

Primary Care Physicians' Knowledge, Attitude, and Practice towards Diabetic Foot Ulcer at Primary Healthcare Corporation, Qatar: A Cross-Sectional Survey

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Abstract

Original Research Article

Background: Diabetic foot ulcers (DFU) pose significant challenges globally, impacting millions of individuals with diabetes. Effective management requires adequate knowledge, positive attitudes, and evidence-based practices among primary care physicians. This study aimed to assess the knowledge, attitudes, and practices (KAP) of primary care physicians regarding DFU management in Qatar. **Methods:** A descriptive cross-sectional study was conducted using a structured questionnaire distributed online to 724 primary care physicians at Primary Health Care Corporation, Qatar, between September 2022 and January 2023. Data were collected on demographics, knowledge, attitudes, and practices related to DFU management. **Results:** A total of 131 physicians responded (response rate: 18.09%). The majority were male (53.4%) and aged 46-55 years (37.4%). Most physicians (49.6%) received training on DFU. The primary care physicians at PHCC demonstrated high knowledge (with mean score of 16 out of 20), positive attitudes (with a mean score of 36.5 out of 50), and effective practices (mean score of 5.3) regarding the management of diabetic foot ulcers. Male physicians outperformed females significantly in knowledge (16.5±2.1 vs. 15.4±2.3), attitude (37.3±4.7 vs. 35.3±4.0), and practice (5.5±1.3 vs. 5.0±1.5), all with p<0.05. Primary care physicians with an MBBS degree scored higher in practice (5.6±1.4) compared to master's (5.5±1.7), diplomas (5.2±1.2), and Ph.D. holders (3.4±1.1), all statistically significant (p<0.05). Participants who read the diabetic foot ulcer guideline showed superior knowledge (16.5±2.1), attitude (37.2±4.7), and practice (5.6±1.3) scores, all statistically significant (p<0.05). Physicians who have training in DFU showed higher knowledge and practice scores than those without training. **Conclusion:** Despite a generally high level of knowledge and positive attitudes towards DFU management among primary care physicians in Qatar, targeted interventions are needed to address gender disparities and enhance educational opportunities. Integrating DFU management into undergraduate and family medicine training programs, along with specialized workshops, can improve physician skills and reduce the burden of DFU-related complications.

Keywords: Primary care physicians; Diabetic foot ulcer; Knowledge, attitude and practice.

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INTRODUCTION

Persistent and unregulated diabetes mellitus gives rise to substantial and enduring macrovascular and microvascular complications over an extended duration [1]. The aetiology of diabetic foot ulcers (DFU) involves a range of aetiological factors encompassing neuropathy, peripheral arterial disease, foot infection, foot deformities, inadequately fitting footwear, traumatic incidents, and oedematous conditions. On a global scale,

diabetic foot ulcers and their associated complications impact an estimated population of approximately 40 to 60 million individuals suffering from diabetes. Persistently unhealed DFU exhibit a notable correlation with elevated healthcare expenditures, diminished quality of life, and heightened rates of morbidity and mortality [2-7].

Given the diagnosis of diabetes in a population exceeding 400 million individuals worldwide, the

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escalating prevalence of DFU is swiftly evolving into a pressing global concern [3,8]. Globally, the occurrence of DFU stands at approximately 6.3% (3-13%), while in Europe and Southeast Asia, the prevalence rates are recorded as 5.1% and 5.5%, respectively [9]. In Africa it is 13.0% (4–54%) [10]. In the context of Qatar, the collective prevalence of DFU was documented at 6.3% [11]. DFU emerges as the primary factor accountable for 85% of lower extremity amputations among individuals afflicted by diabetes, contributing significantly to the substantial financial burden on healthcare systems, elevated morbidity rates, and increased mortality [3, 8]. Additionally, it is imperative to note that the presence of DFU imparts a substantial 10 to 20-fold escalation in the propensity for lower extremity amputations among individuals with diabetes, in contrast to their nondiabetic counterparts. Across the globe, the frequency of amputation is very concerning: every half a minute, an individual experiences the loss of a lower limb due to diabetic foot ulcers [12, 14-16]. In 50% of these instances, lower extremity amputations can be averted through preventive measures encompassing the provision of comprehensive foot care and regular education on optimal foot care practices [5].

To mitigate the impact of diabetic foot ulcers, it requires early recognition of etiological factors, assessing co-morbidities [17], optimal glycaemic control, regular foot inspection and addressing risk factors such as smoking, improper footwear, obesity [18, 19], callus removal, addressing nail pathology, and timely referral to tertiary care [20-22]. A multi-disciplinary approach is essential for management of DFU. Primary care physicians have a pivotal role in educating, maintaining healthy feet, and preventing or reducing the burden of DFU by identifying emerging problems and practicing evidence-based diabetic foot care practice. They also, need to be aware of and be competent in using advanced wound care products to enhance the healing process of DFU. These include but are not limited to foam dressing, hydrogels, hydrocolloids, non-adherent dressings, and alginates.

Primary care physicians practicing in Qatar are composed of not only indigenous Qatari physicians but rather of a plethora of physicians coming from various parts of the world with different ethnicities and backgrounds including UK, Egypt, Iraq, and Sudan. Physicians working in primary care in Qatar include senior consultants, consultants, specialists, and general practitioners.

The objectives of this study were wide ranging, covering an assessment of the depth of knowledge, prevailing attitudes, and operational practices among primary care physicians concerning diabetic foot ulcers. Furthermore, the study also aimed to determine potential associations between demographic/general question

variables and the domains of knowledge, attitude, and practice within the context of diabetic foot ulcers.

METHODS

The study utilized a descriptive cross-sectional design to evaluate the knowledge, attitude, and practice of primary healthcare physicians regarding diabetic foot wound care at PHCC, Qatar. Online questionnaire was sent to 724 practising primary care physicians of PHCC between September 2022 and January 2023. The survey was originally planned to last for just one month. However, its timeline was extended to enhance response rates, attributed to the commitment of primary care physicians to the FIFA World Cup 2022.

Data Collection Instrument

Data was collected using a reliable instrument consisting of a 46-item structured questionnaire [23, 24, 27] based on relevant clinical literature related to diabetic foot wound care [25] and PHCC guidelines on management of diabetes (CLA-G12V03.0). The objective was to collect thorough information about the knowledge, attitudes, and practices of primary care physicians regarding diabetic foot ulcers.

The questionnaire was initially piloted with 20 physicians to assess its reliability and content validity. Data obtained during the pilot study were excluded from this study.

Questionnaire Sections

1. Sociodemographic and General Questions (Q1-Q9): This section covered sociodemographic details and general inquiries that influenced physicians' knowledge of wound care. Variables such as age, gender, professional qualifications, level of training experience, and utilization of knowledge-updating resources were considered.
2. Physician Knowledge Assessment (Q10-Q25): This segment consisted of 16 multiple-choice questions (MCQs) to assess physicians' understanding of diabetic wound care complexities. The MCQ's covered different aspects of DFU, including predisposing factors (Q10-Q13), ulcer characteristics (Q14-Q16), ulcer complications (Q17-Q19), and DFU care (Q20-Q24). (Q25) evaluated primary care physicians' knowledge on the examination of feet of diabetic patients with insensate feet, foot deformities, and ulcers with response options (monthly, three monthly, six monthly, every visit). Response options for other questions were "Yes," "No," and "Do not know." The inclusion of the "Do not know" option is intended to discourage guessing on MCQ's [26]. Correct answers were scored 1 point each, while incorrect and "do not know" responses

received 0 points [27]. The scores were categorized as very low (mean < 12.00), moderate (mean 12.00-13.99), high (mean 14.00-17.99), and very high (mean 18.00-20.00). These scores were calculated based on the mean, with the total score ranging from 0 to 20.

3. **Physician Attitudes Assessment (Q26-Q36):** This section included 11 questions aimed at evaluating physicians' attitudes towards diabetic foot wound management. Participants expressed their level of agreement using a five-point Likert scale, spanning from "strongly disagree" to "strongly agree." The questions were formulated in a negative manner to encourage responses that would reflect a scoring range from 10 (indicating an extremely negative attitude) to 50 (representing an extremely positive attitude).
4. **Physician Practice Assessment (Q37-Q46):** This domain focused on primary care physicians' practical approaches to diabetic foot management. With ten items, it covered various aspects of diabetic foot care, including foot assessment, dressing selection, callus debridement, and referral patterns. Physicians with scores equal to or above the mean were categorized as having good practice, while scores below the mean indicated poor practice.

Data Analysis

Descriptive statistics were applied to succinctly summarize the data acquired from the questionnaire. Frequency distributions, percentages, means, and

standard deviations were computed across different variables, offering a comprehensive snapshot of the demographic features, as well as the levels of knowledge, attitudes, and practices pertaining to diabetic foot wound care among the study participants. Associations between demographic and general questions variables (such as age, gender, professional qualifications, level of training experience, and utilization of knowledge-updating resources) and levels of knowledge, attitudes, and practices were explored using the Chi-Square test. The test was also used to determine whether there were significant relationships between physicians' attitudes and their practices regarding diabetic foot wound care. The significance level (α) was established at a value less than 0.05 to assess the statistical significance of observed associations.

RESULTS

Demographics and general questions

A total of 131 out of 724 participants completed the questionnaire, resulting in a response rate of 18.09%. Among these respondents, 53.4% (70 out of 131) were men, and 37.4% (49 out of 131) belonged to the 46-55 years age group. Approximately 42.7% (56 out of 131) of physicians were consultants, and 9.9% (13 out of 131) were from Qatar. In terms of educational status, 46.6% (61 out of 131) of physicians held a Diploma (MRCGP, Arab board, etc.). About 49.6% (65 out of 131) of physicians had received training or participated in educational activities related to diabetic foot ulcers. The sociodemographic and clinical characteristics of the study population are summarized in Table (1).

Table 1: Participant characteristics (N=131)

Variables n (%)		
Gender	Female	61 (46.6%)
	Male	70 (53.4%)
Age	25-35	15 (11.5%)
	36-45	46 (35.1%)
	46-55	49 (37.4%)
	56-65	19 (14.5%)
	>65	2 (1.5%)
	Licensed years	11-15
	16-20	17 (13.0%)
	2-5	30 (22.9%)
	21-25	22 (16.8%)
	6-10	19 (14.5%)
	>26	19 (14.5%)
Nationality	Iraq	2 (1.5%)
	Jordan	10 (7.6%)
	Libya	2 (1.5%)
	Other	104 (79.4%)
	Qatar	13 (9.9%)
Job role	Consultant	56 (42.7%)
	General practitioner	38 (29.0%)

	Senior consultant	14 (10.7%)
	Specialist	23 (17.6%)
Workplace	Primary health care corporation, Qatar	131 (100.0%)
Qualifications	Diploma (MRCGP, Arab board etc.)	61 (46.6%)
	MBBS	37 (28.2%)
	Master's degree	26 (19.8%)
	Ph.D.	7 (5.3%)
Did you receive any training/educational activities for diabetic foot ulcers?	No	66 (50.4%)
	Yes	65 (49.6%)
Have you read any guidelines related to diabetic foot ulcers?	No	46 (35.1%)
	Yes	85 (64.9%)

Knowledge of Primary care physicians on diabetic foot ulcers

Table (2) provides an overview of the knowledge among primary care physicians regarding the management of diabetic foot ulcers. Notably, 91.6% of respondents (120 out of 131) correctly identified peripheral neuropathy as a significant factor in the development of diabetic foot ulcers, while 95.4% (125 out of 131) recognized skin damage due to sensory neuropathy as a crucial contributor to the aetiology of these ulcers. Autonomic neuropathy, resulting in dry and fissured skin, was acknowledged by the majority, with 83.2% (109 out of 131) providing the correct response. Moreover, 85.5% (112 out of 131) correctly identified weight-bearing areas as common locations for neuropathic diabetic foot ulcers. Additionally, 68.7% (90

out of 131) of respondents were aware that these ulcers are less painful than diabetic ischemic ulcers. The respondents demonstrated strong awareness 96.2% (126 out of 131) regarding potential complications, such as a higher risk of amputation in the presence of limb ischemia. Recognition of clinical signs, including slough as an indication of infection 51.1% (67 out of 131), and a pink appearance of the wound bed as satisfactory for healing 82.4% (108 out of 131), was also noted. Recommendations for key practices, such as daily cleansing for highly exudative wounds 89.3% (117 out of 131), and the use of hydrogel dressings 74.8% (98 out of 131), were well-received as effective strategies for wound rehydration. Moreover, 67.2% (88 out of 131) of respondents accurately responded to the frequency of diabetic patients' foot examinations.

Table 2: Knowledge of primary care physicians on management of diabetic foot ulcer (N=131)

Statement	Correct answer n (%)
The main factor responsible for diabetic ulcers is peripheral neuropathy (yes, no, don't know).	Yes: 120 (91.6%)
Unrecognized skin damage results from sensory neuropathy, which leads ultimately to ulcer formation (yes, no, don't know).	Yes: 125 (95.4%)
Dry and fissured skin is a consequence of autonomic neuropathy, which predisposes to ulcer formation (yes, no, don't know).	Yes: 109 (83.2%)
Neuropathic diabetic foot ulcers are typically located in weight-bearing areas of the foot (yes, no, don't know).	Yes: 112 (85.5%)
Neuropathic diabetic foot ulcers are more painful than diabetic ischemic ulcers (yes, no, don't know).	No: 90 (68.7%)
If the foot is cold to the touch and pulses are absent, then neuropathy can be excluded (yes, no, don't know).	No: 98 (74.8%)
A diabetic foot ulcer associated with limb ischemia confers a higher risk of amputation (yes, no, don't know).	Yes: 126 (96.2%)
The presence of slough is not an indication of infection in diabetic ulcers (yes, no, don't know).	No: 67 (51.1%)
Healing of a diabetic foot ulcer is impaired by the presence of osteomyelitis (yes, no, don't know).	Yes: 115 (87.8%)
A pink appearance of the wound bed is unsatisfactory and is associated with poor wound healing (yes, no, don't know).	No: 108 (82.4%)
Healing of foot ulcers is facilitated by mechanical offloading (yes, no, don't know).	Yes: 95 (72.5%)
It is recommended to use hyperbaric oxygen therapy for ulcer healing even in a well perfused foot (yes, no, don't know).	No: 42 (32.1%)
Daily cleansing is recommended for infected, highly exuding wounds (yes, no, don't know).	Yes: 117 (89.3%)
Wound dressings containing iodine are effective for clinically infected wounds (yes, no, don't know).	Yes: 65 (49.6%)
The use of hydrogel dressings is a useful strategy to rehydrate the wound bed and control moisture in wounds (yes, no, don't know).	Yes: 98 (74.8%)
How frequently will you perform an examination of the feet of diabetic patients with insensate feet, foot deformities, and ulcers (monthly, three monthly, six monthly, every visit).	Every Visit: 88 (67.2%)

Attitude of Family Physicians on Diabetic Foot ulcers

Table (3) shows the attitudes of primary care physicians regarding the management of diabetic foot ulcers. A significant majority strongly disagrees with statements implying a lesser importance of diabetic treatment compared to ulcer prevention, with 52.7% (69 out of 131). Similarly, 69.5% (91 out of 131) strongly disagree with the belief that regular assessments of diabetic ulcers are unnecessary. The majority also strongly disagrees with the perception that managing diabetic foot ulcers is of low priority in comparison to

other responsibilities, with 48.1% (63 out of 131) expressing strong disagreement. Moreover, 64.1% (84 out of 131) strongly disagree with the notion of ignoring foot ulcer care if given a choice. Physicians reaffirm their commitment to patient education, with 59.5% (78 out of 131) strongly disagreeing with the idea that educating patients on risk reduction is not within their duty. However, there is a nuanced perspective on considering pain during cleaning and dressing, with 36.6% (48 out of 131) expressing strong disagreement. Only 22.1% agree on treating diabetic foot ulcers at the health center.

Table 3: Attitude of primary care physicians on management of diabetic foot ulcers (N=131)

Statement	Correct answer n (%)
I don't think diabetic treatment is more important than ulcer prevention (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 69 (52.7%)
I do not believe it is necessary to assess diabetic ulcers regularly (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 91 (69.5%)
It takes a lot of time to manage diabetic foot ulcers (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 7 (5.3%)
Considering my other responsibilities, diabetic foot ulcer care is a low priority task for me (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 63 (48.1%)
If I have a choice, I would like to ignore caring for diabetic foot ulcers (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 84 (64.1%)
I do not have enough time to educate each individual patient on how to look after their ulcers (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 27 (20.6%)
It is not my duty to educate patients with diabetic foot ulcers on how to reduce re-ulceration (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 78 (59.5%)
I cannot think about pain when cleaning and dressing diabetic foot ulcers (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 48 (36.6%)
I do not like to manage diabetic foot ulcers in my clinic (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 33 (25.2%)
I do not feel satisfied when caring for diabetic foot ulcers (agree, disagree, neutral, strongly agree, strongly disagree).	Strongly disagree: 24 (18.3%)
I regularly treat diabetic foot ulcers at the health center (agree, disagree, neutral, strongly agree, strongly disagree).	Agree: 29 (22.1%)

Practice of Family Physicians on Diabetic Foot ulcers

Table (4) shows the perceived practice of primary care physicians in the management of diabetic foot ulcers. Notably, 41.2% (54 out of 131) of respondents affirmed the use of a standardized screening tool, indicating a proactive and structured approach to assessments. Among those implementing the screening tool, 16.0% (21 out of 131) reported frequent usage, emphasizing a commitment to regular evaluations. Additionally, 93.8% (123 out of 131) correctly identified factors to assess when treating diabetic foot ulcers. Furthermore, 58.0% (76 out of 131) of respondents expressed frequent use of dressings in diabetic foot ulcer treatment. Dressing preferences exhibited diversity, with Silvercel being the most used at 34.4% (45 out of 131). Responses regarding callus debridement varied, with 18 out of 131 respondents (13.7%) indicating frequent debridement. In terms of referral patterns, a significant

majority (74.81%) of physicians (98 out of 131) indicated they would refer a patient in cases of failing to heal ulcer, localized gangrene, or cellulitis. Moreover, in instances of new-onset gangrene, 74.0% of participants (97 out of 131) would promptly refer patients to A&E, reflecting an appropriate response. Similarly, in cases of non-healing foot ulcers, 56.5% (74 out of 131) would direct patients to podiatrists. An overwhelming majority, 98.5% of participants (129 out of 131), indicated they would refer a patient who smokes to a foot care specialist. Overall, most physicians demonstrate good practice in diabetic foot management, as evidenced by their use of screening tools, appropriate assessment of factors, utilization of dressings, referral patterns, and recognition of the need for specialist care in high-risk cases. However, areas for improvement may include increasing the frequency of using the diabetic foot ulcer screening tool and debriding callus at the site of the ulcer.

Table 4: Primary care physicians perceived practice towards management of diabetic foot ulcers (N=131)

Statement	Correct answer n (%)
I manage diabetic foot ulcers using a standardized screening tool (Yes or No).	Yes: 54 (41.2%)
If answer yes to above question, how often do you use the diabetic foot ulcer screening tool? (frequently, sometimes, never).	Frequently: 21 (16.0%)
Which of the following factors do you assess when treating diabetic foot ulcers? Please select all that applies (history of diabetic foot ulcer, wound status, vascular status, neurological assessment, measure dimensions of the wound, superficial swabbing of the wound, glycaemic control, signs of infection, footwear, smoking status, osteomyelitis, peri-wound skin status, foot contour, ordering an x-ray for chronic wounds, referral to secondary care).	All correct except (superficial swabbing of wound) 123 (93.8%)
How often do you use dressings in the treatment of diabetic foot ulcers? (Frequently, sometimes, never).	Frequently: 76 (58.0%)
Types of Dressings used (betadine, inadine, silvercel, promogran, honey, hydrogen peroxide, nugel, actisorb).	All correct: Betadine 37(28.2%); (Silvercel 45 (34.4%)
I debride the callus at the site of the ulcer (frequently, sometimes, never).	Frequently: 18 (13.7%)
I usually make a referral in the following situations as below, please tick all that applies (local infection, failing to heal ulcers, localised gangrene, cellulitis, new onset of pain in the foot, malodour of ulcer, tinea pedis).	Failing to heal ulcer, localized gangrene, cellulitis 98 (74.81%)
In the case of the new onset of gangrene, I would refer the patient to (A&E, vascular surgeon, orthopaedic surgeon, podiatrist).	A&E: 97 (74.0%)
In the case of a non-healing diabetic foot ulcer that has been present for more than two months, I would refer patient to (A&E, vascular surgeon, orthopaedic surgeon, general surgeon, podiatrist).	Podiatrist: 74 (56.5%)
I would refer a patient to a foot care specialist in case of a patient who smoke or who have loss of protective sensation, structural abnormalities, or a history of prior lower extremity complications to foot for preventive care and long-life surveillance (Yes or No).	Yes: 129 (98.5%)

Overall, Knowledge, attitude and practice of primary care physicians on Diabetic Foot Ulcers

The overall KAP score for the management of diabetic foot ulcers is summarized in Table (5). The knowledge scores of the 131 participants ranged from 8

to 20, with an average of 16±2.26. The average attitude score was 36.3±4.5, ranging from 26 to 45. Similarly, the practice score was 5.3±1.4, ranging from 2 to 8.

Table 5: Overall knowledge, attitude and practice on management of diabetic foot ulcer

Variables	Mean± SD	Range
Knowledge	16 ± 2.26	8 to 20
Attitude	36.3 ± 4.5	26 to 45
Practice	5.3 ± 1.4	2 to 8

Table (6) illustrates the association between demographic variables and physician knowledge, attitude, and practice regarding diabetic foot ulcers. Male physicians exhibited notably higher knowledge scores (16.5±2.1), attitudes (37.3±4.7), and practices (5.5±1.3) compared to their female counterparts (knowledge: 15.4±2.3, attitude: 35.3±4.0, practice: 5.0±1.5). Physicians with an MBBS degree achieved a significantly higher practice score (5.6±1.4) than those with master's degrees (5.5±1.7), diplomas (5.2±1.2), and

Ph.D. qualifications (3.4±1.1), with a p-value of 0.001. Participants who read guidelines related to diabetic foot ulcers had significantly higher knowledge (16.5±2.1), attitude (37.2±4.7), and practice (5.6±1.3) scores compared to those who did not read the guidelines. No significant differences were observed in knowledge, attitude, and practice concerning age, years of licensure, nationality, job role, and diabetes foot ulcer-related training.

Table 6: Factors associated with physician knowledge, attitude, and practice (N=131)

Variables	N	Knowledge, mean \pm SD	Attitude, mean \pm SD	Practice, mean \pm SD
Gender				
Female	61	15.4 \pm 2.3	35.3 \pm 4.0	5.0 \pm 1.5
Male	70	16.5 \pm 2.1	37.3 \pm 4.7	5.5 \pm 1.3
p-value		0.006	0.012	0.066
Age				
25-35	15	16.2 \pm 2.7	35.2 \pm 4.1	4.9 \pm 1.0
36-45	46	15.8 \pm 2.3	35.0 \pm 4.2	5.3 \pm 1.5
46-55	49	15.9 \pm 2.2	37.4 \pm 4.6	5.3 \pm 1.3
56-65	19	16.5 \pm 2.0	37.4 \pm 4.4	5.2 \pm 1.7
>65	2	16.5 \pm 2.1	39.0 \pm 7.1	7.5 \pm 0.7
p-value		0.84	0.051	0.17
Licensed Years				
11-15	24	16.0 \pm 2.6	35.6 \pm 4.9	5.4 \pm 1.5
16-20	17	16.2 \pm 3.0	36.3 \pm 4.9	5.4 \pm 0.9
2-5	30	16.0 \pm 2.3	35.4 \pm 3.9	4.9 \pm 1.1
21-25	22	16.0 \pm 1.5	37.8 \pm 4.2	5.5 \pm 1.3
6-10	19	15.3 \pm 1.6	35.3 \pm 5.4	5.1 \pm 1.6
>26	19	16.5 \pm 2.3	38.1 \pm 3.4	5.6 \pm 2.0
p-value		0.74	0.15	0.57
Nationality				
Iraq	2	18.5 \pm 0.7	35.0 \pm 1.4	3.5 \pm 0.7
Jordan	10	14.8 \pm 2.9	35.7 \pm 3.5	5.5 \pm 1.2
Libya	2	16.0 \pm 4.2	38.5 \pm 2.1	6.0 \pm 1.4
Other	10	16.1 \pm 2.2	36.4 \pm 4.7	5.3 \pm 1.4
Qatar	13	15.5 \pm 1.8	36.2 \pm 4.2	5.1 \pm 1.7
p-value		0.19	0.93	0.38
Job role				
Consultant	56	16.0 \pm 2.3	36.0 \pm 4.7	5.1 \pm 1.3
General practitioner	38	16.1 \pm 2.1	36.7 \pm 3.6	5.4 \pm 1.4
Senior consultant	14	16.1 \pm 2.3	38.5 \pm 4.3	4.9 \pm 1.5
Specialist	23	15.8 \pm 2.6	35.2 \pm 5.0	5.6 \pm 1.4
p-value		0.98	0.16	0.32
Qualifications				
Diploma (MRCGP, Arab board etc.)	61	16.0 \pm 2.1	36.0 \pm 4.5	5.2 \pm 1.2
MBBS	37	15.6 \pm 2.1	36.1 \pm 3.7	5.6 \pm 1.4
Master's degree	26	16.6 \pm 2.7	37.7 \pm 5.7	5.5 \pm 1.7
Ph.D.	7	16.6 \pm 2.1	35.7 \pm 2.0	3.4 \pm 1.1
p-value		0.32	0.43	0.001
Received training				
No	66	15.4 \pm 2.4	35.8 \pm 4.1	5.1 \pm 1.4
Yes	65	16.6 \pm 2.0	36.9 \pm 4.8	5.4 \pm 1.4
p-value		<0.001	0.17	0.26
Guideline related to diabetic foot ulcers				
No	46	15.1 \pm 2.2	34.7 \pm 3.5	4.8 \pm 1.5
Yes	85	16.5 \pm 2.1	37.2 \pm 4.7	5.6 \pm 1.3
p-value		<0.001	0.002	0.002

DISCUSSION

Principal findings

To the best of our knowledge, this is the first study reporting on primary care physicians' knowledge, attitudes, and practices in the management of diabetic foot ulcers in Qatar. Overall, primary care physicians at

PHCC demonstrated a high level of knowledge (with a mean score of 16 out of 20), a positive attitude (with a mean score of 36.5 out of 50), and effective practices (mean score of 5.3) regarding diabetic foot ulcer management. Male physicians exhibited statistically significantly higher scores in knowledge (16.5 \pm 2.1),

attitude (37.3 ± 4.7), and practice (5.5 ± 1.3) compared to their female counterparts, whose scores were (15.4 ± 2.3 , 35.3 ± 4.0) and (5.0 ± 1.5), respectively ($p < 0.05$). Furthermore, primary care physicians with an MBBS degree achieved significantly higher practice scores (5.6 ± 1.4) compared to those with master's degrees (5.5 ± 1.7), diplomas (5.2 ± 1.2), and Ph.D. qualifications (3.4 ± 1.1), significantly ($p < 0.05$). Participants who read the guideline related to diabetic foot ulcers also demonstrated significantly higher knowledge (16.5 ± 2.1), attitude (37.2 ± 4.7), and practice (5.6 ± 1.3) scores compared to those who did not read the guideline ($p < 0.05$). Physicians who received training had significantly higher knowledge and practice scores than those without training. However, no significant differences were observed in knowledge, attitude, and practice concerning age, license years, nationality, and job role.

Comparison with previous work

Although the overall knowledge of Primary care physicians is regarded as very good but 32.82 % will not perform examination of feet of diabetic patients with insensate feet, foot deformities and ulcers at every visit which increases the likelihood of missing DFU. About 20% of the DFU are found incidentally on routine foot examination of diabetic patients [28]. Most patients with diabetes have lower scores of knowledges and practice on foot care [29]. In Qatar there have been poor practices in regular inspection of feet among diabetic patients [30]. Similarly, knowledge and practice of diabetic foot care was found to be poor among diabetic patients in central area of Jazan region of Saudi Arabia [31].

There is no study which has compared knowledge, attitude and practice of primary care physicians regarding the management of diabetic foot ulcers across gender groups. This discrepancy can be attributed to the fact that female physicians at PHCC in Qatar predominantly engage in overseeing well baby clinics, well woman clinics, vaccination clinics, in addition to their responsibilities in triage and family medicine model clinics. This extensive range of responsibilities leaves them with limited time to participate in educational activities related to diabetic foot ulcers or actively manage DFU cases at their respective health centers.

Regarding the influence of higher educational degrees on Knowledge, Attitude, and Practice (KAP) scores, this study found no impact of obtaining a Ph.D. or master's degree, emphasizing that diabetic foot ulcer management is often not part of the undergraduate medical curriculum. Diabetic foot ulcer management is often not part of the undergraduate medical curriculum. Developed countries, such as the US, offer wound healing curricula as elective courses for undergraduate medical students [32], primarily focusing on assessment

rather than pathophysiology and management [33]. It is not mandatory speciality in family physicians training programs world-wide except in some parts of the country such as in the US [34]. Notably, participants with only MBBS degrees achieved higher KAP scores, potentially influenced by their participation in diabetic foot ulcer workshops during primary care conferences in the two years preceding the study. The study highlighted local efforts in Qatar to enhance the skills and knowledge of family physicians through the 'Evidence-Based Diabetic Foot Program.'

A similar picture is depicted regionally in a recent study done in Saudi Arabia assessing diabetic foot management done among family physicians concluded "deficits were found regarding diagnosing and management of DF infections among family physicians" [29].

It is crucial to recognize that positive responses to practice questions may not always accurately reflect the actual practice of primary care physicians in clinical settings. Several factors can contribute to this disparity. Firstly, the wording of questions can significantly influence respondents' answers [35]. Thus, even if physicians answer practice questions positively, it does not guarantee their ability to apply that knowledge effectively in real clinical practice scenarios. Another factor to be considered is the social desirability bias [36] whereby primary care physicians could feel compelled to give affirmative answers to practice questions to meet perceived professional standards, thereby hiding areas that require additional training. Overconfidence and conservative decision bias [37] are other important factors that may distort self-assessment survey results. It is important to note that the absence of real-time evaluation methods, such as clinical simulations or standardized patient encounters, limits the holistic assessment of physicians' competencies. Although, positive responses to practice questions provides valuable insights, however these results should be interpreted with caution and should include other forms of real-time evaluation methods. Real time evaluation methods examples include objective and subjective evaluation method (OSCE), short and long cases and retrospectively reviewing of patient notes in electronic health record to determine the actual practice to validate physicians practice responses. Logbooks of physicians that are countersigned can also be reviewed.

CONCLUSIONS

In conclusion, this study has shown that primary care physicians working at PHCC Qatar have an overall high level of knowledge, positive attitude, and good practice towards the management of DFU. However, it also reveals gender disparities in KAP scores, highlighting the need for targeted interventions to enhance educational opportunities. This study

underscores the necessity of integrating DFU management into undergraduate and family medicine training programs, as well as providing specialized workshops tailored to physicians' needs. Promoting a supportive learning environment, such as offering protected time for self-directed learning and fostering a positive attitude towards DFU management, are essential components of holistic and integrated care delivery. Healthcare systems can effectively mitigate the burden of DFU-related complications, improve patient outcomes, and reduce the risk of lower limb amputations by prioritizing evidence-based interventions and investing in physician education and support. This study emphasizes the urgency of proactive measures in improving DFU management practices, particularly in regions with high diabetes prevalence like Qatar.

Limitations

The study, however, is limited by the fact that it suffered from a lower response rate which limits the generalization of our results. The low response rate 18.09 % in our study may be attributed to various reasons including busy clinics, lack of incentives, fatigue [38, 39], too many surveys being carried out through the year [38], burn out, negative attitude [40], lack of protected time to study or carry out research activities or self-directed learning [41]. Participation in research surveys among physicians is challenging because of time restrictions, lack of involvement or awareness between researchers and participants and lack of understanding of the survey purpose [41]. Furthermore, the low level of response could still be due to lack of monetary and non-monetary remuneration [42]. An important strategy that is often overlooked in research is building a rapport and collaboration with target participants or key stakeholders [43].

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