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THE RELATIONSHIP OF KNOWLEDGE AND SELF-EFFICACY WITH FOOT SELF-CARE AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT
Diabetic foot ulcer is a serious complication of type 2 diabetes mellitus (T2DM) that can be prevented through foot self-care. Knowledge and self-efficacy may be related to this practice, yet evidence among outpatients in Indonesia remains limited. To analyze the relationship of foot care knowledge and self-efficacy with foot self-care behavior among patients with T2DM. A quantitative correlational cross-sectional study was conducted among 156 outpatients with T2DM at PKU Muhammadiyah Yogyakarta Hospital (Agustus–October 2025), recruited by purposive sampling. Knowledge, self-efficacy and foot self-care behavior were measured with the Diabetic Foot Knowledge Scale, the General Self-Efficacy Scale and the Nottingham Assessment of Functional Footcare, respectively. Data were analyzed using Spearman correlation. Most respondents had moderate knowledge (66.7%), moderate self-efficacy (72.4%) and good foot self-care behavior (76.9%). Knowledge (rs = 0.183; 95% CI 0.03–0.33; p = 0.023) and self-efficacy (rs = 0.207; 95% CI 0.05–0.35; p= 0.010) were weakly and positively correlated with foot self-care behavior. Knowledge and self-efficacy are positive but weakly associated with foot self-care behavior, each sharing less than 5% of its variation. Foot care education should be combined with strategies that strengthen self-efficacy.

Keywords: diabetic foot ulcer; foot self-care; knowledge; self-efficacy; type 2 diabetes mellitus

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INTRODUCTION

Diabetes mellitus (DM) is a major global health problem with a continuously increasing burden. The 11th edition of the IDF Diabetes Atlas estimated that 589 million adults aged 20-79 years were living with DM in 2024, and this number is projected to rise to 853 million by 2050. Of these, approximately 252 million cases remain undiagnosed (Genitsaridi et al., 2026); (Federation, 2025). Indonesia ranks fifth globally, with an estimated 20.4 million adults aged 20-79 years living with diabetes in 2024 (Federation, 2025). The growing prevalence of DM is particularly concerning because the disease is associated with a wide range of chronic complications that contribute substantially to morbidity, disability, and mortality.

In patients with type 2 diabetes mellitus (T2DM), chronic hyperglycemia can lead to macrovascular and microvascular complications as well as motor, sensory, and autonomic neuropathy (Soelistijo, Soebagijo Adi Suastika et al., 2021). The interplay of neuropathy, peripheral vascular impairment, and minor trauma represents the primary pathway leading to the development of diabetic foot ulcers (DFUs) (Wang et al., 2022). A global systematic review reported a prevalence of approximately 6.3% for DFUs among individuals with DM (Zhang et al., 2017). If left untreated, DFUs may result in severe infections, lower-extremity amputation, and even death (Armstrong, D. G., Tan, T.-W., Boulton, A. J. M., & Bus, 2023). Therefore, effective preventive strategies are essential to reduce

the incidence and consequences of diabetic foot complications. The 2023 International Working Group on the Diabetic Foot (IWGDF) guidelines emphasize patient education on foot self-care as a key preventive measure for individuals at risk (Bus et al., 2024).

Despite these recommendations, the practice of foot self-care remains a challenge in Indonesia. A study involving 546 patients with T2DM across 22 primary healthcare centers in Banyumas Regency found that both foot-care knowledge and foot-care behaviors were generally low. Older age, higher educational level, diabetes-related distress, family support, and foot-care knowledge were identified as predictors of foot-care behavior; however, the overall model explained only 19.7% of the variance in behavior (Sari et al., 2020). These findings suggest that knowledge alone may not be sufficient to promote consistent foot self-care practices. According to Social Cognitive Theory, self-efficacy, an individual's belief in their capability to perform a behavior, operates together with goals, outcome expectation, and perceived environmental barriers and facilitators, and influences whether people initiate, persist in, and maintain health behavior change (Bandura, 2004). Self-efficacy has therefore been concidered crucial role in determining whether knowledge is translated into sustained action (Bandura, 1977). Recent empirical evidence indicates that Social Cognitive Theory provides a robust framework for understanding health behaviors, with self-efficacy consistently identified as the most influential determinant among its core constructs (Egele et al., 2025). Consistent with these findings, studies involving patients with type 2 diabetes mellitus have demonstrated that self-efficacy possesses the strongest predictive power for self-care behaviors compared with other constructs within Social Cognitive Theory (Yari et al., 2023).

Evidence supporting the role of self-efficacy in DM self-management has continued to emerge. A systematic review indicated that foot-care education can positively influence both self-efficacy and self-care behaviors among people with DM (Goodall et al., 2020). Similarly, a recent study conducted among patients with DFUs in Türkiye demonstrated a positive linear relationship between self-efficacy and foot-care behaviors (Sezgunsay et al., 2025). These findings suggest that optimal foot self-care behavior may depend not only on adequate knowledge but also on patients' confidence in their ability to apply that knowledge in daily practice.

Although previous studies in Indonesia have examined the relationship between knowledge (Ningrum Puspa Tita et al., 2021) or self-efficacy (Susanti et al., 2020) and foot-care behavior (Woo & Cui, 2023), these factors have generally been investigated separately. From the perspective of Social Cognitive Theory, knowledge and self-efficacy are interconnected determinants of health behavior and may jointly influence foot self-care practices. However, empirical evidence examining both factors simultaneously among outpatients with T2DM in referral hospital settings remains limited. Therefore, this study aimed to analyze the relationships of foot-care knowledge and self-efficacy with foot self-care behavior among patients with T2DM at PKU Muhammadiyah Hospital Yogyakarta. It was hypothesized that higher levels of knowledge and self-efficacy would be associated with better foot self-care behavior.

METHOD

Study Design

A quantitative analytical correlational study with a cross-sectional design was conducted and reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2007). This study was conducted at the outpatient clinic of PKU Muhammadiyah Yogyakarta Hospital, Yogyakarta, Indonesia, between July and October 2025.

Sample
The study population consisted of outpatients with type 2 diabetes mellitus attending PKU Muhammadiyah Yogyakarta Hospital. The minimum sample size was estimated using the Slovin formula based on 310 eligible patients recorded in 2024, resulting in a target sample of 175 participants. Participants were recruited using purposive sampling, and 156 respondents were successfully enrolled and included in the analysis. Ethical approval was obtained from the Research Ethics Committee of PKU Muhammadiyah Yogyakarta Hospital (No. 00271/KT.7.4/VIII/2025). Written informed consent was obtained from all participants prior to data collection.

Inclusion and exclusion criteria
Participants were eligible if they: (1) had been diagnosed with type 2 diabetes mellitus, (2) were adolescents or older, (3) were able to perform activities of daily living independently, and (4) provided informed consent to participate. Patients were excluded if they had an active diabetic foot ulcer, foot infection, severe diabetic foot complications, peripheral vascular disease, or severe neuropathy.

Research instruments
Data were collected using a structured questionnaire consisting of demographic and clinical characteristics, as well as three instruments assessing foot care knowledge, self-efficacy, and self-foot care behavior. Foot care knowledge was assessed using the Diabetic Foot Knowledge Scale (DFKS) modified by (Septia Ningrum & Imamah, 2022). The instrument consists of 64 true-false items and demonstrated a validity coefficient of 0.67 and a reliability coefficient of 0.963 (Septia Ningrum & Imamah, 2022). Knowledge scores were categorized as good, moderate, and poor based on the modified Arikunto criteria. Self-efficacy was measured using the 10-item General Self-Efficacy Scale (GSE) developed by (Schwarzer, Ralf; Jerusalem, 1995). The Indonesian version was validated by (Kusmawati, 2016). Content validity was evaluated by two experts and deemed acceptable. Construct validity coefficients ranged from 0.343 to 0.746, and the instrument demonstrated excellent reliability with a Cronbach's alpha of 0.923 (Kusmawati, 2016). Self-efficacy scores were categorized as high, moderate, and low. Self-foot care behavior was assessed using the 29-item Nottingham Assessment of Functional Footcare (NAFF) developed by (Lincoln et al., 2007) and modified by (Septia Ningrum & Imamah, 2022). The modified instrument demonstrated a validity coefficient of 0.53 and a reliability coefficient of 0.83. Foot care behavior was categorized as good or poor, while knowledge levels were classified using the modified (Arikunto, 2013) criteria.

Data analysis
Data were analysed using IBM SPSS statistic v24. Descriptive statistics were used to summarize the data, with categorical variables presented as frequencies and percentages, and questionnaire scores reported as means and standard deviations (SD). Normality was assessed using the Kolmogorov-Smirnov test, which indicated that all study variables were not normally distributed. Therefore, associations between variables were examined using Spearman's rank-order correlation. Correlation strength was interpreted as weak (0.10-0.39), moderate (0.40-0.69), and strong (0.70-0.89) according to the criteria proposed by (Schober et al., 2018). Ninety-five percent confidence intervals (95% CIs) for the correlation coefficients were estimated using the Fisher transformation approximation, and a p-value of < 0.05 was considered statistically significant.

RESULT
As shown in Table 1, the mean age of responden was 60.16 ± 8.85 years, most respondents were early elderly aged 60-74 years (51.3%), female (55.8%), had completed senior high school or higher education (75.0%), were married (80.8%), and were unemployed or retired (46.8%). A total of

87.8% of respondents had been living with DM for at least one year, 10.3% reported a history of diabetic foot ulcer, and 97.4% indicated regular medication use.

Table 1.
Respondent characteristics (n= 156)

Respondent characteristics	f	%
Age (year) (Mean ± SD: 60.16 ± 8.85)		
Adolescents (10–24)	1	0.6
Young Adults (25–44)	6	3.8
Middle-Aged Adults (45–59)	62	39.7
Early Elderly (60–74)	80	51.3
Late Elderly (75–90)	7	4.5
Gender		
Male	69	44.2
Female	87	55.8
Educational		
No Formal Education	5	3.2
Primary School	15	9.6
Junior High School	19	12.2
Senior High School	69	44.2
College/University	48	30.8
Occupation		
Unemployed/Retired	73	46.8
Self-Employed	37	23.7
Civil Servant/Village Official	26	16.7
Manual Laborer	8	5.1
Private Sector Employee	7	4.5
Others*	5	3.2
Duration of DM (year)		
<1	19	12.2
1-5	70	44.9
>5	67	42.9
Marital status		
Single	7	4.5
Married	126	80.8
Widowed	23	14.7
History of DFUs (years ago)		
None	140	89.7
< 1	7	4.5
1-5	9	5.8
Regular Medication Use		
Yes	152	97.4
No	4	2.6

*The "Others" category included a lecturer, a student, a security officer, an early childhood education (PAUD) staff member, and a farmer (n= 1 for each occupation).

Table 2.
Distribution of Knowledge, Self-Efficacy, and Foot Self-Care Behaviors among Respondents (n= 156)

Variable	f	%
Knowledge of Foot Care (36.87 ± 6.05)		
Good	6	3.8
Moderate	104	66.7
Poor	46	29.5
Self-efficacy (30.06 ± 3.68)		
High	42	26.9
Moderate	113	72.4
Low	1	0.6
Foot Self-Care Behaviors (48.90 ± 6.36)		
Good	120	76.9
Poor	36	23.1

As presented in table 2, most respondents had a moderate level of foot care knowledge (66.7%) and moderate self-efficacy (72.4%), while good foot self-care behaviors were observed in 76.9% of respondents.

Table 3.
Spearman Correlation Analysis between Foot Care Knowledge, Self-Efficacy, and Self-Foot Care Behavior (n= 156)

Variable	r_s	95% CI	p value
Foot care knowledge	0.183	0.03–0.33	0.023
Self-Efficacy	0.207	0.05–0.35	0.010

Table 3 presents the results of the Spearman rank correlation analysis (n = 156). A significant positive correlation was found between foot care knowledge and self-foot care behavior (r_s = 0.183; 95% CI: 0.03-0.33; p = 0.023), indicating a weak correlation strength. Similarly, self-efficacy was significantly and positively correlated with self-foot care behavior (r_s = 0.207; 95% CI: 0.05-0.35; p = 0.010), also demonstrating a weak correlation strength. These findings suggest that higher levels of knowledge and self-efficacy are associated with better self-foot care behavior among patients.

DISCUSSION

Foot Care Knowledge and Foot Care Behavior

Foot care knowledge showed a statistically significant positive association with self-foot care behavior; however, the strength of the relationship was weak (r_s = 0.183; p = 0.023). The positive direction of the correlation is consistent with studies conducted by (Ningrum Puspa Tita et al., 2021) in Indonesian clinical settings and (Sari et al., 2020), which demonstrated that a basic understanding of pathophysiology and foot protection techniques serves as a predisposing factor for engaging in preventive behaviors.

These findings are also consistent with studies by (Elmansy & Elbqry, 2024) and (Mekonen, 2025), which reported that adequate knowledge facilitates patients' awareness of ulceration risks. Nevertheless, the weak correlation observed in the present study reflects the phenomenon known as the *knowledge-practice gap*. As emphasized in systematic reviews and meta-analyses by (Atalay et al., 2025) and (He et al., 2022), adequate theoretical knowledge does not automatically translate into routine self-care practices unless accompanied by hands-on demonstrations and adequate supportive resources. Furthermore, the weak correlation may be partially explained by a *ceiling effect*. Because the majority of respondents were categorized as having good foot care behavior (76%), score saturation may have occurred, resulting in a restricted range of data and limited variability. Such homogeneity reduces the sensitivity of correlation analyses to detect stronger associations.

Self-Efficacy and Foot Care Behavior

Self-efficacy was positively and significantly associated with foot care behavior (r_s = 0.207; p = 0.010). According to Bandura's Social Cognitive Theory (1977), an individual's belief in their ability to perform a behavior influences the amount of effort, resilience, and persistence devoted to that behavior. Patients with higher self-efficacy are therefore less likely to perceive daily foot inspections, cleaning between the toes, and selecting appropriate footwear as burdensome activities.

This positive association reinforces empirical evidence from similar cross-sectional studies by (Kaplan, B., Koçak, H. S., & Kaplan Serin, 2024) and (Shojaeimotlagh et al., 2022), both of which reported significant positive correlations between self-efficacy and adherence to diabetic foot care practices. The findings are also consistent with evidence from Indonesia reported by (Huda et al., 2019), where self-efficacy was identified as a significant determinant of protective foot care behaviors. Although the present study used a cross-sectional design, findings from clinical trials and meta-analyses suggest that self-efficacy is a dynamic and modifiable psychological factor. Structured nurse-led education programs and technology-based interventions have been shown to

effectively enhance self-efficacy while improving sustainable diabetic foot self-management behaviors (Ahn, J., Yang, Y., Kim, J. Y., 2025); (Han et al., 2025); (Yıldırım Ayaz, E., Dincer, B., & Oğuz, 2022).

Magnitude of the Associations

Based on the coefficient of determination, knowledge and self-efficacy explained approximately 3.3% and 4.3% of the variation in self-foot care behavior rankings, respectively. This suggests that more than 90% of the variation in behavior is influenced by factors other than these two variables. As reported in the path analysis conducted by (Kerari, 2024), the adoption of diabetes self-care behaviors is a complex multifactorial process influenced both directly and indirectly by emotional distress related to diabetes, depression, self-acceptance, and family and social support. Therefore, the statistical significance observed in this study should not be interpreted as evidence of a singular or dominant clinical effect. Comprehensive diabetic nursing care should extend beyond one-way educational interventions and incorporate strategies to strengthen self-efficacy, engage family support, and provide continuous psychological counseling. Such a multidimensional approach is essential for fostering lasting protective behaviors and preventing diabetic foot ulceration.

Limitations and Implications

This study has several limitations. First, the cross-sectional design precludes causal inference. Second, the validity and reliability testing of the instruments was not repeated in the current sample; therefore, their internal consistency within this population remains unconfirmed. Third, the sample size (156 respondents) was below the minimum target obtained using the Slovin formula (175 respondents), potentially reducing statistical power. With a sample size of 156, the estimated power was approximately 63% for the correlation of $r_s = 0.183$ and 74% for the correlation of $r_s = 0.207$. In addition, purposive sampling from a single hospital limits the generalizability of the findings. Data were obtained through self-administered questionnaires and are therefore susceptible to self-report and social desirability biases. Patients with severe foot complications, peripheral vascular disease, or severe neuropathy were excluded; consequently, the results may not be applicable to high-risk patient populations. Furthermore, the bivariate analysis did not control for potential confounders such as age, education, duration of diabetes, and history of foot ulceration, while foot ulcers themselves were not assessed as an outcome variable. From a practical perspective, these findings support the recommendations of the International Working Group on the Diabetic Foot (IWGDF) to provide foot care education for at-risk patients (Bus et al., 2024). However, educational interventions should go beyond merely providing information and should actively strengthen patients' confidence and skills through demonstrations and hands-on practice. The effectiveness of such approaches in improving foot care behaviors and reducing ulcer incidence warrants further investigation through intervention studies.

CONCLUSION

Foot care knowledge and self-efficacy were positively and significantly associated with self-foot care behavior among outpatients with type 2 diabetes mellitus; however, the strength of these associations was weak. Both variables explained less than 5% of the variation in self-foot care behavior, indicating that other factors may play a more substantial role. Nurses may integrate foot care education with self-efficacy enhancement strategies in outpatient care settings. Future studies are recommended to adopt multicenter designs, examine these relationships using multivariable regression analyses that control for age, educational level, duration of diabetes, history of foot ulcers, and family support, and evaluate the effectiveness of self-efficacy-based educational interventions.

DECLARATIONS

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