



Cross-Sectional Study Concerning the Knowledge, Attitude, and Practice of People With Diabetes Regarding the Prevention of Foot Ulcers in a Community

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Foot ulceration is a serious problem among people with diabetes. This study assessed the knowledge, attitude, and practice of 483 people with diabetes with regard to the prevention of diabetic foot ulcers (DFUs). Data were collected using a valid and reliable questionnaire, and logistic regression was carried out to predict the effect of statistically significant independent variables on the scores of dependent variables. A significant association was found between knowledge and attitude about DFU prevention. Individuals who were unmarried were more likely to have higher knowledge scores than those who were married, and those who had university and secondary education were more likely to have higher attitude and practice scores than other groups. Overall, however, only a small percentage of study participants achieved high scores for knowledge, practice, and attitude in this study.

According to the International Diabetes Federation, the number of people with diabetes worldwide is expected to increase from 451 million in 2017 to 693 million in 2045 (1). Moreover, diabetes statistics in the Middle East are extremely concerning, with the number of people with diabetes likely to increase by 96.2% by 2035 (2). Diabetic foot ulcers (DFUs) are one of the most common complications in hospitals and a serious risk for people with diabetes (3). DFUs are considered an important and serious problem that can lead to prolonged treatment and worse (e.g., gangrene of the lower limb) if appropriate strategies and care are not implemented to prevent them (4).

Twenty percent of people with diabetes will develop a DFU, and an estimated 15% of those who do will eventually require amputation (5). A Malaysian study

KEY POINTS

Knowledge, attitude, and practice are important determining factors in the successful prevention and management of diabetic foot ulcers (DFUs). However, few studies have assessed these factors.

- » This study showed that there are, overall, low levels of necessary knowledge, favorable attitude, and recommended practice related to preventing DFUs among people with diabetes.
- » Unmarried respondents are more likely to have high knowledge, individuals who are 40–49 years of age are less likely to have positive attitudes, and people who have finished secondary school are more likely to practice prevention and have a favorable attitude.

involving hospitalized patients with diabetic foot problems showed that the prevalence of amputation in these patients was 88.7%, including both minor and major amputations (6). In another study in Bahrain, people with diabetes were found to be 25 times more likely than those without diabetes to have a limb amputated, and people with diabetes accounted for up to 70% of all leg amputations (7). Every 30 seconds, a limb is amputated somewhere in the world because of diabetes (7).

Knowledge, attitude, and practice (KAP) are important factors in diabetic foot management and, collectively, may serve as a gauge to determine an individuals' likelihood of carrying out recommended foot care (8). KAP

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in diabetes are directly related to self-management and linked to actual and target health outcomes (9). Previous studies that assessed the KAP of people with diabetes showed generally poor scores on these factors. These studies concluded that periodically assessing and improving patients' levels of KAP is important to facilitate the effective control of diabetes and its complications (10–12). Developing the appropriate skills and performing self-care tasks take time, and having an appropriate level of self-care knowledge is crucial to reduce rates of diabetes and its complications, including foot problems (12).

Increased KAP in people with diabetes is a key element in preventive foot care (13) and can help to prevent 50–86% of DFUs (14). However, few recent studies have evaluated levels of knowledge and/or attitude and/or practice of diabetes self-care regarding foot ulcers (15). Low levels of KAP among people with diabetes, in combination with the increase in numbers of people with diabetes, has led to an increase in the number of patients with DFUs (16). A systematic review showed that the global prevalence of DFUs has risen from 3 to 23% (17). People in low-income countries have a 30% higher risk than people from higher-income countries (18,19). Furthermore, after 3 years, the mortality rate for people who have had a limb amputated is ~50% (18,19).

In addition, low levels of KAP can lead to poor decisions by people with diabetes with regard to the immediate treatment of foot problems, which in turn can lead to progressing of DFUs from minor to major and then to amputation (20). However, there is little evidence that having knowledge and skill and performing regular self-care leads to earlier medical examination of DFUs (21). Thus, preventing DFUs from developing in people with risk factors is crucial, especially given that DFUs occur in >80% of such cases, often leading to amputation (21).

A few studies have focused on KAP related to prevention of DFUs among people with diabetes in the Middle East in general and in Palestine in particular. However, there is a lack of up-to-date KAP research in this area. Hence, the primary objective of this study was to assess the current levels of KAP with regard to the prevention of DFUs among people with diabetes who were treated at government hospitals in the West Bank of Palestine.

Research Design and Methods

Study Design

There was a descriptive cross-sectional study conducted between March to May 2021 in Palestinian government hospitals among 483 Palestinian patients with diabetes.

Instrument/Questionnaire

A validated KAP questionnaire on diabetic foot care in the prevention of DFUs was used (22). The questionnaire consists of two broad sections. Section A collects patients' demographic information, and section B comprises 25 questions about KAP, including 10 questions to assess the knowledge, five to assess attitude, and 10 to assess foot care practice. Some of these questions are open-ended to allow for detailed responses, whereas others are written in a close-ended yes-or-no format. One point is given for each positive answer, whereas no point is given for negative answers.

To evaluate questionnaire responses, we used the average score as the cut-off. A person's knowledge level was considered good if the score in that section was ≥ 8 , satisfactory with a score of 4–7, and poor with a score ≤ 3 . A person's attitude was deemed favorable with a score ≥ 4 or unfavorable with a score ≤ 3 . A person's foot care practices were deemed good with a score ≥ 8 , satisfactory with a score of 4–7, and poor with a score ≤ 3 (22). Consent to use this questionnaire was obtained from its developers (22). The questionnaire was tested for internal consistency with a Cronbach α of 0.770 (22).

In this study, face validity was assessed by administering the questionnaire to experts and people with diabetes and noting their comments, suggestions, and changes, revising as necessary. Furthermore, a pre-test was given to 10% of the study sample and used for reliability analysis. The Cronbach α was 0.799 for the knowledge scale, 0.841 for the attitude scale, and 0.716 for the practice scale. The overall Cronbach α for KAP was 0.845. Moreover, the KAP questionnaire was evaluated by a panel of six experts, and the result for content validity was 0.812. Ethical approval was obtained from the Palestinian Ministry of Health (reference number 216/966/2021).

Data Analysis

Data were analyzed using SPSS, v. 24.0, statistical software. Depending on the objectives of the current study, descriptive statistics, the χ^2 test, and logistic regression were used, as appropriate. All tests were estimated to be two-sided, and statistical significance was set at $P < 0.05$. A P value < 0.25 was selected for the logistic regression (23).

Results

Sociodemographic Characteristics of Respondents

As shown in Table 1, the mean age of respondents was 49.91 ± 9.982 years, and the largest percentage

TABLE 1 Sociodemographic Characteristics of Study Participants (N = 483)

Age, years	49.9 ± 9.98
Age-group, years	
30–39	81 (16.8)
40–49	134 (27.7)
50–59	186 (38.5)
≥60	82 (17.0)
Sex	
Male	204 (42.2)
Female	279 (57.8)
Marital status	
Unmarried	185 (38.3)
Married	298 (61.7)
Education	
Primary school	156 (32.3)
Secondary school	237 (49.1)
University	90 (18.6)
BMI, kg/m ²	
Underweight <18.5	11 (2.3)
Normal weight 18.5–24.9	171 (35.4)
Overweight 25–29.9	162 (33.5)
Obese ≥30	139 (28.8)
Smoking status	
Smoker	129 (26.7)
Nonsmoker	354 (73.3)
Alcohol use	
Yes	72 (14.9)
No	411 (85.1)
Monthly income, ILS	
<2,000	169 (35.0)
2,000–4,000	203 (42.0)
>4,000	111 (23.0)
Occupation	
Professional	68 (14.1)
Nonprofessional	209 (43.3)
Retired	48 (9.9)
Unemployed	158 (32.7)

Data are n (%) or mean ± SD. ILS, Israeli new shekel.

of respondents (n = 168 [38.5%]) fell into the age-group of 50–59 years. A total of 279 respondents (57.8%) were female, and 298 (61.7%) were married.

Levels of KAP Regarding Prevention of DFUs

Table 2 shows that the majority of respondents (n = 332 [68.7%]) had satisfactory knowledge about DFU prevention, whereas 135 (28.0%) had poor knowledge, and 16 (3.3%) had good knowledge. On the other hand, the majority (n = 298 [61.7%]) had an

TABLE 2 Participants' KAP Levels Regarding Prevention of DFUs (N = 483)

Variable	n (%)
Knowledge score	
Good (≥8)	16 (3.3)
Satisfactory (4–7)	332 (68.7)
Poor (≤3)	135 (28.0)
Attitude score	
Favorable (≥4)	185 (38.3)
Unfavorable (≤3)	298 (61.7)
Practice score	
Good (≥8)	50 (10.4)
Satisfactory (4–7)	279 (57.8)
Poor (≤3)	154 (31.8)

unfavorable attitude regarding the prevention of DFUs compared with 185 (38.3%) who had a favorable attitude. Although the majority (n = 279 [57.8%]) had satisfactory practice regarding the prevention of DFUs, 154 (31.9%) had poor practice, and 50 (10.4%) had good practice.

Associations Among Knowledge, Attitude, and Practice Scores

Table 3 shows that there was a statistically significant association between knowledge level and attitude regarding the prevention of DFUs ($\chi^2 = 12.145$, $df = 1$, $P = 0.001$).

Associations Between Sociodemographic Characteristics and KAP Scores

As shown in Table 4, respondents who were unmarried were 1.7 times more likely to have high knowledge compared with those who were married (adjusted odds ratio [OR] 1.778, 95% CI 1.138–2.776, $P = 0.011$). Monthly income and occupation were not significant in the final logistic regression model.

Table 5 shows that the respondents who had finished university education were 1.9 times more likely to have a favorable attitude compared with those who had primary school education (adjusted OR 1.907, 95% CI 1.108–3.283, $P = 0.020$). In addition, respondents who had finished secondary school were 1.6 times more likely to have a favorable attitude compared with those who had primary school education (adjusted OR 1.611, 95% CI 1.040–2.495, $P = 0.033$). Respondents who were 40 to 49 years of age were 0.48 times less likely to have a favorable attitude compared with those who were 30–39 years of age (adjusted OR 0.481, 95% CI

TABLE 3 Association Between Knowledge and Attitude Regarding Prevention of DFUs (N = 483)

Variable	Knowledge		Test statistics		
	Good/satisfactory score (≥ 4), n (%)	Poor score (≤ 3), n (%)	χ^2	df	P
Attitude			12.145	1	0.001*
Favorable score (≥ 4)	150 (81.1)	35 (18.9)			
Unfavorable score (≤ 3)	198 (66.4)	100 (33.6)			

*Significant at $P < 0.05$.

0.272–0.849, $P = 0.012$). Likewise, respondents who were 50–59 years of age were 0.44 times less likely to have a favorable attitude compared with those aged 30–39 years (adjusted OR 0.446, 95% CI 0.259–0.767, $P = 0.004$).

Table 6 shows that respondents who had finished secondary school were 0.5 times more likely to have a high score practice compared with those who had a primary school education (adjusted OR 0.561, 95% CI 0.357–0.882, $P = 0.012$).

Discussion

In this study, the majority of respondents (68.7%) had a satisfactory level of knowledge regarding the prevention of DFUs. This finding was similar to those of previous studies in Malaysia and Pakistan, which showed a satisfactory level of knowledge in the majority of respondents. This result could be because there was a relationship between education level and knowledge regarding the prevention of DFUs (24).

On the other hand, 61.7% of respondents were found to have an unfavorable attitude toward the prevention of

DFUs in the current study. The finding was similar to a study in Ethiopia, where 60.5% of respondents had a poor attitude score. A slightly higher result was reported in a study conducted in North India (25), in which 71.0% had a negative attitude. This result could be because of a lack of awareness, unavailability of information, or low education level of the study population (26).

Practice concerning DFU prevention was satisfactory among study participants. The proportions of participants with satisfactory, good, and poor practice were 57.8, 31.9, and 10.4%, respectively. These proportions were similar to findings in a Pakistani study (27), in which 54.0% of respondents were categorized in the satisfactory level. This finding may have resulted from the study sample size and the percentage of participants who had secondary school education level, which constituted a high percentage in this study and thus affected practice scores (28).

There was a significant association between knowledge and attitude scores. This finding was similar to that in a Thai study (29), in which there was a statistically significant positive association between knowledge and attitude. Furthermore, other similar studies found a

TABLE 4 Sociodemographic Factors Associated With Knowledge of Prevention of DFUs Using Multiple Logistic Regression

Variable	β	SE	Wald Test	Adjusted OR (95% CI)	P
Marital status					
Married	Ref				
Unmarried	0.435	0.215	4.071	1.778 (1.138–2.776)	0.011*
Monthly Income, ILS					
<2,000	Ref				
>4,000	0.665	0.281	5.582	1.465 (0.668–3.214)	0.241
Occupation					
Unemployed	Ref				
Professional	0.770	0.361	4.549	1.451 (0.500–4.208)	0.193

*Significant at $P < 0.05$. ILS, Israeli new shekel; Ref, reference category.

TABLE 5 Sociodemographic Factors Associated With Attitude About Prevention of DFUs Using Multiple Logistic Regression

Variable	β	SE	Wald Test	Adjusted OR (95% CI)	P
Age-group, years					
30–39	Ref				
40–49	–0.707	0.286	6.089	0.481 (0.272–0.849)	0.012*
50–59	–0.793	0.271	8.540	0.446 (0.259–0.767)	0.004*
Education					
Primary school	Ref				
Secondary school	0.409	0.218	3.509	1.611 (1.040–2.495)	0.033*
University	0.677	0.273	6.140	1.907 (1.108–3.283)	0.020*

*Significant at $P < 0.05$. Ref, reference category.

statistically significant correlation between knowledge level and attitude in Malaysia and the United Arab Emirates (30,31). Participants' attitudes and knowledge regarding diabetes complications are affected by their education level (32).

In our study, unmarried participants had 1.7 times higher knowledge concerning DFUs compared with those who were married. This finding was reported in a previous study in Northwest Ethiopia, but was not completely similar in that participants who were single were found to be 0.4 times less likely to have good knowledge compared with married participants (adjusted OR 0.4, 95% CI 0.199–0.913) (33). Likewise, a previous study in Ghana (34) showed that single participants were 3.3 times less likely to understand diabetes complications compared with married respondents. This finding might have been influenced by the study's sample size and geographic location, as well as the sex of participants (35).

In our study, people who were 30–39 years of age had a higher attitude score than those aged 40–49 or 50–59 years. A similar finding was reported in a previous study, in which participants who were 35 years of age had a significantly higher positive attitude toward diabetes than those >65 years of age (36). This finding may be because the age-group of 30–39 years had sufficient information about diabetes and its complications, available methods of prevention through the use of

technology, and the know-how to access information in fast ways; there was also a correlation between knowledge and attitude in this study (37).

Regarding education, our finding was consistent with a previous study in Ethiopia (38), which showed that the attitude score of respondents who had graduated and had a higher education was three times higher than that of those who were illiterate. Thus, a higher education level increases the level of knowledge and improves attitude. This may be because greater knowledge in itself also improves attitude.

Participants in our study who had a high level of education had a higher practice score for DFU prevention than those with a low education level. This finding was reported in a previous study (35), in which participants who had completed school grade 9–12 or higher were 2.9 times more likely to have good foot care practice than those who were illiterate. This finding may be because those with high levels of education and knowledge will likely have better practice because they are better able to apply their knowledge in their daily lives to avoid diabetes complications (39).

Based on the findings of the current study, multidisciplinary diabetes care should focus on improving patients' KAP because each of these three factors is complementary to the others. Foot care education should be

TABLE 6 Sociodemographic Factors Associated With Practice Regarding Prevention of DFUs Using Multiple Logistic Regression

Variable	β	SE	Wald Test	Adjusted OR (95% CI)	P
Education					
Primary school	Ref				
Secondary school	0.536	0.229	5.472	0.561 (0.357–0.882)	0.012*

*Significant at $P < 0.05$. Ref, reference category.

increased to improve knowledge, and health care programs and interventions should be developed to improve patients' attitude and self-care practice. Moreover, health care providers should assess patients' KAP and follow up to address areas in need of improvement.

Limitations of the Study

The cross-sectional design of this study did not allow for the establishment of causal relationships. Additionally, the study was only conducted among people with diabetes who were treated at government hospitals in the West Bank of Palestine; hence, the results and causes may not be truly representative of all people with diabetes in Palestine.

Conclusion

Among Palestinian patients in government hospitals, this study showed that most had satisfactory knowledge (65%), unfavorable attitude (60%), and satisfactory practice (55%). In total, 150 respondents (81.1%) with favorable attitudes had good knowledge, and 198 (66.4%) with an unfavorable attitude had good knowledge; this finding showed a significant association between knowledge and attitude.

Marriage status was found to be a predictor of knowledge, with unmarried participants being more likely to have good knowledge scores than those who were married. Education was found to be a predictor of attitude, with participants with a high level of education being more likely to have a good attitude than those with a low education level. Education level also predicted practice, with respondents who had at least a high school education being more likely to have a good practice score than those who had a lower level of education.

For people with diabetes, KAP are essential parts of diabetic foot management and can be used to evaluate the quality of foot care practice. Thus, patients' KAP of self-care should be emphasized by health care providers, who should then follow up with patients who need help improving these factors.

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DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

Both authors researched data, wrote the manuscript, contributed to discussion, and reviewed and edited the manuscript. K.A.A. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

REFERENCES

1. Cho NH, Shaw JE, Karuranga S, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract* 2018;138:271–281
2. Abuyassin B, Laher I. Diabetes epidemic sweeping the Arab world. *World J Diabetes* 2016;7:165–174
3. Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. *N Engl J Med* 2017;376:2367–2375
4. Boulton AJM, Armstrong DG, Kirsner RS, et al. *Diagnosis and Management of Diabetic Foot Complications*. Arlington, VA, American Diabetes Association, 2018
5. Lotfy M, Adeghate J, Kalasz H, Singh J, Adeghate E. Chronic complications of diabetes mellitus: a mini review. *Curr Diabetes Rev* 2017;13:3–10
6. Ng BW, Azhar AA, Azman MH, Sukri MS, Arvinder-Singh HS, Abdul Wahid AM. Knowledge and attitude of nurses towards diabetic foot care in a secondary health care centre in Malaysia. *Med J Malaysia* 2020;75:391–395
7. Al-Mahroos F, Al-Roomi K. Diabetic neuropathy, foot ulceration, peripheral vascular disease and potential risk factors among patients with diabetes in Bahrain: a nationwide primary care diabetes clinic-based study. *Ann Saudi Med* 2007;27:25–31
8. Bilal M, Haseeb A, Rehman A, et al. Knowledge, attitudes, and practices among nurses in Pakistan towards diabetic foot. *Cureus* 2018;10:e3001
9. Azar FE, Solhi M, Darabi F, Rohban A, Abolfathi M, Nejhdadgar N. Effect of educational intervention based on PRECEDE-PROCEED model combined with self-management theory on self-care behaviors in type 2 diabetic patients. *Diabetes Metab Syndr* 2018;12:1075–1078
10. Beiranvand S, Fayazi S, Asadzaker M. Effect of educational programs on the knowledge, attitude, and practice of foot care in patients with diabetes. *Jundishapur Journal of Chronic Disease Care* 2015;4:e26540
11. Muhammad-Lutfi AR, Zaraihah MR, Anuar-Ramdhan IM. Knowledge and practice of diabetic foot care in an in-patient setting at a tertiary medical center. *Malays Orthop J* 2014;8:22–26
12. Taksande BA, Thote M, Jajoo UN. Knowledge, attitude, and practice of foot care in patients with diabetes at central rural India. *J Family Med Prim Care* 2017;6:284–287
13. Fatema K, Hossain S, Natasha K, et al. Knowledge attitude and practice regarding diabetes mellitus among

nondiabetic and diabetic study participants in Bangladesh. *BMC Public Health* 2017;17:364

14. Haq NU, Durrani P, Nasim A, Riaz S. Assessment of knowledge and practice of diabetes mellitus patients regarding foot care in tertiary care hospitals in Quetta, Pakistan. *Specialty Journal of Medical Research and Health Science* 2017;2:35–43
15. Sari Y, Upoyo AS, Isworo A, et al. Foot self-care behavior and its predictors in diabetic patients in Indonesia. *BMC Res Notes* 2020;13:38
16. Ugwu E, Adeleye O, Gezawa I, Okpe I, Enamino M, Ezeani I. Predictors of lower extremity amputation in patients with diabetic foot ulcer: findings from MEDFUN, a multi-center observational study. *J Foot Ankle Res* 2019;12:34
17. Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. *Ann Med* 2017;49:106–116
18. Yazdanpanah L, Shahbazian H, Nazari I, et al. Prevalence and related risk factors of diabetic foot ulcer in Ahvaz, south west of Iran. *Diabetes Metab Syndr* 2018;12:519–524
19. Mariam TG, Alemayehu A, Tesfaye E, et al. Prevalence of diabetic foot ulcer and associated factors among adult diabetic patients who attend the diabetic follow-up clinic at the University of Gondar Referral Hospital, North West Ethiopia, 2016: institutional-based cross-sectional study. *J Diabetes Res* 2017;2017:2879249
20. Pemayun TGD, Naibaho RM. Clinical profile and outcome of diabetic foot ulcer, a view from tertiary care hospital in Semarang, Indonesia. *Diabet Foot Ankle* 2017;8:1312974
21. van Netten JJ, Price PE, Lavery LA, et al.; International Working Group on the Diabetic Foot. Prevention of foot ulcers in the at-risk patient with diabetes: a systematic review. *Diabetes Metab Res Rev* 2016;32(Suppl. 1):84–98
22. Chellan G, Srikumar S, Varma AK, et al. Foot care practice: the key to prevent diabetic foot ulcers in India. *Foot* 2012;22:298–302
23. Hosmer DW Jr, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. Vol. 398. Hoboken, NJ, John Wiley & Sons, 2013
24. Saleh F, Mumu SJ, Ara F, Ali L, Hossain S, Ahmed KR. Knowledge, attitude and practice of type 2 diabetic patients regarding obesity: study in a tertiary care hospital in Bangladesh. *J Public Health Africa* 2012;3:e8
25. Reid M, Roux ML, Raubenheimer J, Walsh C. Diabetes-related knowledge, attitude and practices (KAP) of adult patients with type 2 diabetes mellitus in the Free State province, South Africa. *South Afr J Clin Nutr* 2019;32:20–27
26. Asmamaw A, Asres G, Negese D, Fekadu A, Assefa G. Knowledge and attitude about diabetes mellitus and its associated factors among people in Debre Tabor town, Northwest Ethiopia: cross sectional study. *Science* 2015;3:199–209

27. Hasnain S, Sheikh NH. Knowledge and practices regarding foot care in diabetic patients visiting diabetic clinic in Jinnah Hospital, Lahore. *J Pak Med Assoc* 2009;59:687–690
28. Khurshid TK, Othman SM. Knowledge and practice about diabetes among adult diabetic patients in Erbil, Iraq. *Zanco J Med Sci* 2014;18:659–666
29. Kim SY, Hongsraragon P. Preventive behaviors regarding foot ulcers in diabetes type II patients at BMA health center no. 48, Bangkok, Thailand. *Journal of Health Research* 2008;22(Suppl.):21–28
30. Al-Maskari F, El-Sadig M, Al-Kaabi JM, Afandi B, Nagelkerke N, Yeatts KB. Knowledge, attitude and practices of diabetic patients in the United Arab Emirates. *PLoS One* 2013;8:e52857
31. Ng SH, Chan KH, Lian ZY, Chuah YH, Waseem AN, Kadirvelu A. Reality vs illusion: knowledge, attitude and practice among diabetic patients. *Int J Collab Res Intern Med Public Health* 2012;4:709–718
32. Kheir N, Greer W, Yousif A, Al Geed H, Al Okkah R. Knowledge, attitude and practices of Qatari patients with type 2 diabetes mellitus. *Int J Pharm Pract* 2011;19:185–191
33. Seid A, Tsige Y. Knowledge, practice, and barriers of foot care among diabetic patients attending Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia. *Adv Nurs* 2015;2015:934623
34. Obirikorang Y, Obirikorang C, Anto EO, et al. Knowledge of complications of diabetes mellitus among patients visiting the diabetes clinic at Sampa Government Hospital, Ghana: a descriptive study. *BMC Public Health* 2016;16:637
35. Abdulghani HM, AlRajeh AS, AlSalman BH, et al. Prevalence of diabetic comorbidities and knowledge and practices of foot care among diabetic patients: a cross-sectional study. *Diabetes Metab Syndr Obes* 2018;11:417–425
36. Islam FMA, Chakrabarti R, Dirani M, et al. Knowledge, attitudes and practice of diabetes in rural Bangladesh: the Bangladesh Population based Diabetes and Eye Study (BPDES). *PLoS One* 2014;9:e110368
37. Arnhold M, Quade M, Kirch W. Mobile applications for diabetics: a systematic review and expert-based usability evaluation considering the special requirements of diabetes patients age 50 years or older. *J Med Internet Res* 2014;16:e104
38. Kassahun CW, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia: a cross-sectional study. *PLoS One* 2017;12:e0170040
39. Lincoln NB, Radford KA, Game FL, Jeffcoate WJ. Education for secondary prevention of foot ulcers in people with diabetes: a randomised controlled trial. *Diabetologia* 2008;51:1954–1961