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Perceptions of protective shoes and recommendations from patients with diabetic foot ulcers

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Abstract: Development of diabetic foot can cause serious harm to a patient's body and pose a heavy burden on family members and society. Protective shoes are of great significance to preventing diabetic foot. The aim of the current study was to understand patients' views and suggestions concerning the selection and promotion of protective shoes for diabetics in order to explore existing obstacles and to provide a reference for improving relevant public health care policies and clinical decision-making for patients with diabetic foot ulcers (DFUs). A total of 10 patients with DFUs were recruited. All participants completed a one-hour semi-structured interview, and results reflected the participants' choice of footwear, the patients' perceptions and acceptance of protective footwear, and factors influencing those processes. The use and promotion of protective shoes in China requires greater support, including improved medical insurance policies, promotion of multidisciplinary cooperation between medicine and industry in clinical practice, and better health education.

***Keywords*:** protective shoes, diabetic foot ulcers, footwear, qualitative study

Introduction

With the growing elderly population, the number of patients with diabetes is also increasing (*1*). Diabetic foot ulcers (DFUs) are one of the most serious chronic complications in patients with diabetes. DFUs refer to tissue infections, ulcers, or tissue injuries to the foot of patients with current or previously diagnosed diabetes, and they are usually accompanied by lower extremity neuropathy and/or peripheral artery disease (*2*). DFUs occur in 9.1 million to 26.1 million diabetic patients worldwide every year (*3*) and the treatment of DFUs is difficult, their prognosis is poor, and recurrence rates are high.

Wearing protective shoes is particularly important for prevention and management of DFUs. Australia issued the Guidelines for Footwear for Diabetic Patients in 2013 and 2018, which described the importance of wearing appropriate footwear to prevent foot ulcers (*4*). The Chinese guidelines for the prevention and treatment of DFUs suggest that orthopedic decompression designed and manufactured based on plantar pressure and foot shape can effectively prevent and reduce foot ulcers in high-risk patients (*5*). A study in the Netherlands, however, found that 33–82% of diabetic patients wear inappropriate shoes, and 21–33% of DFUs are caused by wearing unsuitable shoes or socks (*2*). A study in China found that more than 30% of diabetic patients had insufficient knowledge about proper shoe selection (*6*). A significant number of patients who have or may develop DFUs are reluctant to use protective shoes, which greatly increases the risk of foot ulcers developing and worsening (*7*).

Therefore, the aim of the current study was to explore the limitations in the promotion and use of protective shoes from the perspective of patients with DFUs through qualitative research in order to provide a reference to improve relevant public health care policies and clinical decision-making.

The state of and views on the use of protective shoes

A total of 10 patients were included in this study (Supplemental Data, *https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=71*). Patient characteristics are shown in Table 1. All of the participants had, at the time, a current foot ulcer problem, and the longest duration of a foot ulcer was nine years and the shortest was four months. Men preferred to wear cloth or leather shoes that are easy to put on and take off and that do not allow tightness to be adjusted. Women wore pointed sandals or slippers; an inappropriate heel height increases the weight borne by the heels and causes heel pain.

Six of the ten patients had never used protective footwear, three patients who had used protective

Table 1. Characteristics of study participants (n = 10)

Characteristics	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Age	48	56	68	74	68	74	73	42	68	64
Sex	Female	Male	Male	Female	Male	Female	Male	Male	Male	Male
Ethnicity	Han	Han	Han	Han	Han	Han	Han	Han	Han	Han
Level of education	Middle school	Middle school	Middle school	Primary school	Middle school	College	Undergraduate	High school	High school	Middle school
Marital status	Married	Married	Married	Widowed	Married	Married	Married	Married	Divorced	Married
Residence	Urban	Urban	Urban	Rural	Urban	Rural	Rural	Urban	Urban	Urban
Living alone	No	No	No	Yes	No	No	No	No	Yes	No
Annual household income (RMB)	<3000	>6000	3000-6000	<3000	>6000	>6000	>6000	>6000	>6000	3000-6000
Health insurance	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	House wife	Worker	Accountant	Unemployed	Worker	Primary school teacher	Designer	Engineer	Assistant	Administrative staff
Self-rated health status	Complete self-care	Complete self-care	Partial self-care	Partial self-care	Partial self-care	Partial self-care	Partial self-care	Complete self-care	Partial self-care	Partial self-care
Duration of diabetes (years)	< 10	10-15	> 15	10-15	> 15	10-15	10-15	10-15	10-15	< 10
Neurological/vascular lesions	+	+	+	+	+	+	+	+	+	+
Have used protective shoes	No	Yes	No	No	Yes	No	Yes	No	No	Yes

footwear ceased doing so for some reason, and only one patient continued to use protective footwear. Most patients had a certain level of understanding of the functions of diabetes footwear, but they do not know enough about the causes of DFUs and they often had too high or too low expectations of protective shoes.

In addition, studies have indicated that shoes for diabetics should be worn for at least 7 hours every day to achieve the desired effect (*8*). In the current study, however, patient compliance was low, which primarily reflects the choice of shoes when walking at home.

Factors influencing the perception and acceptance of protective shoes

Lack of education

Patients mostly obtained information from their relatives and friends rather than from guidance and recommendations from doctors and nurses. Thus, many patients lacked an in-depth understanding of the function of protective shoes, which may influence their choice of footwear. Moreover, the rehabilitative effectiveness of protective shoes may not be obvious to patients in a short period of time, so the importance of those shoes may be only appreciated over the long term. These factors prompt patients to be sceptical about the function of protective shoes.

Economic burden

Chinese researchers have found that the acceptable cost of protective shoes for patients is less than 500 yuan and that 32.96% of patients will not choose protective shoes because of the high price. Shoes for diabetics have been widely used in Europe, the United States, and other countries and are included in the medical insurance system. Due to gaps in relevant medical insurance systems in China, however, obtaining these shoes represents a significant economic burden, which affects the decision to buy them. As can be seen from the interviews, the wear of appropriate shoes by patients is related to socioeconomic factors, and the increased expenses may cause patients to abandon recommendations completely.

Imbalance between supply and demand

Options for protective shoes for diabetics are relatively limited, and there are relatively few types of protective shoes available on the market, so they are unable to meet the needs of patients wishing to wear corresponding types of protective shoes in different environments. The foot morphology of patients with diabetes, and especially elderly patients, changes due to age and condition, and it is often accompanied by abnormal foot structure, so the feet and shoes often do not match. At present, most shoes

Table 2. Perceptions of patients with diabetic foot ulcers regarding the use of protective shoes

Key concepts	Illustrative quotations from participants
Lack of education: Skeptical and/or lack in-depth understanding of the function of protective shoes	"Well…to be honest, I've never heard of certain shoes that can prevent foot ulcers, and no one at home ever mentioned such shoes." [H4]
	"I always feel that the dedicated protective shoes are heavy… so you know, I stand for a long time every day, which would make them inconvenient for my work." [H6]
	"I usually wear slippers, which feel good and which are breathable, cheap, easy to put on and take off, and do not apply pressure to my wound." [H9]
	"I've ordered those kind of shoes before, but they were not very comfortable to wear. ... . They were not as comfortable as normal shoes…so sometimes I'm afraid that they would worsen my wound..." [H2]
	" ... and wear them for about two months, but the plantar ulcers were not significantly alleviated. The shoes did not seem to have much of an effect...." [H10]
	"...the effectiveness of protective shoes will decrease after about 3 months of wear. I felt that the material was not advanced enough to convince me to buy them." [H8]
Economic burden: Protective shoes are expensive	"I always feel that they are not worth it… and the most expensive shoes I usually wear are 200 or 300 yuan. I think I should cut down on my walking, haha." [H5]
	"… they are…too…too expensive..... There is no sense in spending so much money to buy a pair of those shoes. " [H6]
	"...they cost me more than 900 yuan, which I had to pay myself. But hey... After all, the shoes are consumables, and I'm worried that they will deform after wear and cease to be effective." [H7]
	"I have heard of those shoes before, but my friend ordered the shoes for about 1,200 yuan, which is expensive." [H9]
Imbalance between supply and demand: The conflict between style and attention from others. Options for protective shoes for diabetics are limited and they are not available on the market.	"Will wearing such special shoes draw attention to my foot problems? If the answer is yes, er…I don't think I would choose to wear them…" [H1]
	"The doctor said that I should choose protective shoes, but I don't know the appropriate place to order from." [H3]
	"Protective shoes are not stylish or fashionable in appearance, and they are black." [H7]
	"Moreover, the production cycle is too long, and they take 1-2 months to arrive. " [H9]
	"My feet have been operated on and have deformities, but there is no place to buy shoes suitable for deformities."[H10]

for diabetics imported from abroad are not completely suitable for Chinese people because of the differences in foot type (*9*). Social situations pose a dilemma: although some patients know that foot protection is helpful for their foot rehabilitation, they often refuse to use protection shoes because they conflict with style and also draw attention to their health. A female patient said that the style of shoes has improved in recent years. Even so, the style of shoes may differ from what one normally wears. The perceptions of patients with diabetic foot ulcers regarding the use of protective shoes are shown in the Table 2.

Suggestions

Emphasizing health education

Improved patient education can delay the development of foot ulcers and prevent amputations in patients. Healthcare personnel must make clear the fact that the prescribed interventions should be translated into practical actions related to foot care. Health education for people with diabetes is a long-term important task for hospitals, the community, healthcare personnel, and families, and education needs to be followed up and evaluated so that patients can understand their limited knowledge regarding shoes and whether they can correctly use them as prescribed (*10*). Personnel should continue to refine the systems of shoe-related health education, develop professional, comprehensive, and systematic educational plans based on the individual circumstances of the patients, and expand methods of communication (manuals, congresses, and home visits) to provide patients and their families with prompt, systematic, and comprehensive health education in order to encourage them to shift from passive management to active participation in the self-management of their disease (*11,12*).

Formulating and improving social policies

The costs of preventing DFUs are far lower than the costs of treatment, and the health benefits of ulcer healing are far greater than the costs of protective shoes. In 2019,

the guidelines for the prevention of DFUs issued by the International Diabetic Foot Association included diabetic shoes as special assistive devices; the shoes were covered by medical insurance in developed countries in Europe and North America (*13*). These efforts have reduced the amputation rate among diabetics by more than 50% (*14*). In China, protective shoes are not covered by medical insurance, leading to limited use and promotion of protective shoes for patients with DFUs. Therefore, relevant systems need to be improved to help reduce the economic burden on patients and to encourage them to choose protective shoes.

In January 2023, the Ministry of Civil Affairs of China approved and issued "Diabetic Insole Configuration" as an industry standard. The issuance and implementation of this standard has far-reaching significance, but it is only the first step of a long march. There is still a long way to go to ensure the safety, effectiveness, and widespread promotion of protective shoes for diabetics.

Multidisciplinary collaboration in clinical practice

For maximum effect, protective shoes should be able to be worn by patients at any time without being limited to a season, place, or style (*15*). For example, indoor shoes be similar to outdoor shoes with respect to fit and ability to relieve pressure but should be distinguished from outdoor shoes with respect to the ease of wear and removal as well as the materials of manufacture (*16*) in order to improve patient compliance by wearing shoes indoors.

In China, most studies have focused on the preliminary verification and examination of foot protection footwear. The development and manufacture of appropriate protective shoes for different patients with DFUs depends on medical development and enhanced multidisciplinary cooperation with medical engineering. For the elderly population, the designer should simplify the function of protective shoes, reduce the number of steps to use protective shoes, shorten the production cycle as much as possible, and encourage patients to be more willing to accept protective shoes (*17*). More attractive styling of protective shoes is related to a higher level of compliance. In addition, plantar pressure measurement technology can be applied to the design of diabetes shoes (*18*) to permit monitoring of plantar pressure at any time and anywhere. This would permit analysis of the health status of human feet through plantar pressure levels and distribution (*19*). Footwear design is changing from an experience-based and skill-based approach to a more scientific data-driven approach, and more experimental research is needed to support this transition.

In conclusion, this study found that Chinese participants' use of protective shoes for diabetics is influenced by the financial burden, the availability of footwear resources to meet demand, and health education received. This study has shed light on these complexities and it raises some questions to consider. The course of this study suggests that participants' concerns about the footwear are often overlooked in clinical settings. Patients need to constantly weigh the advantages and disadvantages of wearing protective shoes because there are few available footwear options, hampering the promotion and use of protective shoes. Protective shoes are recommended as a means to address the emotional, social, and physical needs of diabetic patients rather than just serving as a medical device. Such changes will depend on improved policies, multidisciplinary cooperation, health education from medical teams, and family and community support.

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