit and training of staff occurred between March and April of 2009. Program implementation and mid review occurred in the following five months and final review occurred in September over a one week period.

c. Study Design and evaluation methods
The implementation of the program was assessed through interviews with program facilitators at both sites to gauge perceptions of the IDFP. To evaluate the impact of the program the outcome measures were an improvement in knowledge about how to care for diabetic feet and an improvement in self
management practices among participants. The most suited study design to evaluate this clinical intervention was a pretest–posttest non experimental design.

To assess participants foot hygiene knowledge and practices pre and post implementation of the program, a questionnaire was designed and implemented. Pre and post implementation data was only collected from Dialysis Unit participants. In the Western Desert this was not possible due to time constraints. It is important to note that despite this, participants from all sites received similar educational delivery, self management practices and were supported with the same resources.

In addition to data collected from program participants, all workshop attendees who took part in the training workshops completed an IDFP generic evaluation form.

d. Assessment tools

i. Pre and post implementation questionnaire for participants

This questionnaire consisted of two components:

1. Educational – assessment of participant knowledge, questions based on workshop content
2. Self care – assessment of behaviour, questions based on information from self management sessions

The questionnaire was reviewed by the original program developer to ensure it was consistent with program outcomes.

ii. Kimberley Indigenous Cognitive Assessment (KICA)

The KICA is a tool to assess cognitive impairment in older rural and remote traditionally living Indigenous Australian populations. It is most reliable at a cut off point of 33/39 in determining the presence of cognitive impairment. Participants were screened using the KICA-Cog (a component of the KICA) and if they were identified as having poor self management practices (DART and/or pre-implementation questionnaire) and/or scored <33 using the Kimberley Indigenous Cognitive Assessment (KICA), self management education was modified and adapted to their style of learning.

iii. Diabetic Foot Assessment of Risk Test (DART)

The DART developed by the IDFP, captures the key components required for a diabetic foot assessment. Areas addressed are:

- Pulses
- Sensation
- Active foot lesions and deformity
- Schematic location of pulses and lesions/deformity
- Presence of amputations or significant scars
- Self-care practices including in depth questions about their knowledge of the above and self management practices relating to their feet and overall diabetes management

e. Equipment

Self Management Kit: simple equipment (bucket, scourer, sand paper, chux, soap, nail file) participants were taught to use to clean their feet

High density foam mat: 2-4 mats distributed to each site. Participants were encouraged to use these when seated to relieve pressure

Promotional posters: aid delivery of education, wider dissemination of program

Promotional stickers: An incentive given for good self management practices
Footwear: Thongs printed with promotional message. Provided to participants who (i) did not have or could not afford footwear or (ii) as an incentive for good self practice behaviours.

f. Process
An overview of the process taken to implement and evaluate the program is presented in Figure 2.1 below. This is a general overview of the program. There were slight differences in the approach for the different sites however fundamentally a similar structure was followed.

Figure 2.1 IDFP implementation overview

An IDFP workshop was held at Port Hedland Hospital’s conference room. It was facilitated by Burke Hugo, a visiting Podiatrist, who was trained in the IDFP by the original developer. Nurses from the Western Desert (x3) and Dialysis Unit (x2) attended with the intention to disseminate information to staff after completion of the training. All materials were distributed and the program’s implementation process discussed.

Participants from the Dialysis Unit were interviewed while receiving dialysis to complete the consent form, pre-implementation form and KICA. Participants were taught self management practices one on one by the program coordinator and staff who attended the workshop. Self management equipment was given to participants to take home and additional supplies kept at the Dialysis Unit. Participants self management practices were reviewed at 6 weeks with spot checks at various intervals and podiatry review twice during the implementation phase.
In the Western Desert, the program was implemented by a physiotherapist, podiatrist, podiatry student and diabetes educator. The approach was less formal and the focus was on working within the communities needs and building relationships which was fostered by education sessions being delivered in a non threatening setting in the community and training of staff locally.

i. **Funding**
Funding was provided by the Department of Health and Ageing Rural Health Scheme, Pilbara Population Health and the West Australian Country Health Service (WACHS).

ii. **Ethics**
The WA Aboriginal Health and Information Ethics Committee were notified about the program however illustrated that ethical approval was not required as it was an evaluation of a pre-established program. Permission for implementation of the IDFP from coordinators of the Western Desert communities was sort to ensure communities were part of the decision process when implementing the program. Where land permits were required, relevant authorities were contacted and visitation rights approved.

5. **RESULTS**

a. **Process evaluation**

i. **IDFP workshop**
Following the workshop, attendees completed a ‘Participator Evaluation’ form (see appendix for form). Table 3.1 shows how attendees rated the workshop.

<table>
<thead>
<tr>
<th>How did you find ….</th>
<th>Very poor</th>
<th>Poor</th>
<th>Satisfactory</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>The advertising and notification</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>The structure of the workshop</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>The venue</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>The content</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>The activities</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>The educational tools</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>The facilitator / presenter</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
</tbody>
</table>

Attendees rated all set-up and workshop activities as satisfactory to excellent however some would have liked more notice about the event. Attendees particularly enjoyed the practical applications the self management session provided and all attendees would use the IDFP educational tools in their workplace; no one mentioned any parts of the workshop they disliked. All attendees answered all knowledge review questions correctly.

ii. **Equipment**
It was important to assess the use of the thongs provided as they were one of the key pieces of equipment and one of the more costly items.
Three quarters of participants stated that the thongs were not useful. Reasons given for this varied and included that they were not used, were too hard, another type of shoe is preferred. However over half of respondent (58.3%) stated that the message printed on the thongs reminded them to wash their feet. Among those who disagreed with the statement, reasons given included that they did not use the thongs provided.

iii. KICA
The KICA was not part of the original program therefore it was important to assess the usefulness of it in the context of the program. Two participants (out of 17) did not meet the recommended 33/35 KICA score however were identified as high risk from the DART, scored poorly on self management practices and had active foot lesions. It was identified from the KICA they had good recall with visual prompting therefore they were given visual strategies to aid their learning style and carers were educated to support their self management.

iv. DART
The assessment of the DART was not a primary objective of this study however it was important to assess the reliability of this tool across this population. The DART demonstrated good inter-rater reliability in the Dialysis Unit with all DARTs cross-checked by the podiatrist. All of the discrepancies between initial assessor and podiatrist were on the section of ‘feeling for pulses’ where the podiatrist required a Doppler to accurately confirm a pulse.

v. Perceptions of program by participants
As part of the post implementation questionnaire, to assess participant perception of the IDFP, participants were asked to report what they enjoyed about the program. Responses were categorized into the following themes:

Better access to services
Prior to the program, access to a podiatrist was inconsistent or non existent. All participants reported that they enjoyed seeing the podiatrist suggesting that one of the most significant benefits to the program is better access to primary health care. In addition, participants at Dialysis Unit would appreciate more education about diabetes.

Culturally appropriate education and practice
Education and self management sessions were appropriately delivered to achieve their primary aim of improving awareness and self management practices. This was demonstrated by participant responses which illustrated they enjoyed washing their feet and would like to continue regular self management sessions. One participant commented that the program came to “their level”.

vi. Perception of program by facilitators
Facilitators from the Dialysis Unit and Western Desert were asked to give their perceptions of the IDFP. Key themes identified include:

Factors affecting sustainability

Staffing
For both the Dialysis Unit and Western Desert staffing was identified as key to the sustainability of the program. The Dialysis Unit stated stable staffing levels determined whether ongoing implementation was feasible. The Western Desert suggested that given the enthusiasm for the program among health workers it was feasible for the program to continue however it would require ongoing support from a program coordinator due to already heavy workloads.

Training
Dialysis Unit stated due to frequency of staff turnover, regular training would be required. Western Desert staff would also like to attend training however may be limited by access to funding for travel, accommodation and incidentals.

Funding
Dialysis Unit staff illustrated they would be able to fund the resources required for the program however Western Desert staff would require external funding.

Participation and Enthusiasm
Dialysis staff noticed participants asking more questions about their foot health and requesting interventions such as urea cream and podiatry review. Western Desert staff illustrated the program was culturally specific and ideal for their communities which generated a genuine interest from participants who asked site facilitators to run more sessions after the initial visit. Health workers were present in good numbers illustrating enthusiasm for the program. Both groups illustrated they would be able to continue self management groups given a site facilitator responsible for coordinating the program to overcome this barrier.

Access to primary health care professionals
All sites illustrated the gap in health care provision in this service area and foresee the need for a podiatrist, diabetes educator and dietician as currently without the program, they don’t have access to any of these providers.

Equipment
Dialysis staff found the resources useful and purchased urea cream to use on participants feet instead of the less effective sorbelene cream. Western Desert staff made particular mention of the pictorial book as a resource that participants could identify with and use of thongs as incentives improved participation. The mats at both locations were not used as originally planned and not required.

Outcomes

Education and Awareness
Dialysis staff noticed participants had increased awareness of their feet and the benefits of self management. Those who embraced the knowledge demonstrated changes in foot hygiene and health. Western Desert facilitators felt education was successfully delivered with Martu people well versed in foot care. Enthusiasm from presenters motivated participants to get involved.

Health benefits
Dialysis Unit speculated reduced statistics for toe ulcers and amputations and Western Desert could see the benefits to the community in terms of attitude, participation and involvement.

b. Impact evaluation
Participant knowledge and behaviour was assessed pre and post implementation of the program. Based on their answers, participants were given separate overall scores for knowledge and behaviour pre and post implementation of the IDFP, scores were only derived for participants who had a valid answer for all questions pre and post implementation. For all participants, scores for knowledge and behaviour increased following the program. For participants, where final review was possible, the mean knowledge score increased from 2.8 to 5.0, the highest possible. Similarly the mean behaviour score increased from 1.6 to 5.0, again the highest possible.

6. DISCUSSION
Overall, this study illustrated that the IDFP is successful in either a controlled environment (Dialysis Unit) or a remote Indigenous community (Western Desert).
In regards to implementation, the workshops were considerable successes, in particular the content of these. It is important to keep these practical as this was highly regarded and results showed that this was an effective way of learning as all attendees answered all review questions correctly.

Participants identified with the culturally specific resources which were used to enhance the education message of preventative behaviours. Particularly useful equipment included the self management kits, as participants were able to adapt the use of the different components to fit their needs, encouraging the use of them; promotional posters placed in front of weigh in machines stimulated discussion; and the educational flip chart prompted vigorous discussion, in particular the use of photos which they could identify with. Interestingly the thongs provided were not considered useful by participants however the reminder message was worthwhile suggesting that the provision of thongs may not be entirely necessary for the program to be successful however a reminder is needed. In addition foam mats were not used and their cost does not warrant further use; the promotional stickers were ineffective in their aim; and the soap bottles from the self management kit were not used as soap was readily accessible. This highlights the importance of discussing with each of the communities what equipment will be most effective for them as this will help ensure the sustainability of the program.

The use of the KICA as a screening tool worked well and was fundamental in ensuring that all participants understood the information they were being told. Although only two out of 17 participants scored less than the 33/39 cut off, these two participants were at high risk and one had active foot lesions. The KICA is an effective screening tool and results allow the delivery of education to be adapted with the help of family members and carers. This ultimately encourages community engagement and impacts on whether an individual can effectively participate in the program.

In the Western Desert, the DART, as an assessment tool, demonstrated good inter rater reliability. In the area it was lacking, the use of a Doppler is required to improve this. Current forms being used only assess foot pulses in patients 55+ years, however this is too late to effectively identify and manage a diabetic foot and does not capture the population for early intervention which is supported by the literature as best practice and given the results, the use of the DART is advocated.

Participant perceptions of the program suggest that they valued the increased access to primary health care services and the fact that the program was culturally safe. Access is known to be a key factor contributing to poorer health outcomes among Indigenous populations. Podiatry review, in this case, was based on availability however given the positive response by participants there is an argument for more podiatrist services. Some participants commented that they would like further education about diabetes demonstrating that so long as the education is culturally appropriate it will be respected.

Among facilitators, perceptions were broadly classified into factors affecting sustainability and outcomes. So long as the program remains culturally safe (encouraging participation from members) and there is someone at each site advocating for the program, sustainability will be made somewhat easier. If the program is staffed appropriately with a full time coordinator overseeing it, then issues pertaining to staffing, training and funding will also be eased. It is encouraging that facilitators noticed differences in participants’ awareness and behaviours in a relatively short time period as this not only demonstrates the effectiveness of the program but may also promote sustainability.

Finally in regards to implementation, pivotal to success, was the time required to develop working relationships with participants and site facilitators. This was established through initial one on one education, which was adapted dependent on KICA results and then later on through group education sessions and shared knowledge.
The results from the impact evaluation showed that for this program an increase in knowledge did result in a change in behaviour and this was the case among all participants, albeit a small sample size. It is not always the case that an increase in awareness or knowledge results in a concomitant change in behaviour, the fact that in the short term it has for this program is encouraging and a testament to ensuring that any programs implemented in Indigenous communities are culturally safe.

a. Limitations to study design
Criteria for inclusion into the study remained broad due to the unpredictable presentation of participants. Upon visiting the Western Desert priority had to be given to building rapport, facilitating self management sessions, assessing and treating participants and training local community members rather than collecting pre intervention data. Due to changes in staffing, mid review of communities three and four could not take place and the visit was cancelled. In communities one and two post evaluation focused on the facilitators only as program participants of these communities were transient by nature.

Among participants from the Dialysis Unit, participation was high (17 out of 18) and all initial participants underwent multiple reviews during the course of the program. There was attrition in the sample due to participants passing away, relocating or they were away during the period data was collected.

b. PRACTICAL IMPLICATIONS

i. Gaps within the health service
To reduce the disease burden that diabetes poses among Aboriginal populations, there is a need to work collaboratively across services to identify and address factors contributing to diabetes. The process of conducting this study has identified that following gaps:

− Insufficient staffing to address the need in the Pilbara, namely a podiatrist and another diabetes educator and dietician.

− Current hospital episode statistics only record a primary diagnosis (i.e. diabetes). Co morbidities relating to the primary diagnosis needs to be introduced in to hospital administrative databases (eg. diabetic foot complications) to help correctly identify at risk people.

− Collaboration of services needs to improve with communication and networking between services to deliver a more unified service. This may be assisted with the development of a regional service map which documents programs and services available in any given area. It would further identify duplication of services and areas of need encouraging reallocation of limited resources.

− Diabetes programs need to address key priorities described by the Endocrine Health Network: Diabetes Model of Care, 2008 report and focus on early identification and prevention rather than acute care.

− Environmental health needs to be addressed in Western Desert communities to reduce the ripple effect poor hygiene, lack of sanitation and introduced pests can have on human health and well being

ii. Aboriginal Health Screen, Western Desert
It is well documented that life expectancy for Aboriginal people is significantly less than other Australians. This calls for early identification and treatment programs which capture the ‘at risk’ population.

Currently, screening tools do not allow early identification and intervention as people are not detected within their life expectancy. A working party with Punturkurnu Aboriginal Medical Service and Medicare is recommended to review the current screening tool and incorporate a more thorough assessment such as the DART, in a timelier manner. An electronic database of client information is
recommended to improve communication and liaison between services and allow clients to be tracked and monitored throughout the Western Desert.

7. RECOMMENDATIONS
   - The IDFP is implemented with sufficient staff which includes but is not limited to divisional program coordinator; site program facilitators; podiatrist; nurse; diabetes educator; health promotion officers; relevant allied health professionals where necessary. Roles in relation to the IDFP should be clearly outlined in JDFs.
   - Education sessions are implemented at a frequency determined with the site/community and at a frequency which helps to ensure adherence to self management practices and sustainability of program.
   - All new program participants receive one to one education initially.
   - Equipment should be discussed with each community to determine the usefulness of different components but should include at the very least self management kit, promotional posters and educational flip chart.
   - Continued use of KICA and DART with Doppler.
   - Training workshops to be implemented at least once per year and are only to be facilitated by people who have undergone the IDFP ‘train the trainer’ workshops. Attendees should include community based facilitators and interested Aboriginal Health Workers.
   - Once implemented, regular evaluations of short term and long term outcomes.

8. CONCLUSION
   The IDFP can be successfully implemented at a controlled site and remote Aboriginal community, however a regular service is a pivotal requirement to the programs acceptance, ongoing implementation and long term sustainability as sites need to see a commitment to follow-up and a meeting of needs which is consistent and demonstrative.

Several key themes underlined the success of the program including participants identification with the cultural safety of the program, the teams genuine interest to develop a working relationship with sites and participants to ensure health outcomes were met, connecting participants with health providers previously inaccessible, provision of funding to allow resources and incentives to be provided and training of staff locally to ensure ownership and ongoing sustainability of the program.

Several areas were highlighted as requiring attention to close the gap between prevention and treatment. The usual primary cause of extreme health gaps of this kind are behavioural so preventative programs need to be driven by the people who are affected by the condition or are motivated to see change. Areas requiring attention are lack of primary health care providers affecting the ability to provide a regular service and sustain programs, lack of integration between services allowing effective delivery of health care and lack of early identification and management to reduce the chronic disease burden. The IDFP is a step forward in addressing these issues and assists in closing the gap by addressing Aboriginal health needs in a culturally safe framework.

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1 Norman PE, Schoen, DE, Gurr JM, Kolybaba ML. High rates of amputation among Indigenous people in Western Australia. The medical journal of Australia 2010;192(7): 421.


Torres Strait Island and Northern Peninsular Health. Torres Strait Islander and Northern Peninsular Health. Thursday Island, Qld.: Torres Strait Islander and Northern Peninsular Health, 1996.


