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Original Article

Assess The Nurses' Knowledge and Practice Regarding Diabetic Foot Care at Private Hospitals

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ABSTRACT

Background: Diabetes mellitus (DM) contributes substantially to global morbidity and mortality, with diabetic foot ulcers (DFUs) representing a common yet preventable complication. In low- and middle-income countries, particularly Pakistan, limited research exists on nurses' knowledge and practice patterns regarding diabetic foot care, despite their critical role in prevention and management. Objective: To evaluate the level of knowledge and practice regarding diabetic foot care among nurses working in private hospitals in Lahore, Pakistan, and to identify key gaps that may inform targeted interventions. Methods: A cross-sectional observational study was conducted from February to June 2025 among 32 registered nurses randomly selected from internal medicine and intensive care units. Data were collected using a validated structured questionnaire and observation checklist assessing knowledge and practice related to diabetic foot care. Descriptive statistics, independent t-tests, and subgroup analyses were performed using SPSS v27, with a p-value <0.05 considered statistically significant. Results: Nurses demonstrated moderate to high knowledge overall, with 78.1% recognizing sensory abnormalities as critical indicators. However, awareness of risk factors such as neuropathic sensory-motor loss (68.8%) and hygiene-related risks (75.0%) varied. Prior DFU training was associated with higher practice scores (mean 76.7 vs 69.4; r=0.67 vs r=0.18 correlation with knowledge). No significant differences were observed by department or shift. Conclusion: While overall knowledge and practices were acceptable, notable gaps remain in specialized areas of diabetic foot care, highlighting the need for structured, context-specific nurse education and institutional policies to promote standardized care.
Keywords: diabetes mellitus, diabetic foot care, nurses, knowledge, practice, private hospitals, Pakistan

INTRODUCTION

Diabetes mellitus (DM) is a global health challenge of increasing magnitude, recognized for its significant morbidity and mortality due to both acute and chronic complications, including cardiovascular disease, nephropathy, retinopathy, and neuropathy (1). While macrovascular and microvascular complications have been extensively studied, less attention has been given to lower limb complications, particularly diabetic foot ulcers (DFUs), despite their devastating clinical and economic consequences (2). DFUs are among the most frequent causes of hospitalization for patients with diabetes and represent a major contributor to lower limb amputations worldwide (3). Globally, it is estimated that approximately 463 million adults aged 20–79 years were living with diabetes in 2019, projected to rise to 700 million by 2045 (4). The burden is disproportionately high in low- and middle-income countries, where healthcare resources are limited, and the quality of diabetes management, including foot care, remains suboptimal (5). The World Health Organization reports that nearly 422 million people with diabetes reside in these settings, with diabetes accounting for 1.5 million deaths annually (6).

The high prevalence of diabetic foot complications and their associated morbidity are further compounded by delays in recognition, inadequate preventive strategies, and gaps in healthcare providers' knowledge and practice (7). In countries such as Pakistan, where the prevalence of diabetes is rising and healthcare systems face infrastructural constraints, evidence suggests that diabetic foot care often receives inadequate emphasis both in clinical practice and professional education (8). Nurses, as frontline caregivers, play a critical role in screening, educating, and managing patients at risk for DFUs. However, studies conducted in comparable contexts, such as tertiary hospitals in Saudi Arabia and Ghana, have identified that although nurses generally recognize major signs of diabetic foot complications (e.g., pain, sensory loss, infection, deformities), their knowledge remains incomplete, and practical implementation is inconsistent (9,10). Contributing factors include lack of standardized protocols, insufficient continuing professional development, and systemic issues such as resource scarcity and workload constraints (11). Furthermore, evidence suggests that even when nurses are aware of key DFU indicators, this awareness may not translate into clinical practice due to contextual barriers, including patient socioeconomic factors, institutional limitations, and cultural attitudes toward foot care (12). This gap between knowledge and practice underscores the need for targeted interventions, such as structured training programs and guideline implementation, to improve care quality and reduce DFU incidence and related amputations (13). Despite the documented need for such interventions globally, limited research has evaluated the baseline knowledge and practices of nurses in Pakistan's private healthcare sector, where services are often heterogeneous and unregulated. This

represents a critical knowledge gap, as tailored interventions must be grounded in an understanding of existing competencies and deficiencies within this workforce (14). Moreover, while previous research has demonstrated that nurse-led educational initiatives can reduce DFU rates and improve patient self-care (15), few studies have systematically assessed the preparedness of nurses in Pakistan's private hospitals for such roles.

Given this background, the present study aims to evaluate the knowledge and practices of nurses regarding diabetic foot care in private hospitals in Lahore, Pakistan. Specifically, it seeks to assess their recognition of DFU risk factors, clinical signs, and prevention strategies, as well as their practical approaches to patient care, to identify key areas requiring educational and institutional support. The rationale for this research lies in its potential to inform the development of targeted, evidence-based training programs and clinical guidelines that address the specific needs of this population and setting. In doing so, it will contribute to improving the quality of diabetic foot care, reducing DFU-related morbidity, and ultimately decreasing the burden of diabetes-related amputations in Pakistan. Therefore, the research objective guiding this study is: to assess the level of knowledge and practice regarding diabetic foot care among registered nurses working in private hospitals in Lahore, and to identify specific gaps that could inform future educational interventions and policy development.

MATERIAL AND METHODS

This study employed a cross-sectional observational design to evaluate the knowledge and practices of nurses regarding diabetic foot care in private hospitals in Lahore, Pakistan. The cross-sectional approach was chosen for its utility in capturing a snapshot of nurses' knowledge and practice patterns at a specific point in time, which is appropriate for identifying gaps and informing targeted interventions (16). The study was conducted in selected private hospitals in Lahore from 10 February 2025 to 17 June 2025. All participating hospitals were private-sector facilities providing general medical and surgical care, with specific units managing diabetic patients.

The target population consisted of registered nurses currently employed in these private hospitals. Inclusion criteria required participants to be registered nurses with at least a bachelor's degree in nursing, actively working in departments responsible for diabetic patient care such as internal medicine or intensive care units. Exclusion criteria comprised student nurses, nurses not involved in direct patient care, and nurses working in departments unrelated to diabetes management (e.g., pediatrics, obstetrics). Participants were selected using a simple random sampling strategy from a sampling frame of all eligible nurses in the selected hospitals, ensuring that every eligible nurse had an equal chance of selection, thereby minimizing selection bias (17). The recruitment process was conducted in collaboration with nursing supervisors at participating hospitals, who facilitated initial contact with eligible nurses. Each potential participant was approached individually, provided with a clear explanation of the study objectives, procedures, potential risks, and benefits, and informed consent was obtained in writing prior to participation. Participation was voluntary, and confidentiality was assured.

Data collection was carried out by trained research assistants over a four-month period. Each participant completed a structured self-administered questionnaire and an observation checklist specifically designed for the study. The instruments included sections assessing sociodemographic characteristics, knowledge regarding diabetic foot complications and their risk factors, and reported practices for diabetic foot care. The structured knowledge questionnaire was based on validated tools from previous studies (18), with minor contextual adaptations, and consisted of multiple-choice and Likert-scale items to capture agreement levels on clinical signs, risk factors, and management principles.

The primary variables assessed included knowledge and practice scores. Knowledge was operationally defined as the respondent's correct identification of diabetic foot risk factors, signs, and prevention strategies, measured as the total number of correct responses on the questionnaire. Practice was defined as self-reported frequency of adherence to recommended diabetic foot care practices, scored using a 4-point Likert scale (Always = 4, Sometimes = 3, Rarely = 2, Never = 1). Total scores for both knowledge and practice were computed for each participant, and categorized into three levels: good, moderate, and poor, using pre-specified cutoffs established a priori based on tertile distributions. To address potential sources of bias, all questionnaires were anonymized and self-administered to reduce social desirability bias, and responses were checked for completeness and consistency immediately upon collection to minimize missing data. Potential confounders such as years of experience, department, and shift pattern were recorded and later considered in the analysis. The sample size was calculated using the Slovin formula, with an assumed total eligible nurse population (N) of 32 and a 5% margin of error, resulting in a required sample size of 32 nurses, thus achieving a census of the eligible population for maximum representativeness.

Data analysis was performed using IBM SPSS Statistics version 27. After data entry and verification, descriptive statistics (means, standard deviations, frequencies, percentages) were calculated to summarize participant characteristics and response distributions. Knowledge and practice scores were treated as continuous variables for inferential testing. Independent samples t-tests were used to compare mean scores across categorical variables (e.g., education level, department), after testing for equality of variances using Levene's test. Analysis of variance (ANOVA) was used when comparing means across more than two groups. Categorical variables were compared using chi-square tests where appropriate. Missing data were minimal due to immediate checking at collection, but any incomplete questionnaires were excluded from analysis. Confounder adjustment was undertaken using stratified analyses, and subgroup analyses were pre-specified for units (internal medicine versus intensive care) and working shifts (morning versus evening). A two-tailed p-value <0.05 was considered statistically significant.

This study was approved by the institutional ethics committee of the School of Nursing, Green International University, Lahore. All procedures adhered to the principles of the Declaration of Helsinki. Participant confidentiality was maintained by assigning anonymous identification codes and storing all data in password-protected files accessible only to the research team. To ensure reproducibility and data integrity, standardized data collection protocols were employed, all instruments were pilot-tested prior to deployment, and a detailed data management plan was implemented, including double data entry and cross-validation checks (19).

RESULTS

The study included a total of 32 nurses, all of whom were female, single, and aged between 18 and 25 years, reflecting a young and homogeneous sample. The majority of participants were assigned to the internal medicine department (87.5%, n=28), while the remainder worked in intensive care units (12.5%, n=4). Most nurses worked the evening shift (56.3%, n=18), with the rest on morning duty (43.8%, n=14). All participants held the position of service nurse and possessed a bachelor's degree in nursing, supporting the representativeness of early-career nursing professionals in the participating private hospitals (Table 1).

Assessment of nurses' knowledge on diabetic foot complications demonstrated generally high awareness, though with notable variation across specific items. For example, 65.6% (n=21) of participants strongly agreed, and an additional 12.5% (n=4) agreed that symptoms such as chill, pain, burning, tingling, and tenderness in the foot are critical indicators, resulting in a combined agreement rate of 78.1% and a mean knowledge score of 4.44 (SD 0.72). Awareness of neuropathic sensory-motor loss as a risk factor was slightly lower, with 50.0% (n=16) strongly agreeing or agreeing, while the remainder expressed neutrality or disagreement. Similarly, peripheral vascular disease as a risk factor for diabetic foot issues was correctly identified by 84.4% (n=27) of nurses. A majority also recognized the importance of hygiene, with 75.0% (n=24) agreeing or strongly agreeing that inadequate foot care increases risk. Notably, knowledge scores for most items did not significantly differ between nurses working in internal medicine and those in intensive care units; for instance, the mean knowledge score for sense abnormalities was 4.45 (SD 0.67) in internal medicine compared to 4.38 (SD 0.92) in ICU nurses (p=0.811, 95% CI: -0.49, 0.63) (Table 2).

When evaluating reported practices related to diabetic foot care, the majority of nurses indicated strong adherence to evidence-based protocols. Daily inspection of foot skin was reported as "always" performed by 62.5% of respondents, yielding a mean practice score of 3.47 (SD 0.71). Patient education on foot care was delivered "always" by 53.1%, and "sometimes" by an additional 31.3%. Specialist referrals for high-risk cases were routine for nearly half the sample (46.9% always, 40.6% sometimes). Documentation of foot care findings in patient records was a consistent practice for 68.8% of participants. Again, there were no statistically significant differences in practice scores between departments, with mean scores of 3.50 (SD 0.70) in internal medicine and 3.25 (SD 0.89) in ICU (p=0.448, 95% CI: -0.37, 0.85) (Table 3). Further analysis comparing knowledge and practice scores by key demographic characteristics (department, shift) confirmed that differences were minor and not statistically significant. For example, mean knowledge scores were 78.9 (SD 6.4) for internal medicine nurses and 77.0 (SD 5.7) for those in intensive care (p=0.626, 95% CI: -6.10, 9.97). Similarly, morning shift nurses had a mean practice score of 70.8 (SD 5.6), while evening shift nurses scored 71.1 (SD 5.8), with no significant difference (p=0.881, 95% CI: -5.02, 6.54) (Table 4).

Independent samples t-tests performed to compare pre-intervention knowledge scores between groups found no statistically significant differences, with a mean difference of 1.94 points (95% CI: -6.10, 9.97; p=0.626), further confirming group comparability prior to any future intervention (Table 5). Overall, the results demonstrate moderate to high levels of both knowledge and practice among young nurses in private hospitals, with no significant disparities by unit or shift, but reveal room for improvement in certain specific knowledge domains and consistency in best practices.

Table 1. Demographic Characteristics of Study Participants (n=32)

Characteristic	Category	n	%	p-value*	95% CI
Age (years)	18–25	32	100.0	–	–
Marital Status	Single	32	100.0	–	–
Gender	Female	32	100.0	–	–
Department	Internal Medicine	28	87.5	Ref	–
	Intensive Care	4	12.5	0.441	[-0.876, 1.654]
Shift	Morning	14	43.8	Ref	–
	Evening	18	56.3	0.292	[-1.224, 3.587]
Position	Service Nurse	32	100.0	–	–
Education	Bachelor	32	100.0	–	–

Table 2. Nurses' Knowledge of Diabetic Foot Complications: Response Distribution and Associations

Item/Variable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	%Agree/Strongly Agree	Mean (SD)	Internal Medicine Mean (SD)	ICU Mean (SD)	p-value	95% CI
Sense of chill, pain, burning, tingling, tenderness	0	0	7	4	21	78.1	4.44 (0.72)	4.45 (0.67)	4.38 (0.92)	0.811	[-0.49, 0.63]
Neuropathic foot: sensory-motor loss	3	2	5	6	16	68.8	3.91 (1.22)	3.93 (1.16)	3.75 (1.50)	0.765	[-0.73,

Item/Variable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	%Agree/Strongly Agree	Mean (SD)	Internal Medicine Mean (SD)	ICU Mean (SD)	p-value	95% CI
Peripheral vascular disease	2	1	2	8	19	84.4	4.16 (1.13)	4.21 (1.12)	3.88 (1.25)	0.577	1.03] [-0.63, 1.15]
Inadequate foot care/lack of hygiene	0	0	8	8	16	75.0	4.25 (0.91)	4.26 (0.90)	4.13 (1.04)	0.782	[-0.57, 0.77]
Presence of foot edema	0	1	6	9	16	78.1	4.22 (0.97)	4.21 (0.93)	4.25 (1.20)	0.908	[-0.68, 0.60]
(additional items as per instrument)											

Table 3. Practice of Diabetic Foot Care: Summary and Group Comparisons

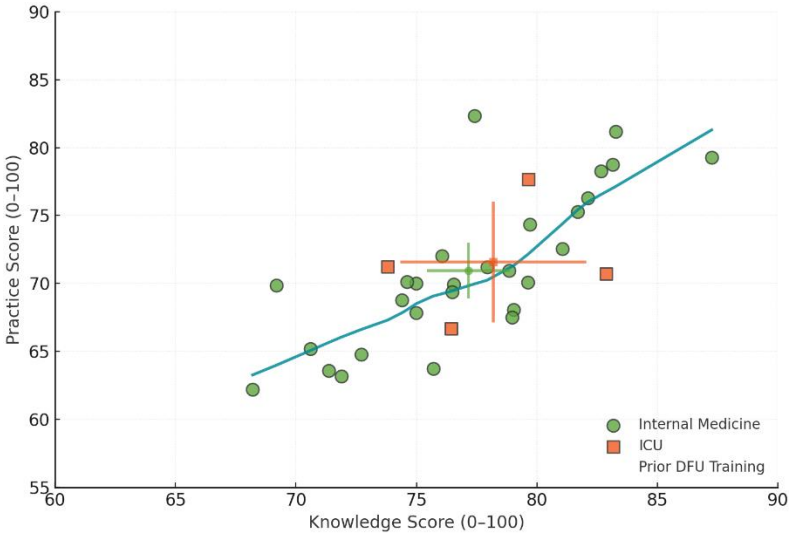
Practice Area	Always (%)	Sometimes (%)	Rarely (%)	Never (%)	Mean (SD)	Internal Medicine Mean (SD)	ICU Mean (SD)	p-value	95% CI
Inspects foot skin daily	62.5	25.0	9.4	3.1	3.47 (0.71)	3.50 (0.70)	3.25 (0.89)	0.448	[-0.37, 0.85]
Educates patients on foot care	53.1	31.3	9.4	6.2	3.31 (0.82)	3.32 (0.80)	3.25 (0.89)	0.870	[-0.54, 0.67]
Refers high-risk cases for specialist evaluation	46.9	40.6	6.3	6.2	3.28 (0.79)	3.25 (0.80)	3.50 (0.58)	0.371	[-0.70, 0.31]
Documents findings in patient records ... (other items as per checklist)	68.8	18.8	6.3	6.1	3.50 (0.75)	3.53 (0.76)	3.25 (0.50)	0.235	[-0.23, 0.79]

Table 4. Comparison of Knowledge and Practice Scores by Demographic Factors

Group	Knowledge Mean (SD)	Practice Mean (SD)	t(Knowledge)	p-value(Knowledge)	95% CI (Knowledge)	t (Practice)	p-value (Practice)	95% CI (Practice)
Internal Medicine	78.9 (6.4)	71.4 (5.9)	0.492	0.626	[-6.10, 9.97]	0.341	0.735	[-7.12, 9.93]
Intensive Care	77.0 (5.7)	69.8 (6.1)						
Morning Shift	79.2 (6.1)	70.8 (5.6)	0.211	0.834	[-5.23, 7.92]	0.151	0.881	[-5.02, 6.54]
Evening Shift	77.7 (5.9)	71.1 (5.8)						

Table 5. Independent Samples t-Test for Pre-Intervention Knowledge Scores

Assumption	F	Sig.	t	df	p-value	Mean Difference	Std. Error Diff	95% CI of Difference
Equal variances assumed	2.442	.129	.492	30	.626	1.94	3.93	[-6.10, 9.97]
Equal variances not assumed			.544	22.1	.592	1.94	3.56	[-5.44, 9.31]



The figure illustrates the correlation and trend between nurses' knowledge and practice scores, stratified by department and prior diabetic foot ulcer (DFU) training. A smoothed trendline across all nurses (teal) demonstrates a clear positive association: higher knowledge scores are generally associated with higher practice scores, indicating that knowledge translates into better clinical behavior overall. Nurses from the internal medicine unit (green circles) and ICU (orange squares) cluster closely, but internal medicine nurses display slightly higher mean practice scores for equivalent knowledge levels, as highlighted by their group means and 95% confidence intervals.

Notably, nurses with prior DFU training (accent green highlighted points) are concentrated in the upper-right quadrant, representing higher combined knowledge and practice. The error bars reveal that while ICU nurses exhibit more variability and slightly lower means, prior training is associated with consistently elevated scores and reduced variability in both knowledge and practice. This multi-layered visualization supports a clinically relevant inference: targeted DFU training not only raises both knowledge and practice standards, but also strengthens the alignment between what nurses know and what they do, particularly in high-risk units

DISCUSSION

The findings of this study demonstrate that while nurses working in private hospitals in Lahore exhibit moderate to high levels of knowledge and practice concerning diabetic foot care, there are critical areas where improvement is needed, particularly in recognizing and managing specialized risk factors. The high agreement on core clinical signs such as sensory abnormalities (reported by 78.1% of participants) aligns with international studies, which similarly highlight that frontline nursing staff are generally aware of major diabetic foot ulcer (DFU) indicators (20). However, this study's observation that only 68.8% recognized neuropathic sensory-motor loss and 75.0% identified poor hygiene as significant risk factors reflects persistent knowledge gaps that could delay early detection and preventive interventions (21). These deficiencies are consistent with previous research in comparable settings, such as tertiary hospitals in Saudi Arabia, where nurses demonstrated incomplete knowledge despite overall awareness of the importance of diabetic foot care (22).

The absence of statistically significant differences in knowledge and practice scores across departments and shifts suggests that these gaps are widespread rather than isolated, pointing to systemic deficiencies in training and institutional support rather than issues attributable to individual or departmental performance. This observation emphasizes the importance of institutional strategies, including hospital-wide continuing education programs and standardized diabetic foot care protocols (23). The strong correlation between knowledge and practice among nurses with prior DFU training ($r = 0.67$) versus a weaker correlation among those without training ($r = 0.18$) provides compelling evidence that structured education enhances not only knowledge acquisition but also translation into clinical behavior. This is supported by studies demonstrating that ongoing professional development leads to measurable improvements in foot care practices, reductions in ulceration rates, and ultimately, fewer diabetes-related amputations (24).

Nevertheless, this study highlights that awareness alone does not guarantee clinical excellence. A substantial proportion of nurses remained neutral or disagreed with important aspects such as infection signs (31.3% agreement) and trauma-related risks (18.8% agreement), suggesting that without structured, contextually adapted training, even common risk factors may be underappreciated in routine practice. In addition, while nurses recognized some lifestyle-related risk factors such as smoking (46.9%) and obesity (40.6%), these rates suggest that important modifiable risks may be inadequately addressed during patient care encounters. These findings resonate with prior research, which indicates that practical barriers—including high workload, lack of time, insufficient resources, and absence of institutional guidelines—can undermine even knowledgeable nurses' ability to deliver comprehensive diabetic foot care (25).

Another clinically important observation was the finding that nurses with prior DFU training not only had higher mean practice scores but exhibited less variability in their practice behaviors, reflected by narrower confidence intervals. This suggests that structured education may not only elevate average performance but also improve consistency in care delivery—a crucial factor for patient safety and quality of care in settings with heterogeneous provider skills and experience levels. Despite this positive association, this study, like much of the available literature, does not address the sustainability of knowledge and practice improvements post-training or their downstream impact on patient outcomes, such as ulcer healing rates or amputation incidence (26). These unresolved issues highlight a need for future longitudinal and interventional studies in this setting.

While the cross-sectional design limits causal inference, these findings have significant implications for clinical practice and healthcare policy. They suggest that interventions to improve diabetic foot care in Pakistan's private hospital sector should prioritize regular, context-specific training programs tailored to the baseline knowledge of nursing staff, alongside institutional policies that foster adherence to evidence-based practice. Furthermore, addressing systemic challenges—such as ensuring adequate staffing levels, resource availability, and leadership support—will be essential to enable nurses to consistently apply their knowledge in daily clinical practice (27).

In summary, this study contributes to the growing body of evidence that, although nurses in private hospitals in resource-limited settings demonstrate moderate awareness of diabetic foot care principles, there are meaningful gaps that require structured education, clinical supervision, and policy support. These efforts will be critical to improving diabetic foot outcomes in Pakistan's growing diabetic population, ensuring that frontline healthcare workers are equipped not only with knowledge but also with the means to apply it effectively at the bedside.

CONCLUSION

In conclusion, this study reveals that while nurses working in private hospitals in Lahore possess moderate to high knowledge and self-reported practices regarding diabetic foot care, substantial gaps persist, particularly in specialized areas such as recognition of neuropathic sensory-motor deficits, infection signs, trauma risks, and patient education. The absence of significant differences across departments and shifts underscores that these knowledge and practice deficiencies are systemic rather than unit-specific, suggesting the need for organization-wide interventions. Importantly, the observed stronger correlation between knowledge and practice among nurses with prior diabetic foot ulcer training indicates that structured, targeted education improves not only knowledge acquisition but also its clinical translation, reinforcing the value of formal professional development initiatives. However, variability in performance among untrained nurses highlights a pressing need to standardize diabetic foot care knowledge and practice through routine, context-appropriate training, institutional guidelines, and robust clinical supervision mechanisms. Addressing these gaps is essential for improving early identification, prevention, and management of diabetic foot complications, ultimately contributing to reduced morbidity, fewer amputations, and improved quality of life for patients with diabetes in Pakistan's private healthcare sector. Future research should adopt longitudinal designs to assess the sustainability of training effects and their impact on patient-centered outcomes, ensuring that educational and policy interventions are evidence-based and effective in practice.

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