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# A Regional Podiatry-led Audit of Multidisciplinary Diabetes Foot Ulcer Management in Community and Hospital sites in Northern Ireland

November 2016

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Assurance, Challenge and Improvement in Health and Social Care

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## Summary

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The Podiatry Managers in the Faculty of Management Northern Ireland Group (FOMNIG) recognised that there was a lack of data on and variation in the availability and quality of care in diabetic foot ulcer (DFU) management in Northern Ireland.

The regional audit of DFU management mapped against national standards provided baseline information on the assessment, clinical management, healing times and amputation rates in 100 patients presenting with a new DFU. Results reported that the assessment of neuropathy, pulses, risk and appropriate review fell below the expected national targets. However, all patients had agreed management plans and at 12 and 24 weeks 57% and 74% of DFUs had healed. All patients with peripheral arterial disease had access to and intervention if appropriate by vascular services. Thirteen patients had an amputation (3 major, 10 minor).

The report recommends that diabetes foot assessments, risk assessment, risk assignment and review should be standardised within the region and completed in a timely way. A regional DFU classification system should be adopted and become embedded in clinical case notes.

The audit findings showed the importance of having robust Information & Technology (IT) systems that interface with each other to provide reliable, timely and specific information on the management of people with diabetes.

Services, processes and teams should be developed within community and hospital settings to support care described in the Northern Ireland Integrated Diabetes Foot care Pathway and National Institute for Health and Care Excellence (NICE) Guidelines. Podiatry Supervision and Competency Frameworks should be developed and implemented regionally.

This audit provided important baseline information on patient care in Northern Ireland. Successful collaboration between Podiatry services in the Trusts will implement change that will standardise the clinical assessment and management of DFUs. Podiatry service development and redesign coupled with an aspiration to have robust IT systems will be key in providing high quality Podiatry care for this vulnerable group of patients.

## Introduction

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The current population of Northern Ireland equates to 1.8 million 84,836 of whom have diabetes (Quality and Outcomes Framework 2014/15). There has been a significant increase (33%) in the number of people diagnosed with diabetes between 2007 and 2012. Of these 15% will develop a diabetic foot ulcer (DFU) during their lifetime and five percent will experience a DFU in any one year. The estimated annual cost of diabetic foot disease for Northern Ireland is £28 million (Diabetes Strategic Framework (Northern Ireland)).

Professionals working in the field of diabetes recognise that there are a number of challenges associated with diabetes foot care in the region. There is a lack of accurate data on the prevalence of DFUs in the diabetic population and in Podiatry caseloads. There is also concern regarding variation in the availability and quality of care for DFUs and recognition that management can be fragmented and inefficient at times. This was supported by The National Diabetes Inpatient Audit (2010) that reported less than optimal care.

The Regional Podiatry Managers Group (FOMNIG) in partnership with the five trusts across Northern Ireland recognised that there was a need to review and change the delivery of diabetes foot care in the region. A Diabetes Strategic Framework Northern Ireland, a Northern Ireland Diabetes Foot Working Group and the Foot Care Services for Patients with Diabetes-An Integrated Care Pathway were already in production at a departmental and regional level. It was anticipated that an audit of the multidisciplinary management of DFUs in hospital and community sites across Northern Ireland would provide essential baseline information to support the implementation of this work and integrate and improve the quality of patient care throughout the region.

A Regional DFU Audit proposal was written and funding was secured from the Guidelines and Audit Implementation Network (GAIN). A Specialist Podiatrist was appointed in July 2015 for one year to complete the audit. Data was collected on the assessment, management and clinical outcomes of patients with a new DFU in Northern Ireland 2013-2014 and the results were monitored against recognised national standards (NICE 2004, 2011, NG19, Putting Feet First, 2013). This data also supported the National Diabetic Foot ulcer Audit (NDFU) in England and Wales (2014).

## **The Pilot Study**

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The aim of the pilot study was to test the feasibility of the audit design including the data collection methods. This methodology was reviewed, appropriate changes made and then replicated in the main audit.

### **Methodology**

#### **Audit Design**

Information was collected on the number of patients on Podiatry caseloads per trust, including the number of patients with diabetes and the prevalence of new DFUs in 2013/2014. The audit period was defined and included patients (n=25) who presented with a new diabetic foot ulcer (DFU) for the audit period 1<sup>st</sup> April 2013 - 31<sup>st</sup> March 2014. The audit design facilitated a retrospective evaluation of current multidisciplinary clinical practice in people with diabetes including risk assignment, DFU classification, time to healing, ulcer prevention and amputation rates. Practice was assessed against the national standards. (Appendices 1, 2)

#### **Sample Size**

It was estimated that 80,000 people in Northern Ireland had diabetes in 2013/14 (Diabetes UK). Approximately five percent of this population (4,000) will develop a DFU in any one year. Based on a population of 4,000, with a confidence level of 90%, and a margin of error of 10%, it was estimated that a sample size of 67 DFUs was required from hospital and community sites in all five trusts. The sample was increased by 50% (34) to allow for missing data (101). This was rounded down to 100 (20 per Trust, 10 hospital and 10 community). For the pilot study a sample of n=25 (five each Trust, two hospital and three community) was used.

#### **Data Collection**

A data access agreement form was completed for each Trust in the region to fulfil all data governance obligations. A data collection form (Appendix 1) was designed and advice taken from trust audit departments and those associated with the NDFA. Permission was granted to use the questions presented in the National Diabetic Footcare Audit (NDFA) data collection forms. Data was collected manually from podiatry charts, medical charts, IT databases, coding departments, previous audits and Trust audit departments. Information was collected on the number of patients with diabetes on podiatry caseloads in five Trusts and the incidence of DFUs in the five Trusts in the audit period. Patients presenting with a new DFU (the target ulcer) were included in the audit.

Once identified, the lists of new DFUs for each Trust were divided into two groups (community and hospital) depending in which setting the DFU originated. The data was entered on to an Excel Spreadsheet and each DFU patient was given an anonymous name/number by their Trust. If a patient's DFU was treated within one or more Trust areas, overall ownership of the DFU was determined by the Trust that initiated treatment.

## Randomisation

An electronic randomisation schedule was created from the Excel spreadsheets and 20 patients were selected per Trust (10 hospital and 10 community). One Trust had a limited hospital service and so the majority of patients were taken from the community list. If selected patients failed to meet the audit criteria, the next sequential anonymised number on the list was selected. For the pilot study five DFU patients were selected from each Trust (two hospital and three community).

Anonymised data was collected on the Data Collection Form and then transferred to an Excel Spreadsheet in preparation for analysis. Data was collected on:

1. **Diabetes status** and HbA1c values (a measure of blood glucose over a three month period) that were closest to the onset of the DFU
2. **Assessment** for the presence of neuropathy and peripheral pulses within 12 months of the start of the DFU (however; assessments completed within 15 months were deemed acceptable as this allowed a buffer to accommodate service user delay and service capacity issues. Please note that within the main body of the report the term 'within the required time period' will reflect this 12-15 month time frame). A foot risk score was classified and assigned; presence of risk in accordance with review date was reviewed; a separate footwear assessment was completed
3. **Classification of the DFU:** the SINBAD system was used
4. **Management of DFU:** interval of time from first presentation of the DFU to assessment by a podiatrist; presence of an agreed management plan; infection/emergency management; time to DFU healing; outcomes of DFU at 12 and 24 weeks; ulcer free period; off-loading; Charcot; limb salvage; amputation; structured education programmes

## The Pilot Study Results

Information was collected on the number of patients on Podiatry caseloads per trust, including the number of patients with diabetes and the prevalence of new DFUs in 2013/2014. The total population in NI and per Trust with Diabetes (2013/2014) was identified using QOF information (81,167). In NI, 53,590 of these patients with diabetes (65.5%) sit within Podiatry caseloads. The range was identified as 28-95%. The number of people with new DFUs in the audit period as a percentage of the total diabetes population in NI was 2.9%. The range was 0.6-4.7%. The number of people with new DFUs on existing Podiatry caseloads in NI was 4.6% with a range 0.9-7.5% (Table 1).

**Table 1: Information on Podiatry Caseloads per Trust in NI**

Trusts	Total Podiatry Caseload 2013/14	Podiatry/Diabetes Caseload 2013/14	Number of new DFU's 2013/14	Population with Diabetes 2013/14 (QOF)	% Diabetes Population on Podiatry Caseloads 2013/2014 (QOF)	% of new DFUs in the Diabetes Population 2013/2014 (QOF)
1	22,398	7869 (35%)	593 (7.5%)	18,307	43%	3.3%
2	45,000	19,170 (42.6%)	871 (4.5%)	20,838	92%	4.2%
3	33,098	13,415 (40.5%)	654 (4.9%)	14,059	95%	4.7%
4	10,000	4200 (42%)	271 (6.5%)	15,263	28%	1.8%
5	26,312	8936 (34%)	79 (0.9%)	13,400	67%	0.6%
<b>TOTAL</b>	<b>136,808</b>	<b>53,590</b>	<b>2,468</b> <b>(4.6%)</b>	<b>81,867</b>	<b>65.5%</b>	<b>2.9%</b>

The Pilot Study (n=25) was conducted prior to the main audit. Five patients, three from community and two from the hospital setting in each Trust were included. In Trust 4 there was no formal acute service so all patients were taken from the community service. Results show how patients were assessed, assigned a risk classification and managed (timely referral, infection management, footwear, off-loading, structured education programme) in the community and hospital settings. Successful healing at 12 and 24 weeks, ulcer recurrence, amputation rates, limb salvage and mortality rates were also reported.

### Diabetes Status and HbA1c Targets

The average duration of diabetes in the pilot study was 17 years (range 1-36 years). HbA1c values ranged from 41-97.8mmol/mol. The average HbA1c was 67.1 mmol/mol (above high normal).

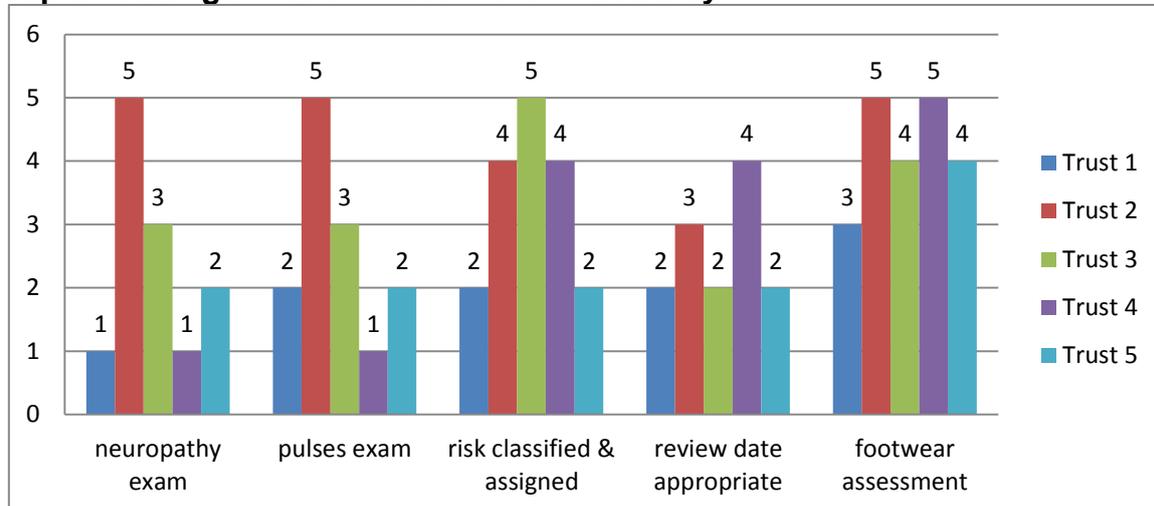
### Assessment

A total of 25 patients were assessed against the assessment criteria described in the NICE Guidelines. A separate footwear assessment independent of risk was completed. Results show the total number of diabetic foot assessments completed in community and hospital settings in each Trust (Fig 1). The total number of assessments completed regionally in the Pilot study is presented in Fig 2.

## Pilot Study results

A total of twenty-five patients were included in the Pilot study.

**Fig 1: Total number of diabetic foot assessments completed in community and hospital settings in each Trust in the Pilot Study**



### 1. Neuropathy Assessment, (n=12)

In total 12/25 patients (48%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 5/5 had neuropathy assessments completed (100%). Trust 3 completed 3/5 (60%), and Trust 5 completed 2/5 (40%). Trusts 1 and 4 completed 1/5 (20%).

### 2. Assessment of Pulses, (n=13)

In total 13/25 patients (52%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 5/5 had pulse assessments completed (100%). Trust 3 completed 3/5 (60%), Trusts 1 and 5 completed 2/5 (40%) and Trust 4 completed 1/5 (20%).

### 3. Foot Risk Classified and Assigned, (n=17)

In total 17/25 patients (68%) presenting with a DFU had their foot risk classified and assigned. Trust 3, completed 5/5 (100%), Trusts 2 and 4 completed 4/5 (80%) and Trusts 1 and 5 completed 2/5 (40%).

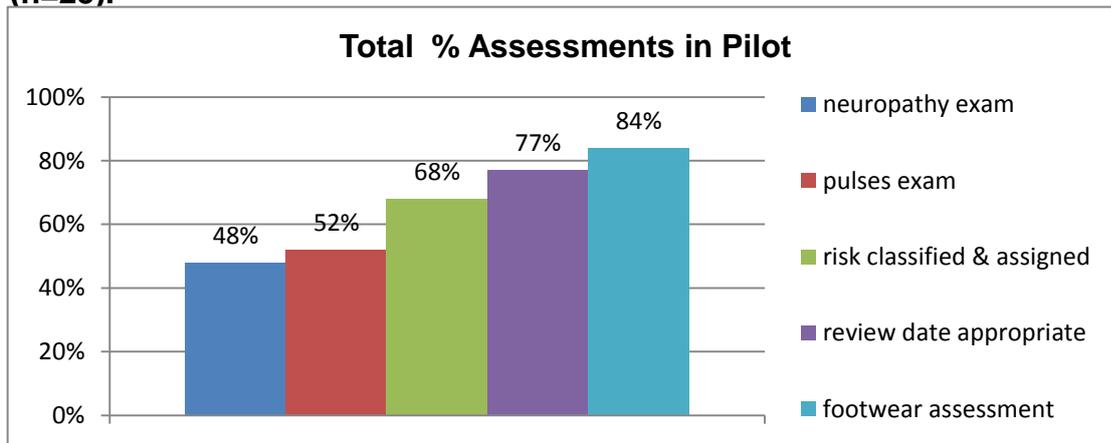
### 4. Review Date Appropriate to Risk Classification, (n=13)

Of the 17 patients who had a foot risk classified and assigned, 13 of these patients (77%) had a review date that was appropriate to their risk classification in all 5 Trusts. Trust 1, 4 and 5 achieved 100%, Trust 2 achieved 3/4 (75%) and Trust 3 achieved 2/5 (40%) of the review dates appropriate to their risk classification.

### 5. Footwear Assessment Completed

In total, 21/25 (84%) patients had a separate footwear assessment completed. Trusts 2 and 4 completed 5/5 (100%). Trusts 3 and 5 completed 4/5 (80%) and Trust 1 completed 3/5 (60%).

**Fig 2: The percentage of assessments completed regionally in the Pilot study, (n=25).**



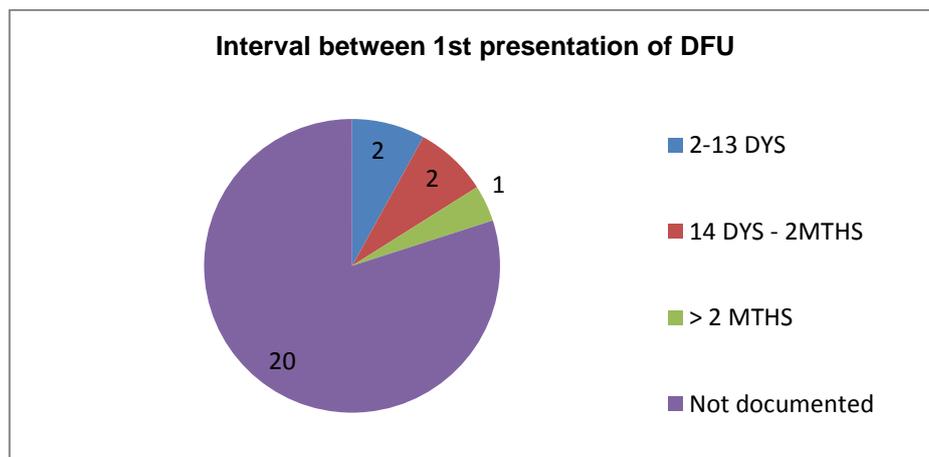
### Diabetic Foot Ulcer Classification

A formal classification system has never been adopted regionally in NI. Podiatrists have traditionally reported some elements within their clinical notes. Components of the SINBAD classification system (Site, Ischaemia, Neuropathy, Bacterial Infection, Area, and Depth) used in the NDFA were considered in this Audit to facilitate some comparability. In total 10/25 patients (40%) in the pilot study had components that reflected a full SINBAD score.

### Time to First Review at Podiatry

The interval between the first presentation of the DFU to a Health Care Professional (HCP) and subsequent assessment by Podiatry was not documented in 20/25 cases. Information on the remaining five patients showed that two were seen 2-13days and two were seen at 14 days-2months. One patient was seen by Podiatry more than two months from when they first presented to the original HCP (Fig 3).

**Fig 3: Time to first review from an HCP to Podiatry.**



## Timely Referral

Results show that 25/25 (100%) of patients in the Pilot Study had agreed management plans within 15 months of the onset of their DFU. Five out of 25 patients (25%) used an offloading system. Footwear assessments were completed in 21/25 patients (84%). Only one patient (4%) had attended a Structured Education Programme (SEP) within 15 months of the onset of their DFU.

In the community setting, 2/17 patients (12%) presented with a foot emergency and foot infection and all were seen within 24 hours and complied with national guidance. In the hospital setting, 3/8 patients (38%) presented with a foot emergency i.e. DFU. Results show that 1/3 patients were referred to the GP within the stipulated 24 hour period. Four of these eight patients (50%) presented with a foot infection. Records show that two patients were referred to the GP/ hospital team within 24 hours.

## Timely Referral of In-Patients to the Hospital team

A total of 8/25 patients (32%) in the pilot study were admitted to hospital with a variety of conditions. Two out of eight in-patients (25%) were referred to the hospital team within 24 hours.

## Time to Healing

The time to DFU healing at 12 and 24 weeks was reviewed for all 25 patients. Overall 15/25, 60% had healed at 12 weeks and 19/25 (76%) of the DFUs had healed at 24 weeks (Table 2).

**Table 2: Time to DFU Healing at 12 and 24 weeks in the Pilot Study**

Trusts	Number of DFUs Healed at 12 weeks, n=25	Patients deceased at 12 weeks	Lost to follow up at 12 weeks		Number of DFUs Healed at 24 weeks, n=25	Patients deceased at 24 weeks	Lost to follow up at 24 weeks
1	4/5 (80%)	1	0		4/5 (80%)	1	0
2	2/5 (40%)	0	1		3/5 (60%)	0	0
3	2/5 (40%)	1	1		4/5 (80%)	1	0
4	5/5 (100%)	0	0		5/5 (100%)	0	0
5	2/5 (40%)	1	0		3/5 (60%)	1	0
<b>TOTAL</b>	<b>15/25 (60%)</b>	<b>3 (12%)</b>	<b>2 (8%)</b>		<b>19/25 (76%)</b>	<b>3 (12%)</b>	<b>0 (0%)</b>

## **Ulcer Recurrence**

Eleven out of 22 patients (50%) remained ulcer free for 12 months from the date of healing of the target ulcer. Three patients were deceased.

## **Presence of Charcot**

In the pilot study 2/25 patients (8%) presented with chronic Charcot deformities. No new Charcot deformities were documented.

## **Limb Salvage Procedures, Amputation and Mortality**

In the Pilot Study all patients with peripheral arterial disease (PAD) 12/25 had access to Vascular Surgery if required. One patient had a minor amputation within the audit period (4%) and three patients died (12%).

## **Discussion and Implications for the main Audit**

The aim of the Pilot Audit was to ascertain if it were possible to interrogate existing Trust information systems in order to access the required information on Podiatry caseloads and the number of patients with diabetes and DFUs therein.

Results from the Pilot study showed that there were a number of Trust information systems in use collecting a variety of data. Robust interrogation of these systems was challenging.

Lists of DFUs within the audit period from acute and community sites in each Trust were produced. It became apparent that patients often had shared care from acute or community services within one Trust or had shared care between Trusts. It was agreed that if a patient's DFU was treated within or between one or more Trust areas, overall ownership of the DFU was determined by which Trust initiated the treatment.

Data collection was achieved using manual and electronic retrieval. Overall the audit design was acceptable and minor alterations were made to the data collection form (Appendix 1). These included:

1. Each field on the data collection form was reviewed and clearly defined to ensure consistency in data collection for the main audit.
2. An option of "not recorded" was introduced in the interval between first presentation of the DFU to a Health Professional and first assessment by Podiatry.
3. There was duplication in asking if the DFU was a new ulcer. This was removed as it was already captured elsewhere.
4. The field asking if there were multiple ulcers was removed as one target ulcer was already identified.
5. Information on the type of amputation was modified to include digital and ray amputations

## The Regional DFU Audit

The main purpose of the Regional DFU audit was to improve the clinical management of patients presenting with diabetic foot ulceration in hospital and community sites in NI. This was achieved by monitoring current Podiatry clinical practice against recognised national clinical standards.

A Pilot Study was completed to assess the feasibility of the study design, methodology and data collection methods. The audit methodology was then reviewed, amended and applied to the main audit. This is described in the previous section.

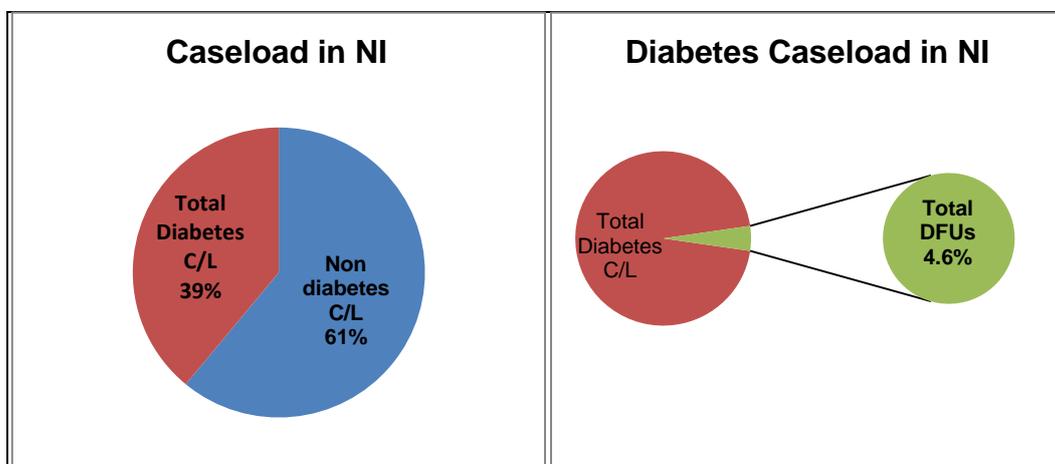
The main audit included patients (n=100) who presented with a new diabetic foot ulcer (DFU) for the audit period 1<sup>st</sup> April 2013 - 31<sup>st</sup> March 2014. The audit design facilitated a retrospective evaluation of current multidisciplinary clinical practice in people with diabetes including risk assignment, DFU classification, time to healing, ulcer prevention and amputation rates. Practice was assessed against national standards. An amended Data Collection Form (Appendix 1) was used to collect audit data from the sources described in the Pilot Study and lists of DFUs produced. Twenty patients from each Trust were randomly selected and data was collected on the relevant fields.

### Results of the Regional DFU Audit

Results in the Pilot Study reported the total Podiatry caseload for the region was 136,808. This included a diabetes caseload of 53,590. The total number of new DFU's in the region in the audit period was 2,468 (4.6%), (Table 1, Fig 4).

Results from the Regional DFU Audit show an overview of regional caseload information, assessment, assignment of risk, DFU classification and management, time to healing, revascularisation, amputation rates and mortality.

**Fig 4: The Total Caseload in NI (diabetes & non diabetes) including the total regional percentage of DFU's**



## Diabetes Status

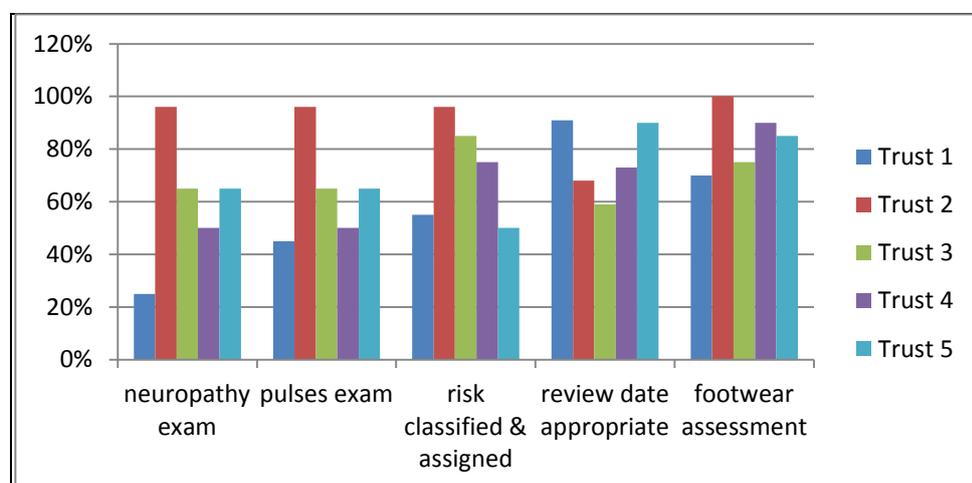
The average duration of diabetes in the audit patients was 17 years (range 1-55 years) with an average HbA1c value of 70.9mmol/mol (range 29-154mmol/mol). This was similar to results found in the Pilot study.

### Assessment

#### A. Assessment in both community and hospital settings

Results of the total number of DFU assessments in both community and acute settings are presented. Results are also individually presented for the community and hospital teams (Fig 5).

**Fig 5: Total percentage of DFU assessments completed in both community and hospital settings in individual Trust areas in NI.**



#### 1. Neuropathy Assessment (n=60)

In total 60/100 patients (60%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 19/20 patients (95%) had neuropathy assessments completed. Trusts 3 and 5 completed 13/20 (65%) and Trust 4 completed 10/20 (50%). Trust 1 completed 5/20 (25%).

#### 2. Assessment of Pulses (n=64)

In total 64/100 patients (64%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 19/20 had pulse assessments completed (95%). Trusts 3 and 5 completed 13/20 (65%), Trust 4 completed 10/20 (50%) and Trust 1 completed 9/20 (45%).

#### 3. Foot Risk Classified and Assigned (n=72)

In total 72/100 patients (72%) presenting with a DFU had their foot risk classified and assigned. In Trust 2, 19/20 were completed (95%). Trust 3 completed 17/20 (85%). Trust 4 completed 15/20 (75%). In Trust 1, 11/20 were completed (55%) and Trust 5 completed 10/20 (50%)

#### 4. Review Date Appropriate to Risk Classification (n=53)

Of the 72 patients who had a risk classified and assigned, 53 (74%) of these patients had a review date that was appropriate to their risk classification in all 5 Trusts. Trust 1 achieved 91%. Trust 5 achieved 90%. Trust 4 achieved 73%. Trust 2 achieved 68% and Trust 3, 59%.

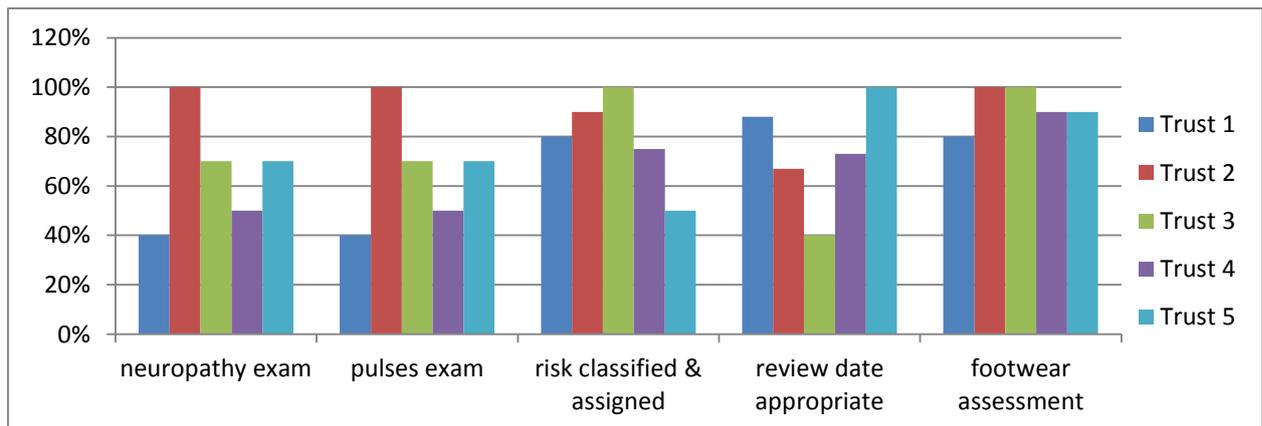
#### 5. Footwear Assessment Completed (n=84)

In total, 84/100 (84%) patients had a footwear assessment completed. Trust 2 completed 20/20 (100%). Trust 4 completed 18/20 (90%). Trust 5 completed 17/20 (85%). In Trust 3, 15/20 (75%) were completed and Trust 1, 14/20 (70%).

### B. Assessment (Community Setting)

A total of 60 patients were assessed against the assessment criteria described in the NICE Guidelines. Trust 4 had no defined service in the hospital setting so all 20 patients came from the community setting and all were included in this analysis. Results of diabetes foot assessments completed by the Community teams are presented in Fig 6.

**Fig 6: DFU assessments completed by the Community Teams in each Trust**



#### 1. Neuropathy Assessment (n=38)

In total 38/60 patients (63%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 10/10 had neuropathy assessments completed (100%). Trusts 3 and 5 completed 7/10 assessments each (70%) while Trust 4 completed 10/20 (50%). In Trust 1, 4/10 assessments were completed (40%).

#### 2. Assessment of Pulses (n=38)

In total 38/60 patients (63%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 10/10 had pulse assessments completed (100%). Trusts 3 and 5 completed 7/10 pulse assessments each (70%) while Trust 4 completed 10/20 (50%). In Trust 1, 4/10 pulse assessments were completed (40%).

### 3. Foot Risk Classified and Assigned (n=47)

In total 47/60 patients (78%) presenting with a DFU had their foot risk classified and assigned. In Trust 3, this was achieved in 10/10 patients, (100%). Trust 2 had 9/10 achieved (90%), and Trust 1 completed 8/10 (80%). Trust 4 completed 15/20 (75%) and in Trust 5, 5/10 (50%) were completed.

### 4. Review Date Appropriate to Risk Classification (n=33)

Of the 47 patients who had their foot risk classified and assigned; 33 (70%) of these patients had a review date that was appropriate to their risk classification in all 5 Trusts. Trust 5 achieved 5/5 (100%) and Trust 1 achieved 7/8 (88%). Trust 4 achieved 11/15 (73%). Trust 2 achieved 6/9 (67%) and Trust 3 4/10 (40%).

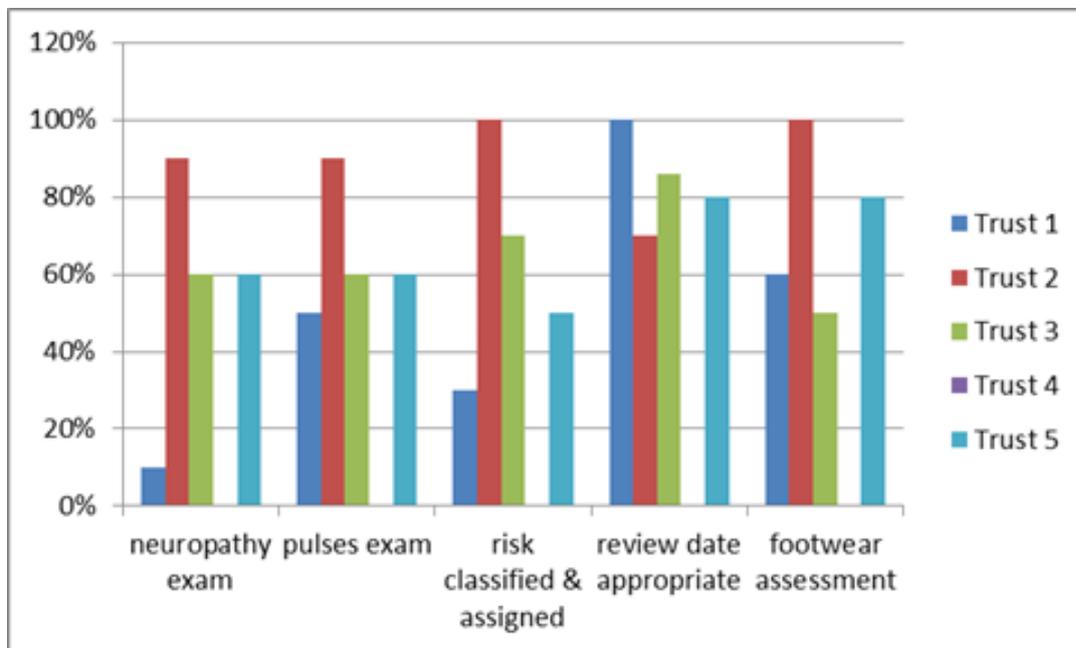
### 5. Footwear Assessment Completed (n=55)

In total, 55/60 (92%) patients had a footwear assessment completed. Trusts 2 and 3 completed 10/10 (100%). Trust 4 completed 18/20 (90%) and Trust 5 completed 9/10 (90%). Trust 1 completed 8/10 (80%).

## C. Assessment Hospital Setting

A total of 40 patients were assessed against the assessment criteria. Results show the total number of diabetic foot assessments completed in the hospital setting. Trust 4 had no formal service in the hospital setting so they were not included in this analysis (Fig 7).

**Fig 7: DFU assessments completed by the Hospital teams in each Trust**



### 1. Neuropathy Assessment (n=40)

In total 22/40 patients (55%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 9/10 had neuropathy assessments completed (90%). Trusts 3 and 5 completed 6/10 (60%) and Trust 1 completed 1/10 (10%).

## 2. Assessment of Pulses (n=26)

In total 26/40 patients (65%) were assessed within the required time period of presenting with the target DFU. In Trust 2, 9/10 had pulse assessments completed (90%). Trusts 3 and 5 completed 6/10 pulse assessments each (60%) while Trust 1 completed 5/10 (50%).

## 3. Foot Risk Classified and Assigned (n=25)

In total 25/40 patients (63%) presenting with a DFU had their foot risk classified and assigned. In Trust 2 this was achieved in 10/10 patients, (100%). Trust 3 achieved 7/10 (70%). Trust 5 achieved 5/10 (50%) and in trust 1, 3/10 (30%).

## 4. Review Date Appropriate to Risk Classification (n=20)

Of the 25 patients who had their foot risk classified and assigned; 20 (80%) of these patients had a review date that was appropriate to their risk classification in all 4 Trusts. Trust 1 achieved 3/3 (100%). Trust 3, 6/7 (86%). Trust 5 achieved 4/5 (80%) and Trust 2 7/10 (70%). Trust 4 was not included as they did not have an acute service.

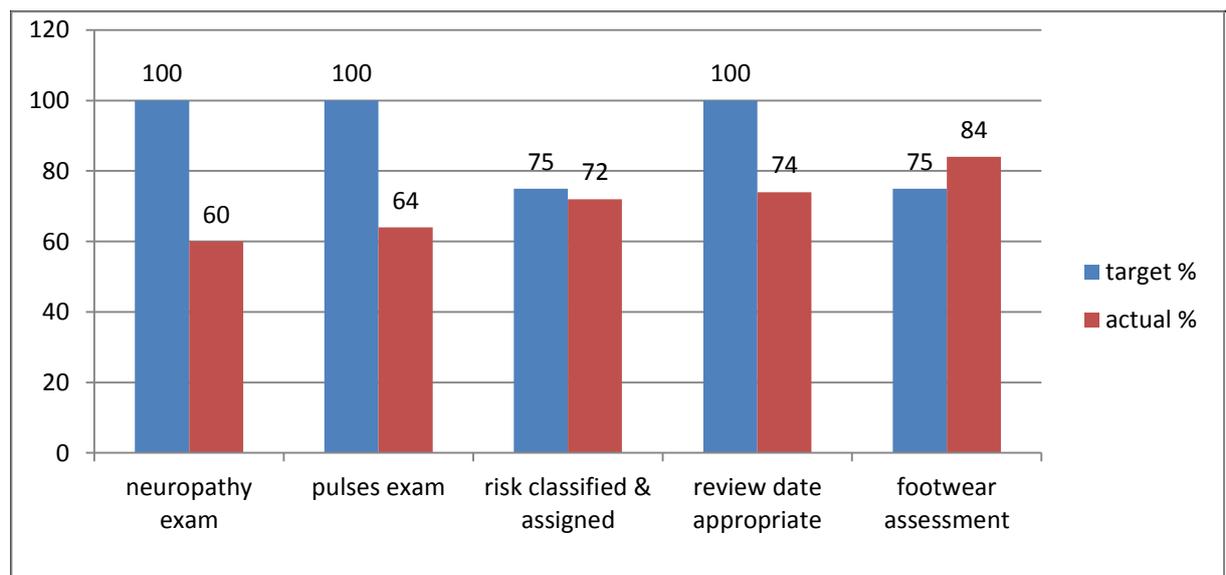
## 5. Footwear Assessment Completed

In total, 29/40 (73%) patients had a separate footwear assessment completed. Trust 2 completed 10/10 (100%), Trust 5 achieved 8/10 (80%). Trust 1 achieved 6/10 (60%) and in Trust 3, 5/10 (50%).

### D. Assessment outcomes compared with audit targets

Regional results of patient assessment outcomes for those presenting with DFU's were compared with the audit targets (Fig 8).

**Fig 8: Actual patient assessment outcomes (%) for those presenting with DFUs in NI compared with expected targets\*.**



\*All expected assessment targets described in Fig 8 are taken from national guidelines and from a regional consensus of expert opinion on what would realistically be expected in good clinical practice at this time.

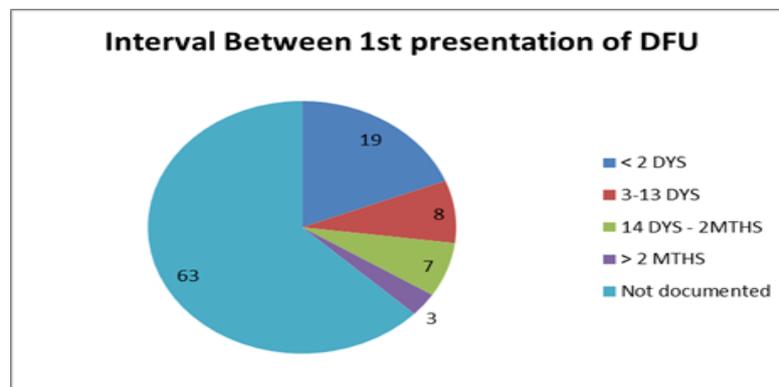
## Diabetic Foot Ulcer Classification

In total 54/100 patients (54%) completed all elements within the SINBAD classification system. The most frequently missing element was area measurement, followed by neuropathy assessment and ischaemia. Three patients had their ulcers classified using the Wagner system.

## Time to First Review at Podiatry

Thirty-seven out of 100 patients had the time to first review at Podiatry following initial presentation to a HCP recorded. Nineteen patients (19%) were seen within two days, 8/100 (8%) were seen 3-13days and 7/100 (7%) were seen at 14 days-2 months. Three patients were seen by Podiatry more than two months from first presentation to the original HCP (Fig 9).

**Fig 9: Time to first review at Podiatry following initial presentation to HCP**



Results show that 100/100 (100%) of patients had agreed management plans within the required time period of the onset of their DFU. Thirty out of 100 patients (30%) used an offloading system to reduce foot pressures. In 64/100 (64%) cases use of a system was not documented and in six cases (6%) it was recorded as not applicable

Footwear assessments were completed in 84/100 patients (84%). Four patients (4%) had attended a Structured Education Programme (SEP) within 15 months of the onset of their DFU.

## Timely Referral in Community and Hospital Settings

A total of 35/100 patients (10 community, 25 hospital) presented with a foot emergency. A total of 26/35 (74%) patients were seen by the community/ hospital teams, GP, or A&E within 24 hours.

Thirty seven of the 100 patients (15 community, 22 hospital) presented with a foot infection (37%). A total of 26/37 (70%) were referred to the GP, A&E or hospital team within 24 hours. Antibiotic therapy was recorded in 16/37 patients (43%). No referrals were made to a non-medical prescriber within 24 hours.

A total of 29/100 patients (29%) were admitted to hospital with DFU's and other medical conditions. Twelve of the 29 in-patients with DFUs (41%) were referred to the hospital foot team within 24 hours.

### Time to DFU Healing at 12 and 24 weeks

The time to DFU healing at 12 and 24 weeks was reviewed for all 100 patients (Table 3). Overall 57/100 of DFUs, 57% had healed at 12 weeks. Results show that in Trust 1, 65% of the DFUs had healed at 12 weeks. In Trusts 2 and 4, 60% healing was achieved. In Trust 3 there was 55% healing and in trust 5, 45%. Overall four patients (4%) were deceased at 12 weeks and four patients (4%) were lost to follow up. In comparison the NDFA and Holman et al (2014) reported a healing rate of 49% at 12 weeks.

Overall 74/100 (74%) of the DFUs had healed at 24 weeks (Table 3). Results show that in Trust 2, 85% of the DFUs had healed at 24 weeks. In Trust 4, 75% and in Trusts 1, 3 and 5, 70% healing was achieved. Overall seven patients (7%) were deceased at 24 weeks and no patients were lost to follow up.

**Table 3: Time to DFU Healing at 12 and 24 weeks in the Regional Audit**

Trusts	Number of DFUs Healed at 12 weeks, n=100	Patients deceased at 12 weeks	Lost to follow up at 12 weeks		Number of DFUs Healed at 24 weeks, n=100	Patients deceased at 24 weeks	Lost to follow up at 24 weeks
1	13/20 (65%)	1	1		14/20 (70%)	2	0
2	12/20 (60%)	0	1		17/20 (85%)	0	0
3	11/20 (55%)	1	1		14/20 (70%)	2	0
4	12/20 (60%)	1	0		15/20 (75%)	2	0
5	9/20 (45%)	1	1		14/20 (70%)	1	0
<b>TOTAL</b>	<b>57/100 (57%)</b>	<b>4 (4%)</b>	<b>4 (4%)</b>		<b>74/100 (74%)</b>	<b>7 (7%)</b>	<b>0 (0%)</b>

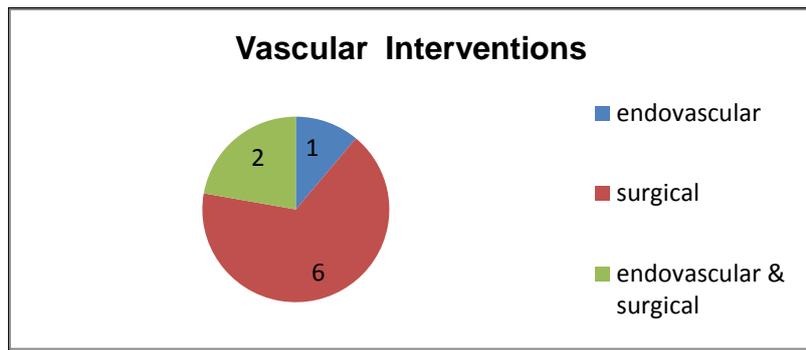
### Ulcer Recurrence

Forty-one out of 100 patients (41%) remained ulcer free for 12 months from the date of healing of the target ulcer.

### Limb Salvage Procedures, Amputation and Mortality

All patients with peripheral arterial disease (PAD), (54/100, 54%) had access if required to vascular services. Nine of 54 patients (17%) patients had vascular intervention including endovascular and surgical intervention (Fig 10).

**Fig 10: Vascular interventions in those presenting with PAD in the DFU Audit**



Thirteen patients (13%) had an amputation within the audit period; three major/above ankle amputations and 10 minor/below ankle amputations. Of these 13 patients with amputation, eight had no history of a vascular intervention. Nine patients were deceased (9%) by the end of the audit period.

## Discussion

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It is estimated that 84,836 people in Northern Ireland have diabetes (Diabetes UK, 2015). As in other areas of the United Kingdom (UK) this number continues to increase imposing a social, economic and financial burden to the NHS. Approximately 15% of people with diabetes in the UK will develop a diabetic foot ulcer (DFU) in their lifetime and around 5% will develop a DFU in any one year (Cheer, Shearman and Jude, 2009). It is recognised that in Northern Ireland there is a lack of accurate baseline data on the prevalence and management of DFUs within the Trusts. Podiatry Managers voiced concern regarding variation in the availability and quality of care provided in hospital and community sites. Funding was sought to carry out the Regional Diabetic Foot Audit in order to provide baseline information on how this vulnerable group of patients was managed compared with national standards.

The Pilot Study demonstrated the feasibility of the main audit methodology and tested the ability to collect data from relevant sources. As in other areas of the UK, access to robust information was a challenge and the number and variability of information systems often contributed to a variation in care to the service user. Professionals across Northern Ireland have sought to address inequalities of care through the production of the Diabetes Strategic Framework, Northern Ireland and the continued development and funding of the Integrated Care Pathway through the Northern Ireland Diabetic Foot Working Group. It is hoped that this audit will enable professionals to benchmark practice against national and local standards and address any gaps in service provision and delivery.

The regional audit reported that 2,468 patients (4.6%) presented with a new DFU in Podiatry caseloads in Northern Ireland (2013-14). This is comparable to the national figure of 5% cited by Cheer, Shearman & Jude 2009. When the number of patients with diabetes reviewed in each Trust area was compared to QOF information, two Trusts reviewed a high percentage of the diabetes population on their Podiatry caseloads (92 and 95%). These Trusts have historically been funded to carry out annual reviews on people with diabetes and so these results are as expected.

One Trust reported a low number of DFU's in their diabetes caseload. This may be explained by the difficulty in extracting specific caseload information from the IT system in use.

In the audit patients presenting with a DFU had diabetes for an average of 17 years and higher than normal HbA1c levels. This is comparable with the average of 15 years reported in the recent NDFA report (2014-15) supporting the likelihood that people presenting with DFUs are more likely to have had diabetes for longer and have sub-optimal HbA1c levels.

## Assessment

Audit results showed that outcomes for assessment of neuropathy, pulses, risk and appropriate review fell below the expected regional and national targets. However, it was evident that Trusts who were historically funded to conduct annual reviews/screening performed better. This was expected.

Three Trusts (2, 3 and 4) met the audit standard for classification and assignment of risk within the required time period of first presentation of the target DFU. However the review date given to the patient was not always appropriate to their risk category. Trusts 1 and 5 did not meet the target for risk classification and assignment. However, patients were reviewed in a time appropriate to their risk in 90-91% of cases.

Footwear assessment outperformed the standard set in this audit.

### **Classification of the DFU:**

A formal DFU classification system has never been adopted regionally. However, 54% of patients did have all the components of the SINBAD score completed within their clinical notes. Area measurement was the component that was most often missing followed by the presence of neuropathy and ischaemia.

### **Management of DFUs:**

Audit results reported that all patients (n=100) had an agreed management plan documented. The use of an offloading system to reduce foot pressures was documented in 30% of patients which was well below the expected target of 75%. There was a significant gap in the uptake and/ or availability of structured education programmes (SEP) in the region. Four percent of patients attended a SEP within 15 months of diagnosis of their target DFU. Currently SEP's are targeted at newly diagnosed patients with diabetes. However it may benefit patients who have cardiovascular co-morbidities to have ongoing access to these programmes long term.

### **Timely Referral**

It was difficult to extract Information on the time interval from first presentation of the DFU to a HCP to onward referral for assessment by Podiatry. This information was not documented in 63% of patients. The retrospective design of the audit undoubtedly influenced this and the authors recognise that in a re-audit a prospective design may capture more reliable data.

It is widely recognised that robust protocols and clear care pathways should be in place for those presenting with diabetic foot emergencies and/or infection as an in or out-patient in the hospital or community setting. The regional audit reported some delays in the referral process and showed that not all patients in the hospital or community setting were seen within 24 hours. Currently several referral routes exist for patients requiring emergency care and the implementation of the Integrated Care Pathway will have the advantage of one direct referral route to the Multidisciplinary Foot Team in keeping with national guidance. This highlights the need for funding and a robust implementation plan to develop this pathway in order to achieve optimum patient care in both hospital and community settings in the region.

### **Time to healing**

The data collected in this audit provided important baseline information on the management and outcomes of diabetic foot ulcers in Northern Ireland. Results from

the NDFA showed that 49% of DFUs were healed at 12 weeks. In comparison a healing rate of 57% at 12 weeks was achieved in Northern Ireland. This increased to 74% at 24 weeks.

### **Ulcer recurrence**

Patients presenting with a DFU have increased risk of ulcer recurrence. Results from this audit showed that only 41% of patients remained ulcer free for 12 months, indicating the complexity and social impact of the disease on these patients.

### **Limb salvage, amputation & mortality**

National guidance recommends that all patients with a DFU and PAD should have access to vascular services/ multidisciplinary foot care team. Regional audit results reflected this target with 100% of patients who had PAD having access to vascular services. However, it is recognised that there may be a delay between referral and first intervention in the vascular pathway.

An amputation rate of 13% was reported in the regional audit. Eight of these patients had no previous history of vascular intervention/ prevention. The importance of monitoring cardio-vascular risk and the early detection of complications is recognised as many amputations (80%) are preceded by a DFU and many are preventable with appropriate management (Pecoraro, Reiber and Burgess, 1990).

In this regional audit, 4% of patients were deceased at 12 weeks, increasing to 7% at 24 weeks and 9% at one year. In comparison the NDFA found that 2.3% of people were deceased at 12 weeks. This high short term mortality rate is consistent with high mortality rates in patients with DFUs (Brownrigg, 2012). It is well documented that 50% of people who present with a DFU will die within five years (Moulik, 2003). Many patients will have DFUs that remain unhealed towards the end of their life highlighting the complexity of their condition and the increased demand on all aspects of multidisciplinary health care as a result (Holman, Young and Stephens, 2015).

## Recommendations

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The following recommendations have been made based on the DFU audit findings:

1. It is essential that there is recognition at national, departmental and Trust levels of the importance of having **robust IT systems** that interface with each other and can provide reliable, timely and specific information on the multidisciplinary management of people with diabetes. This will support audit and research programmes across all professions and ultimately enhance patient care.
2. Annual **diabetic foot screening** in community and hospital settings should be carried out by an appropriately trained HCP.
3. **Diabetic foot assessments** should be standardised and completed annually, or more frequently, based on individual risk. In hospital assessments should be completed by the Multidisciplinary Foot Team.
4. A regional **Podiatry risk assessment tool** should be agreed and adopted in all Trusts. People with diabetes should have a risk assigned, should understand their risk and should have a review time appropriate to their risk and clinical need.
5. A regional **DFU classification system** should be adopted, staff trained and be evident as part of patients' clinical case notes.
6. Services, processes and teams should be developed within community and hospital settings to ensure **timely care** as described in the Integrated Diabetes Foot Care Pathway.
7. Podiatry **Supervision and Competency** Frameworks should be further developed and implemented regionally. This should be supported by a regional training plan.
8. **Service user involvement** should be considered at all stages in this process
9. Appropriate **audit and research** programmes should be developed
10. A **re-audit** of the Regional DFU Audit should be planned 3-5 years ahead.

## **Implementation Plan**

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The implementation plan is based on the recommendations described in the previous section. The importance of the Podiatry services collaborating as a region with the Department of Health and the Public Health Authority/ Commissioners is key to the successful and timely implementation of these recommendations (Table 4). There has already been some financial investment in diabetes foot services. Additional investment in the region will be guided by the recently formed Diabetes Design Group and the Diabetes Clinical Network Group.

An aspiration to work towards the availability of robust IT systems that interface successfully with each other in and between Trusts is essential.

The position of podiatry on annual diabetes foot screening and diabetes foot assessment needs to be agreed as a region and communicated to those involved in diabetes care at all levels. The use of a dedicated regional risk tool and the assignment of risk for each patient will result in early identification of potential limb threatening conditions and promote high quality safe practice. This will be supported by the use of a diabetes foot ulcer classification system and robust supervision and competency frameworks. The implementation of the Integrated Care Pathway (NI Diabetic Foot Working Group) coupled with the development of services, processes and team development in the community and hospital settings will ensure timely referral for emergency care and a reduction in the risk of amputation.

A timeline to prioritise these recommendations is presented in Table 4

**Table 4. Timeline for the implementation of recommendations made in the regional DFU Audit**

	Sept 2016	April 2017	Sept 2017	April 2018
IT	Identify information needs, improve and develop system interfaces and processes to interrogate systems to extract meaningful data			
Annual Diabetic Foot Screening	Faculty of Management Northern Ireland Group (FOMNIG) will work with the PHA to reach regional agreement on this process			
Podiatry Diabetic Foot Assessment	FOMNIG will reach regional agreement on this process (content / staff band and frequency)			
Risk assessment tool	FOMNIG will reach regional agreement on a standard risk tool and risk categories. This will be related to patient review			
DFU Classification System	FOMNIG has reached regional agreement to adopt the SINBAD system. Staff training will be put in place and a case note audit completed.			
Emergency access and care	This will be achieved through collaboration with the Multidisciplinary Team and support the development of the Multidisciplinary Foot Team (MDfT)			
Podiatry Supervision and Competency Frameworks	FOMNIG will reach a regional agreement to put appropriate frameworks in place in the region.			
Service User Involvement	Service Users will be involved in all parts of this process			
Dissemination of results	FOMNIG, Guidelines and Audit Implementation Network (GAIN), Diabetes United Kingdom (DUK)			
Regional DFU Re-audit	3-5 year plan, consideration will be given to the availability of the National Diabetes Footcare Audit (NDFA)			

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<b>Name</b>	<b>Designation</b>	<b>Organisation</b>
Dr Julia Shaw	Assistant Podiatry Manager	Belfast HSC Trust
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Henry McKinney	Podiatrist	Northern HSC Trust
Gail Thompson	Podiatrist	South Eastern HSC Trust
Denise Russell	Podiatrist	Southern HSC Trust
Monica McAteer	Podiatrist	Southern HSC Trust
Aileen Gallagher	Podiatrist	Western HSC Trust
Siobhan Crilly	GAIN Regional Clinical Audit Facilitators	Regulation and Quality Improvement (RQIA)

### **Podiatry Project - Expertise**

Professor William Jeffcoate		Chair of the National Diabetes Footcare Audit Advisory Board
Dr Hamish Courtney	Consultant Diabetologist and Project Peer Reviewer	Belfast HSC Trust

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## Appendix 1

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### REGIONAL PODIATRY AUDIT DATA COLLECTION FORM

<b>Audit Title</b>	A Regional Podiatry-led Audit of Multi-disciplinary Diabetes Foot Ulcer Management in Acute and Community sites in NI.
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<b>Patient Code:</b>	<b>Date (day/month/year):</b>
<b>Trust:</b>	

Duration of Diabetes (yrs) ----- HbA1c -----

Has the patient had a foot examination for:	
Neuropathy <input type="checkbox"/>	Date of examination -----
Peripheral pulses <input type="checkbox"/>	Date of examination -----
Deformity <input type="checkbox"/>	Date of examination -----
in the past 15 months?	Y/N

Interval between first presentation of the DFU to a health professional and first assessment by your team	
< 2 days <input type="checkbox"/>	
2-13 days <input type="checkbox"/>	
14 days-2 months <input type="checkbox"/>	
> 2 months <input type="checkbox"/>	

Has the patient had their foot risk classified and assigned?	Y/N
What is the patient's risk classification:	
Active <input type="checkbox"/>	
High <input type="checkbox"/>	
Moderate <input type="checkbox"/>	
Low <input type="checkbox"/>	
Is the patient high risk?	Y/N
Was the patient's review date in accordance to risk classification?	Y/N
Low = annual screening <input type="checkbox"/>	

Moderate = 3-6 months by a pod or member of FPT	<input type="checkbox"/>
High = 1-3 months by pod or FPT	<input type="checkbox"/>
Active = weekly review / rapid referral to MFPT	<input type="checkbox"/>

Has the patient had a new DFU in the past 12 months?  
(April 2013- March 2014). Y/N

Date presented -----

Duration of treatment -----

Duration of DFU (weeks) -----

Date healed -----

Site of ulcer            Right foot             Left foot             Multiple ulcers

Geographical Location (may be more than 1 location):

Hospital in-pt

Hospital out-pt

Community clinic

Domiciliary

Nursing Home

Has the patient had had their DFU formally classified according to severity?    Y/N  
e.g. Wagner, SAD, Texas, SINBAD or other system

Using the information available to you, at first presentation, were any of the following described:

DFU site

Ischaemia

Neuropathy

Infection

Ulcer depth

Neuropathic DFU

Neuroischaemic DFU

**SINBAD Classification** for target ulcer

Please tick yes /no on each line

Site = hindfoot            Y/N

Ischaemia            Y/N

Neuropathy            Y/N

Bacterial Infection            Y/N

Area >1cm<sup>2</sup>            Y/N

Depth to tendon/bone            Y/N

**To note:**

Hindfoot = behind tarso-metatarsal joints  
 Ischaemia = clinical signs of arterial disease  
 Neuropathy= diminished sensation  
 Bacterial infection= clinical cellulitis+/- OM  
 Area= product of greatest diameters (LxW)  
 Depth= assessment by eye, probe, SOAP

Is there a new Charcot present	Y/N
New Charcot Right	Y/N
New Charcot Left	Y/N
Old Charcot Right	Y/N
Old Charcot Left	Y/N

Was it documented that a footwear assessment had been carried out?	Y/Not doc
Is it documented that an off-loading system is in place?	Y/Not doc/ N App

Is there an agreed management plan (SOAP format) documented in the past 15 months?	Y/N
Has the patient remained ulcer free in the past 12 months? (April 2013 – March 2014)	Y/N

Has the patient attended a Structured Education Programme in the past 15 months?	Y/N N/Av
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In an emergency was the patient referred to the listed professionals within 24 hours?  
 Y/N/ N App

- GP
- Hospital Foot Protection Team
- Specialist Podiatrist
- A&E

If not, please document reason if known:

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Following admission, was the patient referred to the Hospital FPT within 24 hours	Y/N/ N App
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In patients presenting with infection was the patient:

- Referred to GP within 24 hours
- Referred to Hospital FP Team within 24 hours
- Referred to Non-Medical Prescriber within 24 hours
- Was the antibiotic regimen regularly reviewed
- Was the duration of antibiotic therapy regularly reviewed
- No infection suspected

Comment:

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Has the patient access to limb salvage procedures? Y/N/ N App  
If yes has vascular insufficiency been treated? Y/N

Endovascular procedure

Surgical reconstruction   
e.g. angio or by-pass

Has the patient had a new amputation in the previous 12 months Y/N  
(April 2013-2014)

Below ankle amputation

Trans met amputation

Below knee amputation

Above knee amputation

NDA Outcomes:

Is the patient alive with no active ulcer 12 weeks after presentation Y/N

Is the patient alive with no active ulcer 24 weeks after presentation Y/N

Is the patient alive with active ulcer 12 weeks after presentation Y/N

Is the patient alive with active ulcer 24 weeks after presentation Y/N

DNA/ CNA:

No of appointments in Podiatry/ Shared care in past 12 months -----

No of DNAs -----

No of CAN's -----



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