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Predictors of Foot Care Behavior among Patients with Diabetes Mellitus: A Cross-Sectional Study

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Abstract

Background: Diabetes mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia and glucose intolerance, which may lead to various complications, including diabetic foot ulcers. Inadequate foot care practices among patients with DM remain a significant concern and may increase the risk of foot injuries and infections.
Objective: This study aimed to identify factors associated with foot care behavior among patients with DM at the Bakauheni Health Center, South Lampung.
Methods: This study employed a quantitative, descriptive observational analytic design with a cross-sectional approach. The sample consisted of 91 respondents selected through a purposive sampling technique. Data collection was conducted at the Bakauheni Health Center. The research instrument used was the HDFSS & NAFF questionnaire to measure family support and foot care behavior.
Results: The results showed that the majority of respondents were female (60.4%), in the late elderly group (41.8%), and had a basic level of education (84.6%). Most respondents reported high family support (51.6%) and demonstrated good foot care behavior (79.1%). Bivariate analysis using Kendall's Tau-b test revealed a significant correlation between duration of illness and family support with foot care behavior in DM patients ($p < 0.05$). Furthermore, ordinal logistic regression analysis indicated that family support was the most influential factor affecting foot care behavior ($p = 0.037$; OR = 4.039).
Conclusion: In conclusion, family support plays a crucial role in improving foot care behavior among patients with DM. It is recommended that healthcare teams, particularly community nurses, involve family members to enhance adherence to foot care practices and prevent diabetic foot complications.

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INTRODUCTION

The increasing global burden of diabetes mellitus (DM) not only reflects a metabolic disorder, but also indicates a growing public health challenge due to its long-term complications (Hossain et al., 2024; Khunti et al., 2023). Among these complications, diabetic foot ulcers remain one of the most preventable yet highly prevalent conditions, contributing significantly to hospitalization rates, increased healthcare costs, and disability-adjusted life years. This condition highlights the importance of early preventive behaviors, particularly foot care practices among patients with DM (Mullan et al., 2020; Narmawan et al., 2018).

The incidence of DM increases yearly. It is estimated that at least 463 million people aged 20–79 years worldwide had DM in 2019, with a prevalence rate of 9.3% in the same age group. The prevalence is estimated to increase with population aging to 19.9%, or 111.2 million individuals aged 65–79 years. The number is predicted to increase to 578 million in 2030 and 700

million in 2045. Based on data from the Basic Health Research in 2018, the prevalence of DM in Indonesia among individuals aged ≥15 years was recorded at 6.9% to 8.5%, while the prevalence of DM based on physician diagnosis increased from 1.2% to 2%.

People with DM can experience complications at all cellular and anatomical levels. Chronic complications can manifest at the microvascular level (Zuliani et al., 2025). Diabetic foot wounds or infections are among the most common complications requiring hospitalization and are the leading cause of lower limb amputation in patients with DM (Lin et al., 2020; Shatnawi et al., 2018). Open wounds on the skin can become a site for bacterial colonization and may progress to bacterial invasion and infection.

The anatomy of the foot, which consists of several rigid but interconnected compartments, facilitates wider spread of infection to other parts of the foot. Early foot care is essential to prevent foot wounds in people with DM and to reduce the risk of amputation (Black et al., 2009). Foot care behaviors for patients with DM include always wearing footwear when walking, including outside the home; checking footwear before use; inspecting foot shape and color daily; keeping feet clean, dry, and moisturized; trimming toenails regularly; drying between the toes after bathing; wearing comfortable shoes (neither too large nor too small); and avoiding the use of hot water bottles or heated stones intended to warm the feet.

Based on the literature review, several factors influence independent foot care behavior in patients with DM, including knowledge level and duration of illness Ginting (2024), age, education, duration of diabetes, and family history of foot care behavior Xiong (2020), as well as self-efficacy and social support. Poor foot care behavior may lead to ulcers, while unstable blood glucose can worsen wound conditions and eventually result in gangrene. Untreated gangrene may progressively reduce patients' quality of life. Efforts to prevent diabetic foot complications require not only patient-centered interventions but also community-based approaches. A study by Prabawati (2024) highlighted the effectiveness of empowering community health cadres in preventing DM complications through dietary management and foot care education. The study demonstrated that community-based empowerment strategies can improve knowledge and awareness, which are essential components in promoting preventive behaviors among patients with DM.

In addition, these findings suggest that DM management should not rely solely on healthcare professionals but also involve community resources and support systems. In the Indonesian context, where primary healthcare services such as Puskesmas play a central role, the involvement of community health cadres can strengthen health promotion efforts and improve patients' adherence to self-care practices, including foot care. Thus, understanding the factors that influence foot care behavior remains crucial to optimizing both individual and community health interventions.

Family support is a form of assistance that includes providing information about foot care for patients with diabetic ulcers. It may also include emotional support such as reassurance, appreciation support such as encouragement to exercise regularly, accompaniment during healthcare visits so patients do not feel alone, and assistance with routine foot care to prevent ulcers and reminders to consistently wear footwear to avoid direct contact with the floor. This emphasizes the importance of family support in preventing ulcer-related complications. This is supported by research conducted by Galuh (2021), which reported a significant relationship between family support and self-management ($p = 0.000$; $p < 0.05$).

From a nursing perspective, foot care behavior in patients with diabetes mellitus (DM) can be explained through Dorothea Orem's Self-Care Theory, which emphasizes an individual's capacity to perform self-care activities to maintain health and prevent complications. Within this framework, foot care represents a form of self-care agency influenced by internal factors such as knowledge and motivation, as well as external factors, including family support and access to healthcare services (Alligood, 2025). When patients are unable to meet their self-care demands, nursing interventions are required to address this deficit. Despite the availability of clinical guidelines and structured education programs, adherence to foot care practices among DM patients remains suboptimal. This suggests that knowledge alone is insufficient to drive behavioral change and highlights the need to explore multidimensional factors, including psychosocial and environmental influences, that affect adherence to foot care recommendations.

To understand this issue more concretely, interviews were conducted with six patients with diabetes, four of whom had active foot ulcers and two without ulcers. The findings revealed several recurring concerns. Patients reported long-standing diabetes accompanied by difficulties in performing daily activities, fatigue related to ongoing treatment, and irregular medication adherence. These challenges were largely attributed to a perceived lack of family support in diabetes management and wound care. Consistent with these findings, the diabetes coordinator at Bakauheni Primary Health Center identified several contributing factors to the rising incidence of DM in the area, including physical inactivity, high-fat dietary patterns, alcohol consumption, non-compliance with blood glucose monitoring, and inadequate family support, such as absence of accompaniment to health services.

Each month, approximately 105 patients visit the health center for diabetes management, with seven specifically receiving foot wound care. Common complaints include irregular diet and lifestyle, nocturia, polydipsia, polyphagia, and progressive weight loss. Treatment outcomes remain inconsistent; while some patients show improvement, others do not achieve adequate wound healing. Of particular concern, no structured diabetic foot exercise program is currently implemented at the facility.

Although foot care research exists at the global level, a specific gap remains in understanding the dominant factors influencing foot care behavior within the Indonesian primary healthcare context. Bakauheni Health Center lacks a structured diabetic foot exercise program, and preliminary data indicate insufficient family support, both of which represent critical barriers to optimal self-care. This study therefore aims to address these gaps by investigating multidimensional factors that shape foot care behavior among DM patients in this setting. Understanding these determinants is crucial for developing targeted nursing interventions that are not only clinically effective but also culturally and socially appropriate. Therefore, identifying key influencing factors such as family support, duration of illness, and individual characteristics is essential to strengthening diabetes self-management programs. Thus, this study aims to analyze factors associated with foot care behavior among patients with DM at Bakauheni Health Center, South Lampung.

METHOD

The study employed a quantitative approach with an observational analytic design using a cross-sectional method. The research was conducted in the working area of the Bakauheni Primary Health Centre, South Lampung, Indonesia. The study population consisted of patients diagnosed with diabetes mellitus (DM) who were registered and receiving care at the health centre. The sample size was determined using the Slovin formula [$n = N/(1 + Ne^2)$], where N = 120 DM patients and e = 0.10 margin of error, yielding n = 91 respondents. Participants were selected using a non-probability sampling technique, specifically purposive sampling, based on the following inclusion criteria: patients diagnosed with DM, aged ≥25 years, actively receiving treatment at the health centre, and living with family members.

Data were collected using structured questionnaires. Family support for DM was measured using the Hanserling Diabetes Family Support Scale (HDFSS), developed by Hensarling (2009), which assesses multiple dimensions of family support, including emotional, informational, and instrumental support. Foot care behavior was measured using the Nottingham Assessment of Functional Footcare (NAFF), which evaluates the frequency and consistency of foot care practices among patients with DM. Prior to data collection, this study obtained ethical approval from the Ethics Committee of STIK Sint Carolus (No. 103/KEPPKSTIKSC/VII/2024). All respondents provided informed consent before participating in the study. Data analysis was conducted in two stages: descriptive (univariate) analysis was used to summarize respondents' characteristics and study variables. Bivariate analysis was conducted using Kendall's tau test to examine the relationship between independent variables and foot care behavior. Furthermore, ordinal logistic regression was applied to identify the most influential factors affecting foot care behavior among patients with DM.

RESULTS AND DISCUSSION

Results

Table 1. Percentage distribution and correlation analysis of variables of diabetes patients at the sub-district of Bakauheni Lampung Health Center work area

Variables	n	%	p value
Gender			
Male	36	39,6	0.444
Female	55	60,4	
Age			
26-35 years old	3	3,3	
36-45 years old	7	7,7	0.687
46-55 years old	28	30,8	
56-65 years old	38	41,8	
> 65 years old	15	16,5	
Educational background			
Basic	77	84,6	0.462
Advance	14	15,4	
Duration of Illness			
< 3 years	33	36,3	**0.038**
3-5 years	41	45,1	
>5 years	17	18,7	
Blood glucose			
Normal	74	81,3	0.703
Hyperglycemia	17	18,7	
Family support			
Low	44	48,4	**0.011**
High	47	51,6	
Foot Care Behaviour			
Poor	19	20.9	
Good	72	79.1	
Total	91	100	

The results of research conducted on 91 respondents with DM, as depicted in table 1, showed that the majority of respondents were female with a total of 55 (60.4%), a total of 41 were in the elderly (age range 56-65 years), and a total of 77 (84.6%) had the basic educational background category. In addition, most respondents' having a duration of suffering DM for 3-5 years (45.1%), with 74 (81.3%) had blood glucose in normal range, and over fifty per cent (51.6%) had high family support. For the dependent variable in this study, most respondents (79.1%) had a good behavior in performing foot care. Kendal's Tau B statistical test found a significant relationship between duration of suffering from DM, and family support towards foot care behavior in DM patients (p-value < 0.05).

These findings indicate that although most respondents demonstrated good foot care behaviors. A substantial proportion still exhibited inadequate practices. This discrepancy suggests that good behavior may not be consistently performed across all aspects of foot care, indicating partial adherence rather that comprehensive self-care.

Table 2. Partial Parameter Statistical Test

Variabel	Beta	Standar Error	Wald	P-value
Age	0.235	0.292	0.647	0.421
Gender	0.341	0.582	0.343	0.558
Education level	0.502	0.889	0.318	0.573
Duration of illness	-0.680	0.444	2.346	0.126
Family support	**1.240**	**0.596**	**4.332**	**0.037**

Variabel	Beta	Standar Error	Wald	P-value
Blood glucose	0.262	0.776	-.114	0.736
Constant	-1.846	2.319	0.634	0.426

Based on the information presented in table 2, it is evident that the only variable exhibiting a p-value of less than 0.05 is family support (0.037), which leads to the rejection of H0 and indicates that family support influences foot care behavior in patients with diabetes mellitus (DM).

The significant association between duration of illness and foot care behavior suggest that patients' experiences over time may influence their awareness and adaptation to disease management. Similarly, the strong relationship between family support and foot care behavior highlights the importance of interpersonal and environmental factors in shaping health behaviors.

Table 3. Odds Ratio Variabel yang Signifikan

Variable	Estimate parameter $\widehat{\boldsymbol{\beta}}_{\boldsymbol{jk}}$	Odds Ratio $\exp(\widehat{\boldsymbol{\beta}}_{\boldsymbol{jk}})$	$\frac{1}{\exp(\widehat{\boldsymbol{\beta}}_{\boldsymbol{jk}})}$
X1	–0,31761	0,7278853	1,373843
Family support	1.396	**4.039**	0.248

Table 3 reveals that individuals who receive high family support have a 4.039 times greater likelihood (or an increase of 24.8%) of demonstrating better behaviors in preventing diabetic ulcers compared to those with low family support. Strong family support positively influences behaviors related to the prevention of diabetic ulcers. Therefore, the regression analysis further confirms that family support is the most influential factor affecting foot care behavior compared to other variables. This finding indicates that social support plays a more dominant role that demographic or clinical characteristics in determining patients' adherence to preventive behaviors.

Discussion

This study provides important insight into the behavioral aspect of diabetes mellitus (DM) management, particularly in foot care practices. The findings emphasize that behavioral outcomes are not solely determined by individual characteristics but are also strongly influenced by social and environmental factors. Increasing age leads to physiological decline in the body. Age-related changes include reduced production and release of hormones, such as decreased insulin secretion and reduced cellular sensitivity (Biagetti & Puig-Domingo, 2023). A decrease in insulin levels causes glucose to be unable to enter cells and instead accumulate in the bloodstream, resulting in hyperglycemia. Women, especially those in older age groups, are also at risk of developing DM due to decreased estrogen levels, which may contribute to higher blood glucose and low-density lipoprotein (LDL) levels compared to men.

Education is one of the most important factors in understanding blood glucose control adherence and treatment compliance to prevent complications. A low level of education among respondents may affect knowledge and behavior in preventing diabetic ulcers, as well as accessibility to health services. A study also emphasized that knowledge level has a significant relationship with foot care behavior. The longer a person suffers from diabetes mellitus, the greater the likelihood of chronic hyperglycemia, which may progress into complications such as retinopathy, nephropathy, and diabetic ulcers.

Wounds may appear when a person has experienced diabetes mellitus for more than 10 years. This occurs because prolonged hyperglycemia can lead to thickening of blood vessel walls, resulting in damage to capillaries and peripheral nerve fibers over time. Chronic inflammation may also contribute to cellular osmotic imbalance and metabolic dysfunction, which can trigger long-term complications of diabetes mellitus.

In this study, duration of illness showed a significant relationship with foot care behavior. Patients with DM who have been diagnosed for less than five years tend to have a higher motivation to seek information about treatment and are more willing to perform foot care. At the early stage of the disease, patients are generally able to adapt better, and behavioral changes are more easily achieved compared to those who have lived with the condition for more than five years. However, patients with a longer duration of illness may experience "treatment fatigue,"

leading to decreased motivation in maintaining consistent self-care behaviors. This phenomenon highlights the importance of continuous education and reinforcement strategies throughout the disease trajectory. From a theoretical perspective, this finding aligns with social support theory, which suggests that emotional, informational, and instrumental support can significantly influence health-related behaviors. Family members act as a primary support system that reinforces positive behaviors and improves adherence to long-term treatment plans.

Family support is essential because it positively impacts psychological health, physical well-being, and quality of life. Family involvement in diabetes management helps patients reduce stress, improve glycemic control, and increase self-confidence. Although family support is beneficial, if it is not balanced with regular use of antidiabetic medication, it may disrupt blood glucose stability and lead to hyperglycemia (Galuh & Prabawati, 2021). Family support is a significant factor in this study. Patients with strong family support were 4.039 times more likely to demonstrate better diabetic ulcer prevention behavior.

Family support includes providing information about foot care, emotional encouragement, and assistance in daily self-care activities. It may include encouraging regular exercise, accompanying patients to healthcare visits, assisting with routine foot care, and reminding patients to consistently wear appropriate footwear to avoid direct contact with hazardous surfaces. This emphasizes the importance of family involvement in preventing diabetic foot complications. This finding is supported by Galuh (2021), which reports a significant relationship between family support and self-management ($p = 0.000$; $p < 0.05$). Psychological factors such as stress, depression, and emotional distress are also known to negatively affect self-care behaviors in patients with DM. In this context, family support functions as a buffering mechanism that reduces psychological burden and enhances coping ability.

In addition to behavioral and social factors, psychological aspects play a crucial role in DM management and should not be overlooked. Patients with DM, particularly those experiencing complications such as diabetic foot ulcers, are at higher risk of psychological distress, including anxiety, depression, and emotional burden. These conditions may negatively affect self-care behavior and glycemic control, as stress responses can elevate blood glucose levels and reduce adherence to treatment. Moreover, a study conducted by Apituley (2024) revealed that a mindfulness-based intervention, specifically the Open Heart approach, was effective in reducing emotional distress among patients with diabetic ulcers. The study indicated that addressing psychological needs through spiritual and emotional interventions can significantly improve patients' coping mechanisms and overall well-being.

Health education is a fundamental component in DM management, as it equips patients with knowledge and skills necessary for effective self-care and complication prevention. Patients who receive adequate health education are more likely to understand the importance of daily foot care, recognize early signs of complications, and adhere to recommended health behaviors. A study conducted by Sinurat (2025) demonstrated that health education interventions significantly improved foot care behavior among patients with DM in primary healthcare settings.

In addition, it indicated that patients who received health education showed better adherence to foot care practices, including routine foot inspection, proper hygiene, and appropriate footwear use. Similarly, research by Prabawati (2023) revealed that health education significantly increases patients' knowledge regarding foot care. Improved knowledge is a fundamental factor in shaping positive health behaviors, as individuals who understand risks and preventive measures are more likely to adopt appropriate self-care practices.

The principle of wound care is to create a moist wound-healing environment that supports optimal tissue repair. Absorbent dressings are used when the ulcer produces excessive exudate, while moisture-retentive dressings are more appropriate for dry ulcers to maintain an optimal healing environment. Good knowledge generally includes understanding foot inspection, proper sock use, injury prevention, and timely consultation with healthcare professionals. Foot care includes checking the feet, cleaning, maintaining moisture balance, trimming toenails, using appropriate footwear, inspecting shoes, and attending regular medical check-ups.

In relation to the present study, although most respondents demonstrated good foot care behavior, inconsistencies were still found in certain practices, such as not routinely checking footwear, as confirmed through unstructured interviews. Respondents tended to check their

shoes only when not in a hurry. Individuals with diabetes mellitus should always inspect footwear before and after use to ensure that no objects such as gravel or nails are present that may cause injury. In addition, most respondents used moisturizer on their toes. Moisturizers are applied to prevent skin dryness; however, they are not recommended for use between the toes because they may create a humid environment that promotes microbial growth.

Most respondents reported regularly wearing flip-flops or slippers due to comfort in daily activities. However, individuals with diabetes mellitus are recommended to use closed-toe shoes with proper fit to reduce the risk of trauma or injury. Open footwear, high heels, or pointed shoes are discouraged due to increased risk of foot injury.

Using Dorothea Orem's Self-Care Deficit Theory, individuals are described as needing adequate self-care agency to perform health-maintaining activities. Self-care behavior is influenced by an individual's capacity and the availability of supportive systems that assist in meeting self-care needs (Teater, 2024; Yip, 2021). In diabetes management, foot care is a critical component of daily self-care aimed at preventing complications.

This interpretation is consistent with a study conducted by Prabawati (2023), which demonstrated that implementation of a self-care model significantly improves diabetes self-management behavior. The findings indicate that structured self-care interventions enhance patients' ability to perform daily monitoring, prevention, and adherence to recommended practices. This suggests that strengthening self-care capacity is a key strategy for improving health outcomes among patients with DM. Furthermore, Silalahi (2021) found that self-care education significantly improves diabetes self-management behavior in primary healthcare settings. This confirms that behavior change in patients with DM is achievable through structured interventions, particularly in primary care services such as Puskesmas.

These findings have important implications for nursing practice, particularly in community and primary care settings. Nurses should not only focus on patient education but also actively involve family members in the care process. Family-centered interventions may enhance adherence to foot care practices and reduce the risk of diabetic foot complications. Integrating self-care models into diabetes management programs, especially those involving family participation, may significantly improve patient adherence. This approach is particularly relevant in the Indonesian context, where family plays a central role in health decision-making and daily care practices.

CONCLUSION

This study concludes that foot care behavior among patients with diabetes mellitus (DM) is significantly associated with the duration of illness and family support, with family support identified as the most influential factor. Patients who receive strong family support are more likely to demonstrate appropriate preventive behaviors, thereby reducing the risk of diabetic foot complications. In addition, this study highlights the importance of integrating family-centered approaches into diabetes management programs. Healthcare professionals, particularly nurses, need to develop structured educational interventions that actively involve both patients and their families to improve long-term adherence to foot care practices. These efforts include healthcare staff training on supporting family involvement, integrating families into diabetes management protocols, providing routine foot care education with family participation, implementing community nurse-led home visits, and developing family-based foot care education programs.

This study reinforces the importance of integrating nursing theories, particularly Dorothea Orem's Self-Care Theory, into clinical practice to enhance patients' self-care capacity. Strengthening family involvement and psychosocial support is essential to ensure sustainable behavioral change in diabetes mellitus management. Further research is recommended to explore additional psychosocial factors, such as self-efficacy, motivation, and cultural beliefs, which may further influence foot care practices among patients with DM.

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AUTHOR CONTRIBUTION STATEMENT

Dewi Prabawati, Shelsy Aritonang collaboratively contributed to the conception and design of the study. Shelsy Aritonang was primarily responsible for data collection, data analysis, and project administration. Dewi Prabawati contributed to the development of the theoretical framework, original manuscript draft and validation of the findings. All authors participated in revising the manuscript, approved the final version for publication, and agreed to be accountable for all aspects of the work.

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