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Factors Associated with Peripheral Neuropathy Prevention Behaviors among Patients with Type 2 Diabetes Mellitus Based on the Information–Motivation–Behavioral Skills Model

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ABSTRACT

Background: Peripheral neuropathy is a common long-term complication of diabetes mellitus that can cause pain, sensory loss, foot ulceration, and disability. Preventive behaviors are essential to reduce these risks, yet many individuals with diabetes do not consistently practice appropriate self-care. ***Purpose*:** This study aimed to examine the association between information, motivation, behavioral skills, and peripheral neuropathy prevention behaviors among patients with type 2 diabetes mellitus. ***Methods*:** A cross-sectional study was conducted among 196 patients with diabetes mellitus at the Tlogosari Wetan Public Health Center, Semarang, Indonesia, between September and October 2025. Data was collected using validated questionnaires and analyzed using Somers' D test ($p < 0.05$). ***Results*:** Information (Somers' D = 0.184; p = 0.002), motivation (Somers' D = 0.311; p = 0.001), and behavioral skills (Somers' D = 0.393; p = 0.001) were significantly, but weakly, associated with peripheral neuropathy prevention behaviors. ***Conclusion*:** Information, motivation, and behavioral skills were modestly associated with preventive behaviors. ***Implications for Nursing*:** The IMB Model may guide nurses in developing education and counseling interventions that strengthen patient knowledge, motivation, and self-care skills to support neuropathy prevention.

Keywords: Diabetes mellitus, Peripheral neuropathy, Information motivation behavioral model, Preventive behaviors.

What does this paper add?

1. This study shows that information, motivation, and behavioral skills are modestly, yet significantly, associated with peripheral neuropathy prevention behaviors among individuals with type 2 diabetes mellitus. These findings are in line with the Information–Motivation–Behavioral Skills (IMB) framework, suggesting that the three components are meaningfully related to how patients carry out preventive self-care practices.
2. The results provide additional insight into how variations in knowledge, personal and social motivation, and practical skills correspond with differences in preventive behaviors. While the cross-sectional design does not allow conclusions about cause-and-effect relationships, the findings offer empirical support for considering education, motivational support, and skill development as

important elements in nursing approaches to neuropathy prevention.

Introduction

Diabetic peripheral neuropathy (DPN) is a frequent microvascular complication of diabetes mellitus resulting from prolonged hyperglycemia that damages peripheral nerves. This condition causes numbness, neuropathic pain, ulcers, and, in severe cases, amputation, due to oxidative stress and microcirculatory disturbances (Zhu et al., 2024). In Indonesia, peripheral neuropathy is commonly observed in patients with poor foot care knowledge, limited activity, and long-standing diabetes (Suyanto et al., 2022, 2024). The global prevalence of DPN ranges from 6% to 51%, depending on age, diabetes duration, and glycemic control (Hicks & Selvin, 2019), with Southeast Asia showing rates up to 58% (Malik et al., 2020).

The Information Motivation Behavioral Skills (IMB) Model, developed by Fisher in 1992, provides a framework for understanding behavioral determinants in health promotion (Westbrook & Harvey, 2023). This model postulates that adequate information, motivation, and behavioral skills are essential for adopting and sustaining preventive behaviors (Lee & Park, 2021). It has been widely applied across chronic diseases, including diabetes, but limited evidence exists regarding its use in preventing diabetic peripheral neuropathy.

Previous studies have shown that patients' preventive practices are often suboptimal despite adequate knowledge, suggesting a gap between understanding and behavior (Mirzaei-Alavijeh et al., 2025). Thus, analyzing the predictive components of the IMB Model, information, motivation, and behavioral skills, may provide insight into developing effective interventions for peripheral neuropathy prevention among diabetic patients.

Background

Diabetic Peripheral Neuropathy (DPN) is one of the most prevalent microvascular complications of Diabetes Mellitus (DM), primarily caused by prolonged hyperglycemia that leads to peripheral nerve damage. The condition manifests through numbness, neuropathic pain, and ulceration, which may progress to amputation if not properly managed, resulting in a substantial decline in patients' quality of life (Zhu et al., 2024). Globally, the prevalence of DPN ranges between 6% and 51%, depending on patients' age, disease duration, and glycemic control (Hicks & Selvin, 2019). In Southeast Asia, the prevalence may reach up to 58%, highlighting the significant burden of this complication in developing countries (Malik et al., 2020).

In Indonesia, peripheral neuropathy is frequently observed among diabetic patients who have limited knowledge of foot care, low physical activity, and a long duration of illness (Suyanto et al., 2022). Such conditions are often associated with poor self-care behavior and a lack of awareness regarding preventive measures, which contribute to the high rate of diabetic complications. Although preventive behaviors are essential to delay the onset of neuropathy, many patients do not consistently engage in effective self-care practices, indicating a knowledge behavior gap (Dia et al., 2022).

The Information Motivation Behavioral Skills (IMB) Model, developed by Fisher in 1992, provides a comprehensive framework to understand and predict health-related behaviors. It postulates that individuals are more likely to adopt preventive actions when they possess adequate information, sufficient motivation, and the necessary behavioral skills (Westbrook & Harvey, 2023). The model has been successfully applied to a wide range of chronic diseases, including HIV, cardiovascular diseases, and diabetes, to explain variations in treatment adherence and health promoting behaviors (Akbari et al., 2022; Mirzaei-Alavijeh et al., 2025).

Recent studies have demonstrated the relevance of the IMB Model in diabetes management. For instance, Jung & Kim (2023) reported that IMB-based educational interventions significantly improved foot self-care behaviors among patients with type 2 diabetes mellitus undergoing hemodialysis. Similarly, Mirzaei-Alavijeh et al (2025) found that the IMB framework effectively enhanced medication adherence among older adults with type 2 diabetes mellitus. Moreover, studies conducted in Indonesia emphasized the role of peer group support and social motivation in promoting preventive foot-care behaviors (Suyanto et al., 2024).

Despite growing evidence supporting the IMB Model, research focusing specifically on its application to peripheral neuropathy prevention remains limited. Understanding how information, motivation, and behavioral skills influence neuropathy prevention behaviors is crucial to developing effective nursing

interventions. Therefore, this study aims to analyze the relationship between the components of the IMB Model and peripheral neuropathy prevention behaviors among patients with diabetes mellitus. The findings are expected to contribute to the design of IMB-based nursing education programs that strengthen self-care capabilities and prevent neuropathic complications in diabetic populations.

Methods

A cross-sectional quantitative study was conducted to evaluate the relationships between the IMB Model components and peripheral neuropathy prevention behaviors among patients with diabetes mellitus. A total of 196 patients with diabetes mellitus were recruited from the Tlogosari Wetan Public Health Center, Semarang, Indonesia, between September and October 2025 using consecutive sampling. Inclusion criteria comprised patients aged ≥18 years, diagnosed with diabetes mellitus, able to communicate effectively, and willing to participate. The age threshold of 18 years was applied to ensure that all participants were legally adults, capable of providing informed consent independently, and cognitively able to comprehend and respond accurately to questions related to health information, motivation, and self-care behaviors. Patients with non-diabetic neurological disorders or acute conditions that could interfere with participation were excluded.

This study was reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies.

Measurements

Content validity was established through an expert review process involving three nursing academics with experience in diabetes management and behavioral health. Each questionnaire item was carefully evaluated for its relevance to the construct, clarity of wording, and appropriateness to the study context. The Item-Content Validity Index (I-CVI) values ranged from 0.83 to 1.00, reflecting satisfactory agreement among the experts regarding item suitability.

Construct validity was assessed using item–total correlation analysis in a pilot test involving 30 respondents. All items demonstrated correlation coefficients greater than the critical value of 0.361 ($p < 0.05$), indicating that each item contributed adequately to its respective scale.

Reliability was examined using Cronbach's alpha to determine internal consistency. The Information questionnaire yielded an alpha coefficient of 0.82, the Motivation scale 0.85, the Behavioral Skills scale 0.88, and the Peripheral Neuropathy Prevention Behavior questionnaire 0.86, indicating good internal consistency across all instruments.

Data Collection and Ethical Considerations and Analysis

Data collection was conducted from September to October 2025 at the Tlogosari Wetan Public Health Center in Semarang, Indonesia. Participants who met the inclusion criteria were approached during their diabetes clinic visits and provided written informed consent before participation. Data was gathered using structured and validated questionnaires administered through face-to-face interviews by trained research assistants. Each session lasted approximately 25 minutes to 30 minutes in a private setting to ensure comfort and confidentiality. All completed questionnaires were reviewed daily for completeness and accuracy before data entry and analysis.

Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Nursing, Universitas Islam Sultan Agung, Semarang, Indonesia (Approval No. 1111/A.1-KEPK/FIK-SA/VII/2025).

Data was analyzed using Somers' D test to evaluate associations between IMB Model components and peripheral neuropathy prevention behaviors, because the independent and dependent variables were measured on ordinal scales. Somers' D is an appropriate nonparametric statistic for assessing the direction and strength of association between ordered variables, particularly when parametric test assumptions are not met. A significance level of $p < 0.05$ was considered statistically significant.

Results

Somers' D analysis demonstrated statistically significant positive associations between components of the IMB Model and peripheral neuropathy prevention behaviors among patients with diabetes mellitus.

Table 1. Characteristics of respondents (n = 196)

	n	%
Gender		
Male	75	38.3
Female	121	61.7
Age		
>36	16	8.2
36-45	35	17.9
46-55	42	21.4
56-65	75	38.3
>65	28	14.3
Education Level		
No formal education	11	5.6
Primary school	59	30.1
Junior high school	57	29.1
Senior high school	40	20.4
Higher education	29	14.8
Occupation		
Others	42	21.4
Unemployed	72	36.7
Civil servant	32	16.3
Farmer	6	3.1
Entrepreneur	44	22.4
Duration of Diabetes Mellitus		
<1 year	68	34.7
>1 year	128	65.3

The majority of respondents were aged 56-65 years (38.3%).

Most respondents had completed elementary or junior high school (59.2%). In terms of occupation, a substantial proportion of participants were unemployed (36.7%), while others were self-employed, farmers, or civil servants (41.8%).

More than a half of the respondents (65.3%) had been diagnosed with diabetes mellitus for more than one year.

Table 2. Cross-tabulation analysis of the association between information and peripheral neuropathy prevention behaviors among patients with diabetes mellitus (n = 196)

Variable		Preventive Behaviors			Total	Somers' D	*p*-value
		Poor	Moderate	Good			
Information	Low	7	19	3	29	0.184	0.002
	Moderate	10	81	16	107		
	High	2	42	16	60		
Total		19	142	35	196		

A statistically significant positive association was observed between information and peripheral neuropathy prevention behaviors (Somers' D = 0.184; p = 0.002).

The analysis demonstrated a significant positive relationship between all IMB Model components, information, motivation, and behavioral skills, and peripheral neuropathy prevention behaviors.

Table 3. Cross-tabulation analysis of the relationship between motivation and peripheral neuropathy prevention behaviors among patients with diabetes mellitus (n=196)

Variable		Preventive Behaviors			Total	Somers' D	*p*-value
		Poor	Moderate	Good			
Motivation	Low	6	13	0	19	0.311	0.001
	Moderate	13	89	15	117		
	High	0	40	20	60		
Total		19	142	35	196		

Motivation was significantly associated with peripheral neuropathy prevention behaviors (Somers'D= 0.311; p = 0.001).

Table 3 shows a statistically significant positive association between motivation and peripheral neuropathy prevention behaviors among patients with diabetes mellitus (Somers' D = 0.311; p = 0.001).

Table 4. Cross-tabulation analysis of skills and peripheral neuropathy prevention behaviors among patients with diabetes mellitus (n = 196)

Variable		Preventive Behaviors			Total	Somers' D	*p*-value
		Poor	Moderate	Good			
Skills	Low	15	24	0	39	0.393	0.001
	Moderate	4	81	12	97		
	High	0	37	23	60		

Somers' D analysis showed a statistically significant positive associations between information (Somers' D = 0.184; p = 0.002), motivation (Somers' D = 0.311; p = 0.001), behavioral skills (Somers' D = 0.393; p = 0.001), and peripheral neuropathy prevention behaviors.

Discussion

The present study reveals that all three components of the Information, Motivation, and Behavioral Skills (IMB) Model are significantly associated with peripheral neuropathy prevention behaviors among diabetic patients. These findings support the theoretical assumption that health behaviors are shaped by a combination of cognitive, motivational, and practical dimensions, which interact dynamically to influence preventive actions (Jung & Kim, 2023).

The demographic and socioeconomic profile of the respondents may help explain variations in preventive behaviors. Educational background and employment status could be related to differences in access to health information, health literacy, and engagement in self-care practices. These considerations highlight the importance of tailoring nursing education programs to patients' educational and socioeconomic contexts.

1. Information and Preventive Behaviors

The positive, but weak, correlation between information and preventive behavior (Somers' D = 0.184; p = 0.002) suggests that while knowledge is essential, it does not automatically lead to consistent preventive action. This aligns with Fisher and Fisher's IMB Model, which posits that information serves as a prerequisite foundation for behavior change, but must be activated by motivation and behavioral skills (Zhang et al., 2021).

In this study, although most respondents had moderate or high levels of knowledge, optimal preventive behaviors remained limited. Diabetic patients with moderate foot-care knowledge still exhibited suboptimal self-care, highlighting a "knowledge behavior gap" (Dia et al., 2022).

Medication literacy alone did not improve adherence unless supported by self-efficacy, indicating that knowledge requires psychological reinforcement to translate into consistent health behaviors (Abu-Shennar & Bayraktar, 2022). Thus, information serves as a cognitive foundation, but behavioral performance depends on emotional readiness and environmental support.

2. Motivation and Preventive Behaviors

Motivation was more strongly correlated with neuropathy prevention behaviors (Somers' D = 0.311; p = 0.001), indicating that higher levels of motivation were associated with higher levels of reported self-care behavior. Psychological motivation, including perceived benefit and emotional support, was positively associated with adherence to diabetic care regimens (Racaru et al., 2021).

Social and family support significantly improved diabetic wound prevention behaviors, emphasizing that external motivation fosters accountability and consistency (Yongpet et al., 2023). Social reinforcement from peers and families not only provides emotional comfort, but also increases confidence in applying preventive measures.

Peer-group interventions improve motivation and adherence by creating social norms that encourage healthy practices (Setyoadi et al., 2025; Tazangi et al., 2022). These findings highlight the potential importance of social motivation in sustaining preventive behaviors.

3. Behavioral Skills and Preventive Behaviors

Behavioral skills showed the strongest association with preventive behaviors (Somers' D = 0.393; p = 0.001), indicating that higher behavioral skills are associated with better preventive practices. Previous studies have reported that behavioral skills significantly influence clinical outcomes in patients with chronic conditions (Akbari et al., 2022).

Decreased foot sensation correlated with reduced physical activity among diabetic patients, highlighting the need for strong self-care skills to maintain mobility and prevent complications (Kang & Park, 2025). However, despite the importance of behavioral skills, the study observed that many participants still exhibited moderate levels of preventive practice, indicating that technical capability alone is insufficient without motivation and environmental reinforcement.

Family support and self-efficacy are critical predictors of foot-care behavior in Indonesian diabetic patients (Cheng et al., 2023). These findings support integrated approaches that combine motivational and informational components, ensuring that patients not only know what to do, but also why and how to do, it consistently.

Conclusion

This study demonstrates that information, motivation, and behavioral skills are significantly, but weakly, associated with preventive behaviors for peripheral neuropathy among patients with diabetes mellitus. Given the modest strength of the observed associations and the absence of multivariable regression analysis, these findings should not be interpreted as evidence of predictive relationships. Rather, they suggest that the IMB Model may serve as a conceptual framework for understanding variations in self-care behaviors in chronic disease management.

Patients with greater knowledge about neuropathy prevention tend to demonstrate better awareness of self-care practices; however, knowledge alone may be insufficient to ensure consistent preventive behaviors (Suyanto et al., 2024; Zhu et al., 2024). Motivation, particularly social and emotional support from family members and peers, appears to contribute to the maintenance of preventive habits and adherence to care plans (Suyanto et al., 2022). Behavioral skills represent the practical component that facilitates the translation of knowledge and motivation into preventive actions, such as regular foot inspection, appropriate footwear use, and routine clinical monitoring (Malik et al., 2020).

These findings underscore the importance of integrated nursing interventions that combine patient education, motivational support, and skill-building strategies to enhance preventive behaviors, while acknowledging that such interventions should be informed by further analytic studies. Nurses play a key role in developing structured, patient-centered education programs guided by the IMB Model to address both cognitive and psychosocial barriers to self-care (Lee & Park, 2021; Westbrook & Harvey, 2023).

Future research should employ multivariable and longitudinal or intervention-based designs to better assess the predictive value and causal pathways of IMB Model components in relation to peripheral neuropathy prevention behaviors, as well as their impact on clinical outcomes. Strengthening patient empowerment through continuous education and supportive care may help reduce the burden of diabetic peripheral neuropathy and improve overall quality of life.

Implications for Nursing

These findings provide critical insights for nursing professionals. Nurses can use the IMB Model as a practical framework for developing individualized educational interventions that address not only

information gaps, but also motivational barriers and skill limitations. Strengthening peer and family support networks can further enhance patient adherence to neuropathy prevention measures. Nursing care models incorporating these behavioral dimensions could effectively reduce the incidence of diabetic ulcers and improve patients' quality of life.

Limitations

This study has several limitations. First, the cross-sectional design precludes causal inference. Second, the analysis relied on bivariate associations and did not adjust for potential confounders, such as age, educational level, or duration of diabetes, which may partially explain the observed relationships. Third, data was collected using interviewer-administered questionnaires, which may have introduced social desirability bias and potentially overestimated preventive behaviors. Finally, the single-center setting limits generalizability. These limitations should be considered when interpreting the findings.

Furthermore, consecutive sampling from a single public health center may have introduced selection bias, as participants were limited to those actively attending follow-up care. This may restrict the representativeness of the findings to broader diabetic populations in different clinical or community settings.

Conflict of Interests

The authors declare no conflict of interests related to the design, execution, interpretation, or publication of this research.

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Author Contributions

Study Design: **MFR, SS, MAN**. Data Collection: **MFR**. Data Analysis: **MFR, SS MAN**. Study Supervision: **SS, MAN, DCR**, **RW**. Manuscript Writing: **DCR**. Critical Revision for Important Intellectual Content: **SS, MAN, RW**.

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