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ORIGINAL ARTICLE

Stepping up foot care: assessment over foot care knowledge and behavior among individuals with diabetes of risk levels

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Abstract

Background Diabetic foot is a global threat to public health, as it can lead to infections and amputations and cause significant pain and economic costs for patients. Diabetic foot patients in northern China have more severe local ulcers, worse prognosis, and longer disease duration.

Objective This study assessed the foot risk levels and foot care knowledge and behavior status of people with diabetes with different foot risk levels, and investigated the factors that influence the occurrence of high-risk foot in diabetes.

Methods This cross-sectional survey included 410 hospitalized people with diabetes. Demographic and disease-related data and foot risk stratification status were collected using investigator-designed questionnaires. Foot care knowledge and behavior questionnaires were also used.

Results Among the 410 participants, a total of 367 cases were classified as high-risk feet, among which 135 cases were rated as grade 1, 202 cases grade 2, and 30 cases grade 3. Foot care knowledge surveys revealed low scores in the areas of shoe and sock selection, foot and footwear examination, and management of foot problems. Foot care behavior surveys showed low scores in the areas of foot and footwear examination, management of foot problems, and foot injury risk behavior. One-way ANOVA revealed significant differences in foot care behaviors among patients with different foot risk classifications ($p < 0.05$), while no significant differences were observed in foot care knowledge scores. Multivariate logistic regression analysis showed that age, history of cerebrovascular disease, and foot care behavior scores were factors influencing the occurrence of high-risk foot in people with diabetes.

Conclusion The results of this study showed a high prevalence of high-risk foot in diabetics; The knowledge and behavior of foot care in diabetics with different foot risk levels were both at a moderately low level; There were differences in foot behavior scores among patients with different foot risk classes, but, counter-intuitively, no significant differences in foot care knowledge. The study found that advanced age, history of cerebrovascular disease, and low foot care behavior scores are risk factors for high-risk foot in diabetes. Therefore, it is necessary to screen patients with diabetes for high-risk feet and implement targeted interventions according to the results.

Keywords Diabetic foot · Foot care knowledge and behavior · High risk foot

Introduction

Diabetes is a metabolic disorder characterized by high blood sugar levels and is one of the most common chronic non-communicable diseases worldwide [1]. According to the International Diabetes Federation (IDF) guidelines, there were approximately 537 million people with diabetes worldwide in 2021, and this number is expected to rise to 643 million by 2030 [2]. In China, the prevalence of diabetes in the mainland area is 11.2%, making it the country with the highest number of diabetes patients in the world [3, 4]. Long-term high blood sugar can lead to various diabetes-related complications, particularly in the eyes, kidneys, heart, blood vessels, and nerves, with diabetic foot ulcer (DFU) being the most common and serious [5]. The prevalence of DFU worldwide varies from 1.6% to 8.0% [6], and is estimated to reach 19% by 2045 [7]. DFU is associated with high incidence and mortality rates

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worldwide, with amputation rates as high as 74% for new DFU patients and 5-year mortality rates of 43%~55% [8]. The annual cost of care is approximately 81.7 billion US dollars [9]. The rapid increase in global incidence rates and high treatment costs impose a heavy economic burden on patients, families, and society.

A comprehensive approach to foot care, including prevention, education for patients, multidisciplinary collaboration in managing foot ulcers, and close monitoring, leading to a reduction in amputation rates by 49%~85% [10]. Perrin et al. [11] conducted a cross-sectional survey of 121 patients and divided them into three groups according to their knowledge of DFU development: one group had misconceptions about peripheral neuropathy, another group had a relatively accurate understanding of that, and the third group had no knowledge of foot conditions. The results showed that the group with misconceptions had more potentially destructive foot care behavior than the other groups, indicating that correct knowledge of foot care can guide appropriate foot care behavior and have impacts on foot conditions directly. In addition, physical factors such as wearing inappropriate footwear and socks, improper toenail trimming, and burns account for more than 75% of the factors leading to DFU, and good care can prevent the injuries from occurring [12]. Early identification of high-risk factors for diabetic foot and providing targeted interventions and management is crucial for preventing DFU.

The International Working Group on the Diabetic Foot (IWGDF) 2015 guidelines recommend implementing health education, prevention measures, and follow-up duration according to different foot risk levels [13]. However, previous studies have focused mainly on the overall population of diabetes patients, with little differentiation of DFU risk status among people with diabetes, making it difficult to provide targeted prevention measures based on research findings [14, 15]. Though a recent study failed to find significant difference in foot care knowledge and behavior scores among diabetes patients with different DFU risks [16], the authors suggested further studies be necessary on exploring the foot care knowledge and behavior of people with diabetes with different foot risk levels.

Therefore, this study has three objectives: (1) to assess the foot risk level of people with diabetes; (2) to describe the current status of foot care knowledge and behavior among people with diabetes with different foot risks; (3) to explore the impact of foot knowledge and behavior on high-risk foot occurrence in people with diabetes and other key factors.

Materials and methods

Study design

This is a cross-sectional study using convenience sampling, and including people with diabetes who were hospitalized in the endocrinology department of two tertiary hospitals in northern China between June 2021 and December 2022. All patients who met the inclusion criteria were enrolled in the study.

Inclusion criteria: people with diabetes diagnosed by a regular medical institution according to the 1999 diagnostic criteria of the World Health Organization, aged ≥ 18 years, with normal cognitive function and good communication skills, and willing to participate in the study.

Exclusion criteria: patients who had undergone major amputations (above the ankle), those with severe impairment of heart, liver or kidney function, those with severe diabetic complications, and nondiabetic neuropathy such as central nervous system injury, prolapse of lumbar intervertebral disc, and congenital neuropathy.

Sample size calculation

We used the formula for calculating the sample size of a single rate 95% confidence interval for cross-sectional studies: sample size $N = \left(\frac{Z_{1-\alpha}}{\delta}\right)^2 P(1-P)$.

A previous study [17] indicated that the DFU 60-s screening tool can identify 37% to 48% of diabetic high-risk foot patients. In this study, we selected a p value of 37% and allowed for an error range of ± 5%. The calculated sample size was 359 patients, and a 10% expansion was added, resulting in a final sample size of 395 patients. A total of 410 patients were ultimately enrolled in this study, meeting the sample size requirements.

Data collection tool

The questionnaire used in this study consists of three parts: (1) demographic and disease-related information developed by the investigators. The demographic information includes age, gender, education level, marital status, occupation, smoking, and alcohol intake. The disease-related information includes duration of illness, fasting blood-glucose, other chronic diseases (hypertension, coronary heart disease, COPD, and cerebrovascular disease), history of diabetic foot ulcer and amputation. (2) Foot stratification methods, which were applied according to the IWGDF guidelines and the Guidelines for the Prevention and Treatment of Type [18]. The screening for high-risk diabetic foot includes assessment of peripheral neuropathy, peripheral vascular disease, and foot deformities using various tests such as pressure sensation (10 g monofilament test), vibration perception (128 Hz tuning fork test), ankle reflex, pinprick sensation, temperature sensation, ankle-brachial index (ABI), intermittent claudication, and rest pain. Foot deformities include hallux valgus, toe deformities (such as claw toe, hammer

toe, and mallet toe), metatarsal head protrusion, and post-amputation deformities. Risk stratification is based on the screening results, with Grade 0 indicating low-risk foot and Grades 1–3 indicating high-risk diabetic foot (Table 2). (3) Investigation of knowledge and behavior related to foot care using the knowledge and behavior Foot Care Scale [18], which consists of 17 items related to five aspects of foot care: examination of footwear and socks, foot cleansing and maintenance, selection of shoes and socks, risky behaviors related to foot injuries, and management of foot problems. The total score is converted into a standard score with a range of 0–100, with lower scores indicating poorer knowledge and behavior related to foot care. The reliability of the questionnaire was assessed using Cronbach's α coefficient, which was 0.824 for the knowledge questionnaire and 0.768 for the behavior questionnaire.

Data analysis

The collected data were checked for completeness and coded. Then, the data were entered into EpiData version 3.1 and then exported to SPSS version 24.0 for analysis. Normally distributed continuous variables were presented as mean ± standard deviation, and non-normally distributed continuous variables were presented as median and quartile range. Categorical variables were presented as frequency and percentage. Multiple logistic regression analysis was performed with high-risk foot as the dependent variable and statistically significant variables in the univariate analysis as independent variables. Differences were considered statistically significant if $p < 0.05$.

Ethical consideration

This study has been approved by the hospital's ethics committee, and all participants have provided informed consent and voluntarily participated in the study.

Results

Sociodemographic and disease-related characteristics

Sociodemographic characteristics

The study population was predominantly composed of individuals aged 61 years or older (37.1%), with a roughly equal distribution of men and women (52% and 48%, respectively). Approximately half of the patients had a middle to high school education (48.6%), and most were married (82.2%). The majority of the patients were retired (76.6%) (Table 1).

Disease-related characteristics

The majority of the patients had never smoked (63.4%), and had never alcohol intake (65.6%). The duration of diabetes was mostly greater than 10 years (60.7%), and the fasting blood-glucose was poor control (87.6%). The most common comorbidities were hypertension (55.4%) and coronary heart disease (29.3%) (Table 1).

Diabetic foot risk stratification

Among the 410 patients, a total of 367 (89.5%) were identified as high-risk for diabetic foot, while 43 (10.5%) were low-risk diabetic foot. Specifically, there were 135 (32.9%) patients for grade 1 high risk feet, 202 (49.3%) for grade 2 high risk feet, and 30 (7.3%) for grade 3 high risk feet (Table 2). The results of the three IWGDF screening tests are provided in Table 7 Appendix 1.

Foot care knowledge and behavior status

Foot care knowledge score

The foot care knowledge questionnaire score was 50.65 ± 18.60 (ranging from 5.88 to 94.12). The scores of each dimension in descending order were: foot injury risk behavior, foot cleanliness and maintenance, shoes and socks selection, foot and shoes inspection, and foot problem management (Table 3). The specific scores for each item are shown in Table 8 Appendix 2.

Foot care behavior score

The score of the foot care behavior questionnaire for 410 people with diabetes was 54.46 ± 11.87 (ranging from 19.61 to 86.27). The scores of each dimension, from high to low, were foot cleaning and maintenance, selection of shoes and socks, examination of feet and footwear, management of foot problems, and risky foot behavior (Table 4). The scores for each item in the foot care behavior questionnaire are shown in Table 9 Appendix 2.

Knowledge and behavior status of people with diabetes at different foot risk

Univariate analysis of variance found no statistically significant differences in knowledge scores among people with diabetes at different foot risk levels. However, there was a statistically significant difference in behavior scores ($p < 0.05$) among the different foot risk levels (Table 5).

Table1 Sociodemographic and Disease-Related Characteristics of the study population ($n=410$)

Variables	Categories	Frequency	Percent (%)
Age (years)	≤40	15	3.7
	41 ~	33	8
	51 ~	79	19.3
	61 ~	152	37.1
	71 ~	80	19.5
	> 80	51	12.4
Gender	Men	213	52
	Women	197	48
Education status	Primary school or below	59	14.3
	Junior high school to high school	199	48.6
	University and above	152	37.1
Marital status	No partner	73	17.8
	Have a partner	337	82.2
Occupation	Retired	314	76.6
	On duty	96	23.4
Smoking	Never	260	63.4
	Current	93	22.7
	Former	57	13.9
Alcohol intake	Never	269	65.6
	Current	91	22.2
	Former	50	12.2
Duration of DM	< 5 years	66	16.1
	5 to 10 years	95	23.2
	> 10 years	249	60.7
Fasting blood-glucose	Well controlled	51	12.4
	Poor control	359	87.6
Other chronic diseases			
Hypertension		227	55.4
Coronary disease		120	29.3
COPD		21	5.1
Cerebrovascular disease		52	12.7
History of foot ulcers		30	7.3
History of foot amputation		2	0.5

Table 2 DFU risk stratification ($n=410$)

Grade	Description	Frequency	Percent (%)
0	No neuropathy or vascular disease	43	10.5
1	Only neuropathy	135	32.9
2	Neuropathy combined with vascular disease and/or foot deformity	202	49.3
3	Foot ulcer history or amputation history	30	7.3

*Three patients with vascular disease alone were classified as grade 1

Analysis of risk factors associated with diabetic high-risk foot

Univariate analysis showed that there were statistically significant differences in age, occupation, the history of cerebrovascular disease, foot care knowledge standard score, and foot care behavior standard score between patients with high-risk and low-risk diabetic foot ($p<0.05$), as shown in (Table 6). Using the presence of high-risk diabetic feet as the dependent variable, and the factors that showed statistical significance in the univariate analysis as independent variables, a multiple logistic regression analysis was conducted. Age, the standard scores for foot care knowledge and behavior were used as original values, and the remaining variables were set as dummy variables, with good fasting blood glucose control, retired, and no history of cerebrovascular disease as reference levels. The multiple logistic regression analysis showed that age, the history of cerebrovascular disease, and the foot care behavior score were the influencing factors for people with diabetes to develop high-risk feet (Table 6).

Table 3 Scores of foot care knowledge questionnaire dimensions for patients ($n=410$)

Foot care knowledge dimensions	Standard score ($x \pm s$)	Minimum value	Maximum value	Median
Foot injury risk behavior	71.46 ± 25.39	0	100	75
Foot cleanliness and maintenance	66.04 ± 24.11	0	100	75
Selection of shoes and socks	53.51 ± 20.65	0	100	60
Examination of feet and footwear	50.12 ± 39.79	0	100	50
Management of foot problems	29.88 ± 33.41	0	100	0
Total foot care behavior score	57.50 ± 15.12	11.76	94.12	58.82

The standard score is calculated as (actual score—lowest possible score) / (highest possible score—lowest possible score) × 100

Table 4 Scores of foot care behavior questionnaire dimensions for patients ($n=410$)

Foot care behavior dimension	Standard score ($x \pm s$)	Minimum value	Maximum value	Median
Foot injury risk behavior	13.72 ± 15.33	0	100	8.33
Foot cleanliness and maintenance	58.82 ± 23.74	0	100	58.33
Selection of shoes and socks	48.80 ± 19.84	0	100	53.33
Examination of feet and footwear	35.53 ± 29.88	0	100	33.33
Management of foot problems	15.16 ± 21.04	0	100	0
Total foot care behavior score	54.46 ± 11.87	19.61	86.27	54.90

The standard score is calculated as (actual score—lowest possible score) / (highest possible score—lowest possible score) × 100

Table 5 Knowledge and behavior status of diabetic patients with different foot risk classifications ($n=410$)

Grade	Frequency	Foot Care Knowledge Standard Score	Foot Care Behavior Standard Score
0	43	53.21 ± 17.27	49.70 ± 11.26
1	135	57.95 ± 13.83	54.60 ± 12.08
2	202	58.47 ± 15.43	55.06 ± 11.62
3	30	55.10 ± 14.69	56.60 ± 12.32
F-value		1.733	2.842
p-value		0.16	0.038*
*$p<0.05$			

Discussion

Late complications of diabetes, especially DFU, can lead to amputation, functional decline, increased financial burden for patients, and a sharp decline in their quality of life. Therefore, preventing DFU is necessary. To our knowledge, this is the first such survey conducted in northern China to determine the status of foot care knowledge and behaviors of patients with different DFU risk levels during hospitalization in a tertiary hospital, as well as the related risk factors for high-risk foot development.

In this study, a total of 367 cases of high-risk foot (89.5%) and 43 cases of low-risk foot (10.5%) were screened. Among them, 135 cases (32.9%) were classified as grade 1 high-risk foot, 202 cases (49.3%) were grade 2 high-risk foot, and 30 cases (7.3%) were grade 3 high-risk foot. Compared with previous studies, the overall detection rate of high-risk foot in this study was relatively high [19, 20]. This may be due to the fact that tertiary hospitals in China usually admit difficult and critically ill patients, who are older, have a longer course of disease, and more complications [21]. Screening for high-risk foot as the first step in DFU prevention should be given more attention by healthcare workers. However, in practice, medical staff often pay more attention to patients' blood glucose control and the management of related complications, and insufficient attention is paid to the early screening of high-risk foot. Therefore, in patient education, the importance of high-risk foot screening should be emphasized first. Additionally, it may be related to the increase in screening tools. Previous studies mainly focused on single examinations for high-risk foot screening [22, 23], while the research tool used in this study had more screening items and higher sensitivity, resulting in more cases of neuropathy being detected [18]. Currently, research on high-risk foot screening tools is still in its early stages. Developing a systematic and simple method for high-risk foot screening and making it easy to implement in various settings can better serve people with diabetes for high-risk foot screening.

The results of this study indicate that the knowledge and behavior scores for foot care in people with diabetes were at a moderately low level. In terms of foot care knowledge,

Table 6 Univariate and Multivariable logistic regression analysis for high-risk foot in patients with diabetes ($n=410$)

Variable	Univariate analysis		Multivariate analysis	
	p	OR(95%CI)	*p*	OR(95%CI)
Female	0.716	0.890 (0.475–1.667)		
Age(y)	0.001	1.042(1.018–1.067)	**0.017**	**3.831(1.268–11.578)**
Education status				
Junior high school to high school/Primary school or below	0.160	1.924(0.773–4.792)		
University and above/Primary school or below	0.772	0.880(0.370–2.094)		
Marital status	0.228	0.552 (0.21–1.452)		
Occupation	0.005	0.391(0.204–0.750)	0.236	0.551(0.205–1.476)
Smoking	0.260	1.623(0.699–3.773)		
Alcohol intake	0.769	1.123(0.519–2.431)		
Duration of DM(y)				
5 to 10 / < 5	0.852	1.092(0.432–2.762)		
> 10 / < 5	0.296	1.551(0.618–3.535)		
Hypertension	0.088	1.714(0.923–3.182)		
Coronary disease	0.615	1.195(0.596–2.396)		
COPD	0.354	2.616(0.343–19.966)		
Cerebrovascular disease	0.017	3.831(1.268–11.578)	**0.045**	**8.217(1.047–64.513)**
Fasting blood-glucose	0.096	0.292(0.069–1.244)		
Foot Care Knowledge Standard Score	0.048	1.020(1.000–1.040)	0.474	0.988(0.957–1.020)
Foot Care Behavior Standard Score	0.003	1.040(1.013–1.067)	**0.009**	**1.06(1.015–1.108)**

patients had good knowledge of foot cleaning and maintenance, as well as knowledge of the risk behaviors associated with foot injury. However, their knowledge of shoes and socks selection, examination of feet and footwear, and management of foot problem was insufficient, particularly in terms of knowledge of the need for regular foot checkups at the hospital and applying moisturizing cream after washing their feet. This is similar to the findings of Zheng et al. [24], which showed that patients had limited knowledge of foot care and shoes selection. Due to cultural differences, many Chinese people habitually soak or wash their feet in warm water daily, which may not indicate sufficient knowledge of foot cleaning and maintenance [16]. Therefore, when providing patient education, it is important not only to explain the correct knowledge, but also to inform patients about the harmful effects of incorrect knowledge on the development of DFU, so that patients can consciously accept correct knowledge of DFU and maintain good foot behaviors.

In terms of foot care behavior, patients had good behaviors in foot cleaning and maintenance and shoes and socks selection, but poor behaviors in feet and footwear examination, foot injury behavior, and foot problem management, particularly in terms of patients not being able to visit the hospital for regular foot checkups, not being able to trim their toenails correctly, and wearing slippers in bare feet. This is consistent with the findings of Long et al. [25], which showed that regular foot checkups were the worst behavior of people with diabetes. However, the findings of Maha Obaid Alharbi [26], which indicated that over 50% of patients demonstrated good foot care behaviors, appear to differ from the results of our study. One possible explanation for this discrepancy is the absence of specialized foot clinics in community or general hospitals in China, as well as the lack of regular foot checkups included in diabetes follow-up. As a result, patients mainly rely on their own knowledge and daily habits for foot care, and may not fully appreciate the importance of good foot care behaviors in preventing foot complications. Therefore, it is necessary to provide prevention methods and educational programs for foot ulcers, encourage patients to regularly check their foot condition, and promote the establishment of self-care behaviors.

The results of this study showed no statistically significant difference in foot care knowledge scores among patients with different levels of foot risk, while statistically significant differences were found in foot care behaviors. This may be related to the insufficient emphasis on DFU prevention in various medical institutions in China, and

even if patients develop DFU, medical staff tend to focus more on regulating blood glucose, controlling infection, improving nutrition, and neglecting the impact of preaching foot care knowledge on DFU. In addition, this study found a statistically significant correlation between foot condition and patient age and foot care behavior, indicating that as patients age and their personal knowledge reserves increase, they will pay more attention to blood glucose monitoring and control, and establish good behavioral habits [27]. However, the source of this difference is not that medical staff have health education targeted at patients with different foot risk levels, but rather the natural differences in lifestyle habits that arise as patients' educational levels increase and their disease awareness deepens with age. Therefore, it cannot be assumed that as patients' foot risk levels increase, their foot behavior will improve.

The results of this study showed that age is an important predictive factor for high-risk diabetic foot patients. Other studies have also indicated that people with diabetes over 60 years of age are three times more likely to experience peripheral neuropathy than those under 60 [28, 29]. This may be due to age-related visual impairment, which may limit the ability to conduct normal foot and footwear examinations, as well as the presence of osteoporosis and poor coordination. Therefore, education on foot care should be provided to elderly patients and their families. The results of this study also showed that having cerebrovascular disease is an important risk factor for high-risk feet. This is consistent with the results of a cross-sectional survey that included 62,681 patients [30]. That study showed that cerebrovascular disease, age ≥ 45 years, and poor glycemic control were all important risk factors for DFU. This may be due to the fact that people with cerebrovascular disease often have limb sensory impairments, which can lead to delayed diagnosis and treatment. It is recommended that patients with cerebrovascular disease undergo regular foot examinations to assess their risk status and ensure early detection and treatment of foot problems.

In addition, the results of this study show that foot care behaviour scores are also a risk factor for diabetic high risk feet. This finding highlights the importance of patient self-management in preventing complications of DFU. This is consistent with previous research, indicating that foot care practices are crucial for preventing and managing complications of DFU [27]. Relevant studies have shown that the development of foot care education programs can improve foot health outcomes and reduce the incidence of diabetes complications [31]. Therefore, healthcare providers should emphasize the importance of foot care behavior in diabetes management and incorporate this education into their treatment plans to further improve the quality of life of patients .

Limitations

The sample collection for this study was conducted only at two tertiary hospitals in northern China, which may limit the representativeness and generalizability of the findings. In addition, as this study was designed as a cross-sectional study, causal relationships cannot be inferred. Furthermore, due to the short study period, we were unable to diagnose the late outcomes of people with diabetes and observe the progression of their high-risk feet.

Conclusions

The prevalence of high-risk feet in patients with diabetes was found to be high in tertiary hospitals in northern China, with more cases of grade 1 and grade 2 high-risk feet, and poor knowledge of diabetic foot prevention and foot care behavior. We found that age, history of cerebrovascular disease, and foot care behavior score significantly influenced the incidence of high-risk feet in patients. Therefore, it is necessary to strengthen follow-up and education on diabetic foot prevention knowledge for patients who are elderly, suffer from cerebrovascular diseases, and have lower foot care behavior scores. The results of this study can guide the future resource promotion for the most needed groups, thereby helping to reduce the incidence of diabetic feet in adult populations.

Appendix 1

Table 7 Results of the IWGDF Three-Screen Assessment ($n = 410$)

Items	Frequency	Percent(%)
Results of Peripheral Neuropathy		
Ankle reflex	117	28.5
Pinprick sensation	127	30.9
Temperature sensation	130	31.6
Vibration perception	108	26.2
Pressure perception	61	14.7
Results of Vascular Lesions		
ABI	75	18.0
Posterior tibial pulse	162	38.8
Dorsalis pedis pulse	35	8.4
Resting pain	35	8.4
Intermittent claudication	61	14.5
Foot Deformities		
Claw toe	17	4.1
Hallux valgus	9	2.2
Prominent metatarsal heads	4	1.0

Appendix 2

Table 8 Scores for each item on the questionnaire assessing knowledge of foot care among patients ($n=410$)

Items	Number of correct responses (n)	Percent (%)
Check feet daily	213	52
Wash feet daily	350	85
Test water temperature before washing feet	298	73
Dry feet thoroughly after washing	332	81
Apply moisturizer after washing feet	177	43
Trim toenails correctly	103	25
Choose shoes in the afternoon or evening	190	46
Wear comfortable shoes	363	89
Check inside of shoes	198	48
Change socks daily	291	71
Choose light-colored socks	158	39
Gradually adapt to new shoes	95	23
Regularly check feet	68	17
Do not walk barefoot	313	76
Do not wear shoes that expose toes	233	57
Do not wear tight socks	346	84
Do not use heating devices	280	68

Abbreviation *DFU*: Diabetic foot ulcer; *IDF*: The International Diabetes Federation; *IWGDF*: The International Working Group on the Diabetic Foot; *ABI*: Ankle-brachial index

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval This study has been approved by the hospital's ethics committee, and all participants have provided informed consent and voluntarily participated in the study.

Conflict of interest The authors declare no conflict of interest.

Table 9 Scores for each item on the questionnaire assessing behavior of foot care among patients ($n=410$)

Items	Scores($x \pm s$)	Never	Occasionally	Often	Always	Better behavior(%)
Check feet daily	2.11 + 1.09	154	127	59	70	31
Wash feet daily	3.29 + 0.90	15	79	90	226	77
Test water temperature before washing feet	2.93 + 1.19	79	68	65	198	64
Dry feet thoroughly after washing	3.05 + 1.18	71	61	55	223	68
Apply moisturizer after washing feet	1.82 + 1.09	228	83	43	56	24
Trim toenails correctly	1.79 + 1.10	240	73	39	58	24
Choose shoes in the afternoon or evening	2.28 + 1.22	157	91	54	108	40
Wear comfortable shoes	3.45 + 0.94	36	23	71	280	86
Check inside of shoes	2.02 + 1.10	183	95	72	60	32
Change socks daily	2.82 + 1.02	48	113	114	135	61
Choose light-colored socks	2.14 + 1.04	136	141	71	62	32
Gradually adapt to new shoes	1.63 + 1.04	279	50	35	46	20
Regularly check feet	1.09 + 0.45	391	10	1	8	2
Do not walk barefoot	3.72 + 0.69	13	16	43	338	93
Do not wear shoes that expose toes	3.32 + 0.91	23	56	99	232	81
Do not wear tight socks	3.58 + 0.87	29	17	50	314	89
Do not use heating devices	3.73 + 0.68	13	15	41	341	93

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