Assessment of behaviors, risk factors of Diabetic foot ulcer and footwear safety among diabetic patients in primary care setting, Abu Dhabi, UAE

Osama Moheb Ibrahim Mohamed (1)
Nwanneka E. O. Ofiaeli (2)
Adnan Syeed (3)
Amira Elhassan (4)
Mona Al Tunaiji (5)
Khuloud Al Hammadi (6)
Maryam Al Ali (7)

(1) MBBCh, MSc, MD FM, (MSc, UK), Consultant Family Medicine, Ambulatory Health Services, SEHA corporate, Abu Dhabi, UAE
(2) MBBS, MRCGP (UK), DFFP(UK), Consultant Family Medicine, Ambulatory Health Services, SEHA corporate, Abu Dhabi, UAE
(3) MBBS, MRCS, MRCGP(UK), Consultant Family Medicine, Ambulatory Health Services, SEHA corporate, Abu Dhabi, UAE
(4) Consultant Family Medicine, Ambulatory Health Services, SEHA corporate, Abu Dhabi, UAE
(5) Consultant Family Medicine, Ambulatory Health Services, SEHA corporate, Abu Dhabi, UAE
(6) Khuloud Al Hammady, Family Medicine residents, SKMC, SEHA corporate, Abu Dhabi, UAE
(7) Maryam Al Ali , Family medicine resident SKMC, SEHA corporate, Abu Dhabi, UAE

Correspondence:
Dr. Osama Moheb Ibrahim Mohamed
Consultant Family Medicine,
Ambulatory Health Services,
SEHA corporate,
Abu Dhabi,
UAE
Email: osamamohebibrahim@gmail.com

Abstract

Background: Diabetes mellitus accounts for 5.2 % of all deaths world-wide. UAE had a prevalence of 19.3% in 2015. It is estimated that by 2025 this will rise to more than 21.5%(1). In patients with Diabetes 60-70% will develop peripheral neuropathy, (2) and 25% will develop a foot ulcer(3). The yearly incidence of diabetic foot ulcers ranges from 2 to 32%. More than half of all foot ulcers (wounds) will become infected, requiring hospitalization and 20% of infections result in amputation.(5) History of diabetic foot ulcer results in a 40% greater 10-year mortality in diabetic patients(10). Diabetic foot ulcers can be prevented and researchers have established that up to 85% of amputations can be prevented(15).

Objective: The Aim of this study was to assess behaviors, prevalence of diabetic foot risk factors and safety of footwear among diabetic patients.

Methods: A cross-sectional study was conducted in an ambulatory healthcare clinic. Self-reported questionnaire was used to assess foot care behaviors,'. Inlow's 60-second Diabetic Foot Screen was used to examine foot. ADA risk classification was used for risk assessment. Furthermore descriptive statistics were employed to assess the predicators of practice of diabetic foot care.

Results: The total patients were 74; the majority of respondents were local UAE patients 46 (71.88%) with diabetes duration of 8.8 years. Mean age was 59.1±10.11 years; male to female ratio was nearly similar. Mean A1c level was 7.45 ±1.81 and only 21 out of 50 (42%) patients had their HbA1c controlled (<7). 80.28% of patients completed at least elementary school. The frequency patients received foot care education and foot examination were 60 (81.08%) and 55 (74.32 %) respectively; 42 (55.56%) walked barefoot indoors, 43 (56.97%) wore shoes without socks, 35(47.95%) tested the water temperature with hand / elbow before taking a bath or a shower, 50 (68.49%) self-treated corns or calluses with a blade, 67 (90.54%) wore sandals, almost all 73 (98.93) relied on feeling the fit of the shoes when buying a new pair; overall shoes assessment was improper shoes in 64 (86.49 %). There was callus formation in 30 (42.26%), foot deformity in 11 (15.28%), loss of sensation by monofilament in 0 to 9 sites, out of 10 in foot 26 (40.55%), absence of dorsalis pedes pulse in 10 (13.89%) and 40 % were classified at risk category 1 to develop foot ulcer.

Conclusion: Foot care practices are still substandard among diabetic patients. There was a gap between what patient receive in foot education by health care provider and what patients did in real practice. Potential harmful foot care behaviors were high and protective foot care practice was low. Finally there were one or more risk factors of diabetic foot ulcer in the majority of patients.

Key words: Diabetes, Diabetic foot, diabetic neuropathy, foot deformity, proper shoes for diabetics, Abu Dhabi

Introduction

Diabetes mellitus (DM) is a major emerging clinical and public health problem accounting currently for 5.2 % of all deaths world-wide. According to International Diabetes Federation (IDF), prevalence of DM in UAE was 19.3 % in 2015. According to WHO estimates (2007), 190 million people suffer from diabetes world-wide and about 330 million are expected to be diabetic by the year 2025. UAE had been estimated to be the 10th country in the prevalence of Diabetes with prevalence of 19.6. Recent changes in physical activity and dietary patterns have promoted the development of diabetes and if different preventive and control activities are not adopted, by the year 2025 more than 21.5% of the population above 20 years old) will have diabetes(1).

About 60-70% of those with diabetes will develop peripheral neuropathy, or lose sensation in their feet(2). Up to 25% of those with diabetes will develop a foot ulcer(3). The yearly incidence of diabetic foot ulcers ranges from 2% to 32%, depending on ADA risk classification(4). More than half of all foot ulcers (wounds) will become infected, requiring hospitalization and 20% of infections result in amputation(5). Diabetes contributes to approximately 80% of the 120,000 non-traumatic amputations performed yearly in the United States(6). "Every 20 seconds, somewhere in the world, a limb is lost as a consequence of diabetes"(7). After a major amputation, 50% of people will have their other limb amputated within 2 years(7).

The relative 5-year mortality rate after limb amputation is 68%. When compared with cancer, it is second only to lung cancer (86%) (Colorectal cancer 39%, Breast cancer 23%, Hodgkin's disease 18%, Prostate cancer 8%). People with a history of a diabetic foot ulcer have a 40% greater 10-year mortality than people with diabetes alone(8) Every 30 minutes a limb is lost due to a landmine. Every 30 seconds, a limb is lost due to diabetes(9). Having a wound immediately doubles one's chances of dying at 10 years

compared with someone without diabetes(9). Diabetic foot ulcers double mortality and heart attack risk while increasing risk for stroke by 40% (10); each $1 invested in care by a podiatrist for people with diabetes results in $27 to $51 of healthcare savings(11).

Diabetic foot ulcers as a result of neuropathy or ischemia are common. In developed countries, up to five per cent of people with diabetes have foot ulcers, and one in every six people with diabetes will have an ulcer during their lifetime. Foot problems are the most common cause of admission to hospital for people with diabetes. In developing countries, foot problems related to diabetes are thought to be even more common. Without action, global amputations rates will continue to rise(12).

In most cases, however, diabetic foot ulcers and amputations can be prevented. Researchers have established that between 49% and 85% of all amputations can be prevented. It is imperative, therefore, that healthcare professionals, policymakers and diabetes representative organizations undertake concerted action to ensure that diabetic foot care is structured as effectively as local resources will allow. This will facilitate improvements in foot care for people with diabetes throughout the world and bring about a reduction in diabetic-foot-related morbidity and mortality(13).

Rationale

Diabetic foot is one of the common disabling diabetes complications leading to amputation and fortunately 85% of amputation is preventable by a cost-effective foot care. Diabetic foot examination is one of the key performance indicators (KPI) by Health Authority / SEHA Corporation so more data is needed among the Emirati diabetics to be used as a database for formulation of an organized structured foot care intervention program; this study is aiming to provide a database for foot care intervention program.

Objectives

1- To assess the behaviors of patients with diabetes with respect to their foot care,
2- To assess the prevalence of diabetic foot risk among diabetic patients, and
3- To examine the safety of footwear for diabetic patients

Methods

A-Study Design:
A cross sectional study was conducted in a primary care clinic, Ambulatory Health Care.

B-Study Population:

1-Patient population: Patients who presented to Al Bateen Family Medicine Clinic with physician-diagnosed Diabetes based on the A1C above or equal 6.5% and who met the inclusion and exclusion criteria, were included in the study

2-Inclusion Criteria were: patients suffering from diabetes for at least 3 years, Adult (above 18) diabetic patients

3-Exclusion criteria were: Patient with current Diabetic foot ulcer, History of amputation, Charcot's foot, congenital foot deformities, Visual impairment, Physically independent. Informed consent was obtained and study proposal was approved by research committee, ambulatory health care.

4-Sample size: Based on patients' inclusion and exclusion criteria and 11% anticipated frequency of "proper foot care" at 95% confidence interval, sample size was estimated to be 74 diabetic patients(14)..

C- Statistical Analysis:

The data were entered into Excel spreadsheet and analyzed using SPSS(17) for Windows. Analysis used simple frequency distribution of key variables in the study. Comparison was made with selected base line demographic variable age gender, educational status and socioeconomic status. The level of significance was set at $p < 0.05$. Data was collected by the investigators for consistency. For ethical purposes foot care education was promoted among unaware diabetic patients who participated in the study.

D-Methods of Data Collection:

1- Demographic data (age, sex, education, employment status, duration of diabetes, A1c level, smoking status).

2- Evaluation of Foot Care behaviour: Patients were asked to fill Vileikyte and colleagues (15) questionnaires for assessment of foot-care behavior, (Figure 1). The content of the tool was based on international "diabetic foot care guidelines"(16-17). The seventeen-item questionnaire is split into two behavioral subscales: nine items pertaining to preventative behavior and eight items to potentially damaging behavior. Responses were rated on two different scales: a 6-point scale for "during the past week" questions (twice a day, daily, every other day, twice a week, once a week, or never) and on a four-point scale for "in general" questions (always, most of the time, occasionally, or never).

3- Foot Examination: Inlow's 60-second Diabetic Foot Screen was used to examine foot(18), (Figure 2)

4- Foot risk classification : ADA foot risk classification was used for risk assessment (Figure3)(19)

5- Foot-wear assessment checklist (Figure 4). A foot examination check list was also developed which scored on the presence or absence of proper footwear and included footwear recommendations prepared by the International Working Group on the Diabetic Foot; any abnormal character of the footwear in the checklist indicated improper footwear (20).

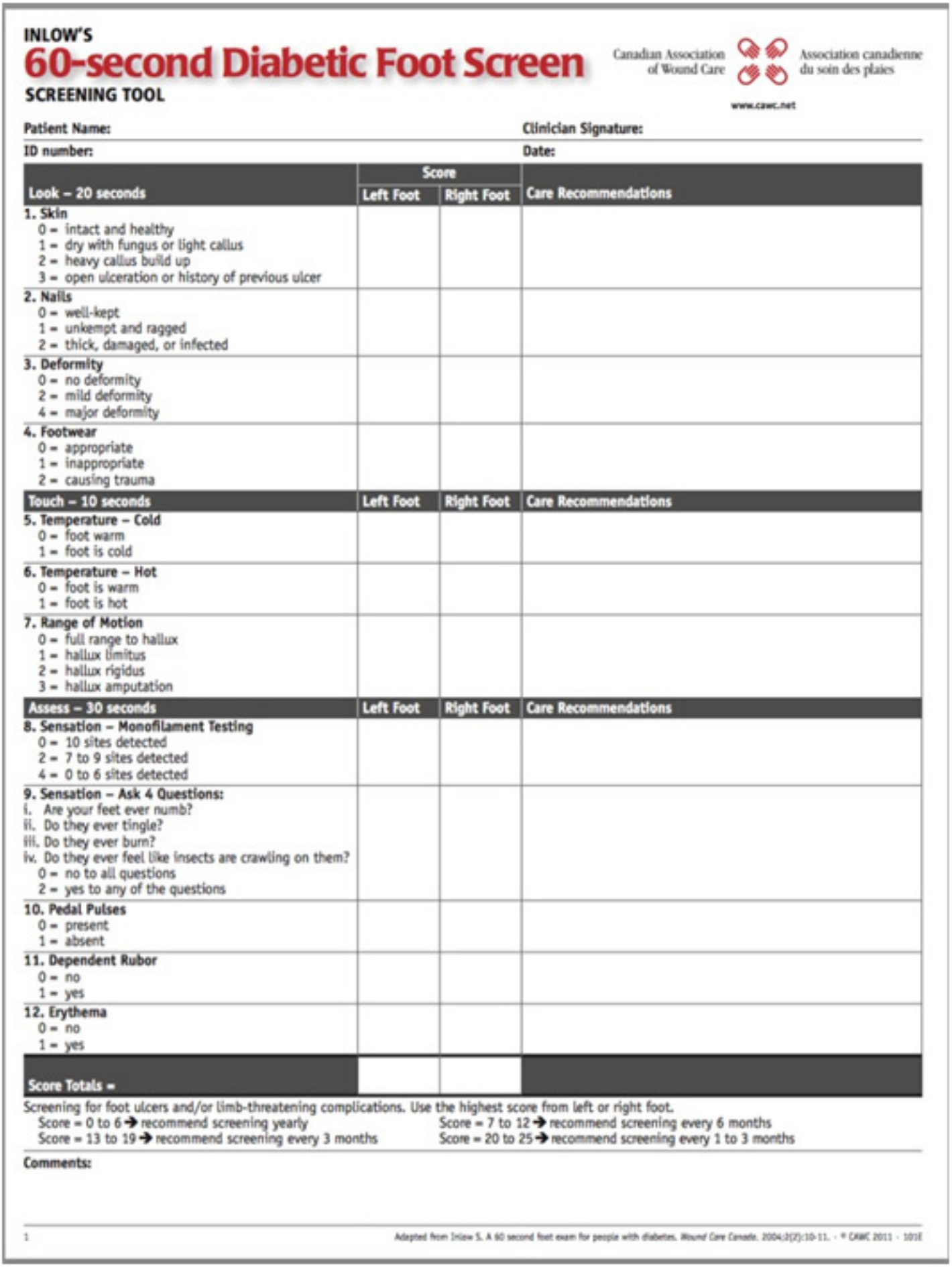
Figure 1: The behavior questions

Question	Behavior subscale
During the past week how often did you examine your feet?	Preventative
During the past week how often did you wash your feet?	Preventative
During the past week how often did you check the inside of your shoes?	Preventative
During the past week how often did you use moisturizing oils or creams for your feet?	Preventative
During the past week how often did you change your socks?	Preventative
During the past week, how often did you test the water temperature with your Hand / elbow before taking a bath or a shower?	Preventative
During the past week how often did you walk barefoot indoors?	Potentially damaging
During the past week how often did you walk barefoot outdoors?	Potentially damaging
During the past week how often did you wear shoes without the socks?	Potentially damaging
In general, how often do you use chemical agents or plasters to remove corns and calluses?	Potentially damaging
In general, how often do you yourself treat corns or calluses with a blade?	Potentially damaging
In general, how often do you cut your toenails straight across?	Preventative
In general, how often do you have your feet measured when buying a new pair of shoes?	Preventative
In general, how often do you wear trainers/sneakers or lace-up shoes?	Preventative
In general, how often do you rely on feeling the fit of the shoes when buying a new pair?	Potentially damaging
In general, how often do you wear sandals or slip-ons?	Potentially damaging
In general, when your feet feel cold at night, how often do you use hot water bottles/heating pads to warm them?	Potentially damaging

Figure 2: Risk classification based on the comprehensive foot examination

Risk category	Definition	Treatment recommendations	Suggested follow-up
0	No LOPS, no PAD, no deformity	• list-behavior=unordered prefix-word= mark-type=disc • Patient education including advice on appropriate footwear.	Annually (by generalist and/ or specialist)
1	LOPS ± deformity	• list-behavior=unordered prefix-word= mark-type=disc • Consider prescriptive or accommodative footwear. • Consider prophylactic surgery if deformity is not able to be safely accommodated in shoes. Continue patient education.	Every 3–6 months (by generalist or specialist
2	PAD ± LOPS	• list-behavior=unordered prefix-word= mark-type=disc • Consider prescriptive or accommodative footwear. • Consider vascular consultation for combined follow-up	Every 2–3 months (by specialist)
3	History of ulcer or amputation	• list-behavior=unordered prefix-word= mark-type=disc • Same as category 1 • Consider vascular consultation for combined follow-up if PAD present	Every 1–2 months (by specialist)

Figure 3



INLOW'S

60-second Diabetic Foot Screen

SCREENING TOOL

Canadian Association of Wound Care / Association canadienne du soin des plaies

www.cawc.net

Patient Name: **Clinician Signature:**

ID number: **Date:**

Look – 20 seconds	Score: Left Foot	Score: Right Foot	Care Recommendations
1. Skin 0 = intact and healthy 1 = dry with fungus or light callus 2 = heavy callus build up 3 = open ulceration or history of previous ulcer			
2. Nails 0 = well-kept 1 = unkempt and ragged 2 = thick, damaged, or infected			
3. Deformity 0 = no deformity 2 = mild deformity 4 = major deformity			
4. Footwear 0 = appropriate 1 = inappropriate 2 = causing trauma			
Touch – 10 seconds	**Left Foot**	**Right Foot**	**Care Recommendations**
5. Temperature – Cold 0 = foot warm 1 = foot is cold			
6. Temperature – Hot 0 = foot is warm 1 = foot is hot			
7. Range of Motion 0 = full range to hallux 1 = hallux limitus 2 = hallux rigidus 3 = hallux amputation			
Assess – 30 seconds	**Left Foot**	**Right Foot**	**Care Recommendations**
8. Sensation – Monofilament Testing 0 = 10 sites detected 2 = 7 to 9 sites detected 4 = 0 to 6 sites detected			
9. Sensation – Ask 4 Questions: i. Are your feet ever numb? ii. Do they ever tingle? iii. Do they ever burn? iv. Do they ever feel like insects are crawling on them? 0 = no to all questions 2 = yes to any of the questions			
10. Pedal Pulses 0 = present 1 = absent			
11. Dependent Rubor 0 = no 1 = yes			
12. Erythema 0 = no 1 = yes			
Score Totals =			

Screening for foot ulcers and/or limb-threatening complications. Use the highest score from left or right foot.

Score = 0 to 6 → recommend screening yearly
Score = 7 to 12 → recommend screening every 6 months
Score = 13 to 19 → recommend screening every 3 months
Score = 20 to 25 → recommend screening every 1 to 3 months

Comments:

1 Adapted from Inlow S. A 60 second foot exam for people with diabetes. *Wound Care Canada*. 2004;2(2):10-11. · © CAWC 2011 · 101E

Figure 4: Footwear Assessment Checklist

Type of heel used	Flat	High (improper)
Shoe type	Open (improper)	Covered
Forepart of shoe	Narrow (improper)	Wide
Shoe material	Hard (improper)	Soft
The back of the shoe, the 'heel counter' is firm enough to provide support for the foot	Yes	No (improper)
The inside of the shoes is 1–2 cm longer than the feet	Yes	No (improper)
The internal width is equal to the width of the foot at the site of the metatarsophalangeal joints, and the height is allowing enough room for the toes.	Yes	No (improper)
Shoes' sole	Thick rubber	Leather (improper)
Shoes have a lace-up or Velcro fastening	Yes	No (improper)
There are any rough seams inside shoes	Yes (improper)	No
Overall Shoes assessment result	**Proper shoes**	**Improper (any improper answer)**

Results

Characteristics of the participants are reported in Table 1. A higher percentage of the participants were local and were diagnosed with type 2 diabetes, and there were a high proportion of participants who did not complete secondary school.

Table 1: Characteristics of Study populations

Variable	Number of patients = 74
Nationality	
Local n (%)	46(71.88%)
Non local n (%)	18(28.12%)
Employment	
Yes, n (%)	21(29.58%)
No n (%)	50(70.42%)
Smoker n (%)	8(11.59%)
Non Smoker n (%)	61(88.41%)
Male sex (%)	32(43.24%)
Female sex (%)	42(56.76%)
Age (years) +SD	59.1 (±10.11)
Diabetes duration (years)+SD	8.86 (±6.95)
HbA1c level +SD	7.45 (±1.81)
HbA1c below 7	21/50 (42%)
HbA1cequal or above 7	29/50 (58%)
No school n (%)	14 (19.72%)
Elementary n (%)	21 (29.58%)
College n (%)	13(18.31%)
University n (%)	9 (12.68%)
Post graduate n (%)	13 (18.31%)
Literacy classes n (%)	1 (1.41%)

There were a significantly higher proportion of study population who received foot care health education and feet were examined by healthcare personnel as shown in Table 2.

There were a significantly higher proportion of study population who received foot care health education and feet were examined by healthcare personnel as shown in Table 2.

Table 2: Frequency patient received foot care education and foot examination

Variable \ Value	YES, N (%)	NO, N (%)	One-Sample Chi-square	P-VALUE
Feet examined by healthcare professional within last year	60 (81.08%)	14 (18.92%)	28.595	0.0001
Patients were aware of diabetes foot care and complications	55 (74.32 %)	19 (25.68%)	17.514	0.0001

Forty-two patients (55.56%) walked barefoot indoors, 43 (56.97%) wear shoes without socks, 35 (47.95%) did you test the water temperature with hand / elbow before taking a bath or a shower, 50 (68.49%) self-treated corns or calluses with a blade, 67 (90.54%) wear sandals as shown in Table 3.

Table 3: Frequency of patients' Diabetic foot preventative behaviors during the past week

Variable \ Value	Once or more daily N (%)	Daily N (%)	Every other day N (%)	Twice a week N (%)	Once a week N (%)	Never N (%)
How often did you examine your feet?	20 (27.40%)	25 (34.25%)	6 (8.22%)	7 (9.59%)	4 (5.48%)	11 (15.07%)
How often did you check the inside of your shoes?	4 (5.56%)	18 (25.00%)	9 (12.50%)	12 (16.67%)	13 (18.06%)	16 (22.22%)
How often did you wash your feet?	58 (78.38%)	12 (16.22%)	2 (2.70%)	1 (1.35%)	11 (15.07%)	1 (1.35%)
How often did you change your socks?	9 (12.33%)	25 (34.25%)	8 (10.96%)	8 (10.9%)	4 (5.48%)	25 (34.25%)
How often did you use moisturizing oils or creams for your feet?	8 (10.96%)	16 (21.92%)	6 (8.22%)	7 (9.59%)	4 (5.48%)	11 (15.07%)
How often did you test the water temperature with your hand / elbow before taking a bath or a shower?	11 (15.07%)	15 (20.55)	5 (6.85%)	5 (6.85%)	2 (2.74%)	35 (47.95%)

Only 41.89 of patients often wear trainers/sneakers or lace-up shoes, Table 4.

Table 4: Frequency of patients' Diabetic foot preventative behaviors during the past week

Variable \ Value	Always N (%)	Most of the time N (%)	Occasionally N (%)	Never N (%)
How often do you have your feet measured when buying a new pair of shoes?	11 (14.86%)	21 (28.38%)	23 (31.08 %)	19 (25.68%)
How often do you wear trainers/sneakers or lace-up shoes?	6 (8.11%)	12 (16.22 %)	25 (33.78 %)	31 (41.89%)
In general, how often do you cut your toenails straight across?	31 (42.47 %)	23 (31.51%)	11 (15.07%)	8 (10.96%)

Thirty two percent and 31% did not walk bare foot or wear shoes without socks respectively, Table 5.

Table 5: Frequency of patients' Diabetic Foot potentially damaging behaviors during the past week

Variable \ Value	Once or more a day N (%)	Daily N (%)	Every other day N (%)	Twice a week N (%)	Once a week	Never N (%)
How often did you walk barefoot indoors?	8 (11.11 %)	15 (20.83 %)	2 (2.78 %)	5 (6.94 %)	10 (13.89 %)	32 (44.44 %)
How often did you wear shoes without socks?	15 (20.83 %)	5 (6.94%)	8 (11.11%)	9 (12.50 %)	4 (5.56 %)	31 (43.06 %)

Table 6: Frequency of patients' Diabetic Foot potentially damaging behaviors during the past week

Variable \ Value	Always N (%)	Most of the time N (%)	Occasionally N (%)	Never N (%)
How often do you use chemical agents or plasters to remove corns and calluses?	4 (5.41 %)	1 (1.35 %)	6 (8.11%)	63 (85.14%)
How often do you wear sandals or slip-ons?	38 (51.35%)	25 (33.78 %)	7 (9.46 %)	7 (9.46%)
How often do you rely on feeling the fit of the shoes when buying a new pair?	28 (38.36%)	30 (41.10)	14 (19.18 %)	1 (1.37%)
In general, how often do you, yourself, treat corns or calluses with a blade?	4 (5.48 %)	3 (4.11 %)	16 (21.92%)	50 (68.49 %)

Table 7: Footwear Assessment among participants

Variable	Character	N (%)	P Value
Type of heel	Flat High	58(80.56%) 14(19.44%)	0.0001
Shoe type	Covered Open	22(29.73%) 52(70.27%)	0.0005
Forepart of shoe	Wide Narrow	50(67.57%) 24(32.43%)	0.0025
Shoe material	Soft Hard	65 (87.84%) 9 (12.16%)	0.0001
Heel counter' is firm enough to provide support	Yes No	59 (79.73%) 15 (20.27%)	0.0001
Inner shoe length 1–2 cm longer than the foot	Yes No	44 (60.27%) 29 (39.73 %)	0.0792
Internal width is equal to the width of the foot at the site of the metatarsophalangeal joints	Yes No	55 (74.32%) 19 (25.68 %)	0.0001
Height of shoes allows enough room for the toes	Yes No	60 (81.08 %) 14 (18.92 %)	0.0001
Shoes' sole	Leather Thick rubber	62 (83.78%) 12 (16.22 %)	0.0001
Lace-up or Velcro fastening present	Yes No	35 (47.30%) 39 (52.70%)	0.6419
Rough seams present inside shoes	Yes No	55 (74.32%) 19 (25.68 %)	0.0001
OVERALL ASSESSMENT	PROPER IMPROPER	10 (13.51%) 64 (86.49 %)	0.0001

There was callus formation in 30 (42.26%), foot deformity in11 (15.28%), loss of sensation by monofilament in 0 to 9 sites out of 10 in foot 26 (40.55%), absence of dorsalis pedes pulse in 10 (13.89%) and 40 % were classified at risk category 1 to develop foot ulcer. as shown in Table 8.

Table 8: 60-second Diabetic Foot Screen

Item	Count /Percent
1. Skin	
• Intact and healthy	40(56.34%)
• Dry with fungus or light callus	21(29.58%)
• Heavy callus builds up	9 (12.68%)
• Open ulceration or history of previous ulcer	1 (1.41%)
2. Nails	
• Well-kept	42(58.33%)
• Unkempt and ragged	23(31.94%)
• Thick, damaged, or infected	7 (9.72%)
3. Deformity	
• No deformity	61(84.72%)
• Mild deformity	9 (12.50%)
• Major deformity	2 (2.78%)
4. Footwear	
• Appropriate	6 (13.51%)
• Inappropriate	64 (86.49%)
5. Temperature – Cold	
• foot is warm	70 (97.22%)
• foot is cold	2 (2.78%)
6. Temperature – hot	
• foot is warm	71(98.61%)
• foot is hot	1(1.39%)
7. Range of Motion	
• full range of hallux	6(8.1%)
• hallux limitus	7(9.72%)
• hallux rigidus	0
• hallux amputation	0
8. Sensation – Monofilament Testing	
• 10 sites detected	44(59.45%)
• 7 to 9 sites detected	19(25.67%)
• 0 to 6 sites detected	11(14.86%)
9. Sensation – Ask 4 Questions:	
i. Are your feet ever numb?	
ii. Do they ever tingle?	
iii. Do they ever burn?	
iv. Do they ever feel like insects are crawling on them?	
• no to all questions	56(78.87%)
• yes, to any of the questions	15(21.13%)
10. Pedal Pulses	
• present	62(86.11%)
• absent	10(13.89%)
11. Dependent Rubor	
• no	68(95.77%)
• yes	3(4.23%)
12. Erythema	
• no	69(95.83%)
• yes	3(4.17%)

Twenty-one (33.79%) of study population were classified to have either risk categories 1, 2 or 3 to develop foot ulcer, Table 9.

Table 9: Risk classification based on foot examination

Risk category Definition	N (%)
0 - No LOPS, no PAD, no deformity	49 (66.21%)
1 - LOPS ± deformity	21 (33.79%)
2 - PAD ± LOPS	10 (13.89%) absent pedal pulse
3 - History of ulcer or amputation	1 (0.)1%)

LOPS; loss of peripheral sensation, PAD; peripheral arterial disease

Discussion

A total 74 patients were recruited; the majority of respondents were local UAE patients 46 (71.88%) with diabetes duration of 8.8 years; mean age was 59.1±10.11 years; male to female ratio was nearly similar; mean A1c level was 7.45 ±1.81 and 80.28 of patients completed at least elementary school. The frequency as to which patients received foot care education and foot examination were 60 (81.08%) and 55 (74.32 %) respectively. 42 (55.56%) walked barefoot indoors; 43(56.97%) wear shoes without socks, 35(47.95%) did test the water temperature with hand / elbow before taking a bath or a shower; 50 (68.49%) self-treated corns or calluses with a blade; 67 (90.54%) wear sandals; almost all 73 (98.93) relied on feeling the fit of the shoes when buying a new pair. Overall shoes assessment was improper shoes in 64 (86.49%); there were callus formation in 30 (42.26%), foot deformity in 11 (15.28%), loss of sensation by monofilament in 0 to 9 sites out of 10 in foot 30 (40.54%), absence of dorsalis pedes pulse in 10 (13.89%) and 40 % were classified at risk category 1 to develop foot ulcer.

Prevalence of patients who achieved controlled DM (<7) in this study was 42%. This result is consistent with a big survey conducted in 9952 subjects which demonstrated that almost half of the subjects did not meet the recommended target of glycemic control, and especially the rate of achieving the HbA1c target markedly decreased with longer durations despite increases in the use of any diabetes medication.(21)

In this study although patients who received foot care education and foot examination were 60 (81.08%) and 55 (74.32 %) respectively, surprisingly, foot care practices are still poor as shown in improper footwear 64 (86.49%). Education and foot examination were not usually associated with improvement of foot care behaviors. A similar result was found in a study conducted in the USA and recommended that understanding the risk factors, and having the ability to manage complications outside of the clinical encounter is an important part of a diabetes foot self-care management program(22).

In this study, there were 21.13% of patients who complained of feet pain and numbness which is not consistent with another study conducted in 160 patients with diabetes in a hospital setting which demonstrated 42% had numbness/ tingling and pain in their feet (23). This difference may be attributed to a population sample in hospital settings. In another community based study painful symptoms occurred in 26% of patients without neuropathy(24) which is similar to the current study.

In this study, we found that although approximately 80% of patients at Al Bateen Clinic engaged in some recommended foot care practices and education, fairly high proportions reported foot care or footwear practices that should be avoided; in particular, walking barefooted, wearing shoes without socks and wearing pointed (narrow) toe shoes that leads to development of predisposing conditions of diabetic foot like corn, calluses, foot injury, foot deformity, fungal infections, clawing, ingrowing nails, edema feet. Comparable data on footwear and foot care practices in Caribbean populations, from two studies, one from Trinidad25 and the other from Barbados26 have reported some data. In Trinidad 49% of patients attending primary care diabetes clinics reported walking barefooted inside the house and 23% walked barefooted outside the house. Comparable data with similar results in a study reported 44.4 % walking barefooted inside home (27, 28).

In this study, we found 33.79% of the study population were classified to have either risk categories 1, 2 or 3 to develop foot ulcer. Our data was similar to data demonstrated in a study conducted in UAE in 2007 which showed 39% (95% CI: 35.1-43.7%) had peripheral neuropathy and 12% (95% CI: 8.8-14.4%) had peripheral vascular disease(29).

The findings of this study are limited by the small sample size which limited our ability to demonstrate any associations between foot care practices or footwear and socio-demographic factors. Despite these limitations, these data highlight the need for further studies with larger, representative samples to better understand the problem at a national level. We also believe that publication of these findings will serve as a catalyst for further studies in the subject area, where clinicians and researchers can evaluate the extent to which appropriate practices are being

followed in their setting. Additionally, prospective studies that evaluate the impact of foot care and footwear practices on outcomes such as foot ulcers and amputations would further help to determine the potential for interventions to improve practice and reduce complications.

Foot care practices are still substandard; there was a gap between what patients receive in foot education by health care provider and what patients did in real practice., Potential harmful foot care behaviors were high and protective foot care practice was low. Finally there were one or more risk factors of diabetic foot ulcer in the majority of diabetic patients.

Overall, the study highlights the need for greater emphasis on foot care education and foot wear practices for patients with diabetes in Al Bateen Clinic and the need to identify barriers to foot care practice, both as it relates to the physician and to the patient. This would then lead to studies evaluating the efficacy of various intervention strategies to provide evidence-based guidelines for practice.

Acknowledgements
The first draft of study protocol was written by the first author then authors from 1-5 reviewed and edited the final study protocol; all authors contributed in data collection. The first author conducted the statistical analysis, results and wrote the manuscript (including the discussion section) then all authors reviewed and edited the manuscript and made the decision to submit the manuscript for publication. The study was approved by the ethics and research committee in Ambulatory Healthcare Services/SEHA.

References

1. International Diabetes Federation. IDF Diabetes, 7 ed. Brussels, Belgium: International Diabetes Federation, 2015. http://www.diabetesatlas.org
2. P J Dyck, J L Davies, D M Wilson, F J Service, L J Melton, 3rd and P C O'Brien. Risk factors for severity of diabetic polyneuropathy: intensive longitudinal assessment of the Rochester Diabetic Neuropathy Study cohort. Diabetes Care September 1999 vol. 22 no. 9 1479-1486
3. Nalini Singh, David G. Armstrong, Benjamin A. Lipsky. Preventing Foot Ulcers in Patients with Diabetes. JAMA, January 12, 2005-Vol 293, No. 2 217-221
4. American Diabetes Association. Preventive Foot care in Diabetes. Diabetes Care 2004; 27 (suppl1):S63-S64
5. Lawrence A. Lavery, David G. Armstrong, Robert P. Wunderlich, M. Jane Mohler, Christopher S. Wendel, Benjamin A. Lipsky. Risk Factors for Foot Infections in Individuals with Diabetes. Diabetes Care, Volume 29, Number 6, June 2006
6. David G. Armstrong, and Lawrence A. Lavery. Diabetic Foot Ulcers: Prevention, Diagnosis and Classification. Am Fam Physician. 1998 Mar 15; 57(6):1325-1332.
7. Andrew JM Boulton , Loretta Vileikyte , Gunnel Ragnarson-Tennvall, Jan Apelqvist. The global burden of diabetic foot disease The Lancet, Volume 366, Issue 9498, Pages 1719 - 1724, 12 November 2005
8. Marjolein M. Iversen, Grethe S. Tell, Trond Riise, Phd Berit R. Hanestad.Truls Østbye, Marit Graue, Kristian Midthjell. History of Foot Ulcer Increases Mortality Among Individuals With Diabetes. Ten-year follow-up of the Nord-Trøndelag Health Study, Norway. Diabetes Care, Volume 32, Number 12, December 2009 2193
9. Bharara M, Mills JL, Suresh K., Rilo HL. Armstrong DG, Diabetes and landmine-related amputations: a call to arms to save limbs. Int Wound J, Feb.:6(1):2-3, 2009
10. Brownrigg JR, Davey J, Holt PJ, Davis WA, Thompson MM, Ray KK, Hinchliffe RJ. The association of ulceration of the foot with cardiovascular and all-cause mortality in patients with diabetes: a meta-analysis. Diabetologia. 2012 Nov;55(11):2906-12. doi: 10.1007/s00125-012-2673-3. Epub 2012 Aug 14.
11. Cara Westphal, Ingrid M. Neame, Jessica C. Harrison, Virginia M. Bower, and Joel M. Gurr, A. Diabetic Foot Ulcer Pilot Study, Journal of the American Podiatric Medical Association March 2011, Vol. 101, No. 2, pp. 116-123 (doi: 10.7547/1010116)
12. International Consensus on the Diabetic Foot and Practical Guidelines on the Management and the Prevention of the Diabetic Foot. International Working Group on the Diabetic Foot, 2003, Amsterdam, the Netherlands, on CD-ROM (www.idf.org/bookshop).
13. Jeffcoate WJ, van Houtum WH. Amputation as a marker of the quality of foot care in diabetes.Diabetologia.2004; 47:2051-2058
http://diabeticfootonline.blogspot.com/p/diabetic-foot-facts-and-figures.html
14. Nadia Saeed, Frequency of patients with diabetes taking proper foot care according to international guidelines and its impact on their foot health, J Pak Med Assoc, Vol. 60, No. 9, September 2010 p 732-735
15. Vileikyte L, Gonzalez J, Leventhal H, Peyrot M, Rubin R, Garrow A, Ulbrecht J, Cavanagh P, Boulton A: Patient interpretation of neuropathy (PIN) questionnaire: an instrument for assessment of cognitive and emotional factors associated with foot selfcare. Diabetes Care 2006, 29:2617-2624.
16. Preventative foot care in diabetes. Diabetes Care 2004, 27:S63-S64.
17. IWGDF: International consensus on the diabetic foot Amsterdam: International Diabetes Federation; 1999.
18. http://cawc.net/images/uploads/wcc/7-2-orsted.pdf
19. Andrew J.M. Boulton, David G. Armstrong, Stephen F. Albert, Robert G. Frykberg, Richard Hellman, M. Sue Kirkman, Lawrence A. Lavery, Joseph W. Lemaster, Joseph L. Mills, Michael J. Mueller, Peter Sheehan, Dane K. Wukich. Comprehensive Foot Examination and Risk Assessment. A report of the Task Force of the Foot Care Interest Group of the American Diabetes Association, with endorsement by the American Association of Clinical Endocrinologists Diabetes Care, Volume 31, Number 8, August 2008
20. J. Apelqvist, K. Bakker, W. H. van Houtum, N. C. Schaper. Practical guidelines on the management and prevention of the diabetic foot based upon the International Consensus on the Diabetic Foot (2007) .Prepared by the International Working Group on the Diabetic Foot Diabetes/Metabolism Research And Reviews Guidelines. Diabetes Metab Res Rev 2008; 24(Suppl 1): S181-S187.

21. Yokoyama, H., Oishi, M., Takamura, H., Yamasaki, K., Shirabe, S., Uchida, D., Sugimoto, H., Kurihara, Y., Araki, S. and Maegawa, H. Large-scale survey of rates of achieving targets for blood glucose, blood pressure, and lipids and prevalence of complications in type 2 diabetes (JDDM 40). BMJ Open Diabetes Research & Care, 4(1), (2016). p. e 000294.
22. Bonner, Timethia; Foster, Margaret; Spears-Lanoix, Erica. Type 2 diabetes-related foot care knowledge and foot self-care practice interventions in the United States: a systematic review of the literature. Diabetic Foot & Ankle, [S.l.], v. 7, feb. 2016.
Available at: <http://diabeticfootandankle.net/index.php/dfa/article/view/29758>. Date accessed: 18 Nov. 2016. doi:http://dx.doi.org/10.3402/dfa.v7.29758.
23. Caroline A. Abbott, Rayaz A. Malik, Ernest R.E. van Ross, Jai Kulkarni, Andrew J.M. Boulton Prevalence and Characteristics of Painful Diabetic Neuropathy in a Large Community-Based Diabetic Population in the U.K 25-Diabetes Care. 2011 Oct; 34(10): 2220-2224. Published online 2011 Sep 15. doi: 10.2337/dc11-1108
24. D'Souza, M., Ruppert, S., Parahoo, K., Karkada, S., Amirtharaj, A., Jacob, D., Balachandran, S. and Al Salmi, N. (2016). Foot care behaviors among adults with type 2 diabetes. Primary Care Diabetes, 10(6), pp.442-451.
25. Gulliford MC, Mahabir D. Diabetic foot disease and foot care in a Caribbean community.
Diabetes Res Clin Pract 2002; 56:35- 40.
26. Hennis AJ, Fraser HS, Jonnalagadda R, et al. Explanations for the high risk of diabetes- related amputation in a Caribbean population of black African descent and potential for prevention. Diabetes Care 2004; 27:2636-41.
27. Gayle KAT, Tulloch Reid MK, Younger NO, et al. Foot care and footwear practices among patients attending a specialist diabetes clinic in Jamaica. Clinics and Practice. 2012; 2(4):e85. doi:10.4081/cp.2012.e85.
28. Maniram Kumhar, Narendar Dara, Tarachand Saini. Foot Wear and Footcare Knowledge. An Independent Risk Factor for Diabetic Foot in Indian Diabetics. Indian Medical Gazette, January 2014. p25-26
29. Chiwanga FS, Njelekela MA. Diabetic foot: prevalence, knowledge, and foot self-care practices among diabetic patients in Dar es Salaam, Tanzania - a cross-sectional study. Journal of Foot and Ankle Research. 2015;8:20. doi:10.1186/s13047-015-0080-y.
30. Fatma Al-Maskari and Mohammed El-Sadig Prevalence of risk factors for diabetic foot complications.BMC Family Practice20078: 59.DOI: 10.1186/1471-2296-8-59