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Nursing and Paramedic Contributions to Diabetic Foot Ulcer Prevention and Care: A Cross-Sectional Study in Saudi Arabia

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ABSTRACT: Diabetic foot ulcers (DFUs) are an important diabetes-related complication and may lead to infection, delayed recovery, hospitalization, and lower-limb amputation. Because nurses and paramedic personnel frequently interact with patients across outpatient, inpatient, and community settings, their contribution to screening, education, wound care, and referral may influence the course of diabetic foot disease.

Objective: To examine the contribution of nursing and paramedic services to DFU prevention and management and to describe their relationship with selected patient outcomes in Saudi healthcare facilities. Methods: A descriptive cross-sectional study was undertaken in selected Ministry of Health hospitals in Riyadh, Jeddah, and Dammam from January through June 2025. Five hundred and fifty adults with diabetes were recruited consecutively using a non-probability sampling approach. Information was collected with a structured questionnaire covering demographic and clinical characteristics, foot-care education, routine foot assessment, dressing procedures, wound-care protocols, specialist referral, and selected clinical outcomes. Data were analyzed using IBM SPSS Statistics version 26. Chi-square tests and independent-samples t-tests were used as appropriate, with statistical significance set at $p < 0.05$.

Results: The participants had a mean age of 56.4 ± 11.2 years; 508 (92.4%) had type 2 diabetes and 328 (59.6%) reported a history of DFU. Regular nursing foot assessment was reported by 344 participants (62.5%), while 302 (54.9%) had received foot-care education. Paramedic staff performed dressing procedures for 278 participants (50.5%), whereas 188 (34.2%) reported nursing-initiated specialist referral. Among patients receiving regular nursing care, complete ulcer healing within eight weeks was reported in 76.1%, compared with 52.4% among those without regular nursing care. The manuscript data also indicate

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lower recurrence and infection-related complications among patients receiving nursing involvement.Conclusion: Nursing and paramedic personnel represent important components of multidisciplinary diabetic foot care. Strengthening routine screening, patient education, standardized wound-care procedures, referral pathways, and continuing professional training may improve the organization and quality of DFU management in Saudi healthcare settings. Because of the cross-sectional design, the observed associations should not be interpreted as proof of causality.

1. INTRODUCTION

Diabetes mellitus continues to place substantial pressure on healthcare systems in Saudi Arabia, where the burden of the disease has increased over recent decades. Diabetic foot ulceration is among the complications with the greatest potential to produce prolonged morbidity because an apparently minor injury can progress to infection, tissue loss, hospitalization, or amputation. Earlier Saudi work has emphasized the substantial burden of diabetic foot complications and the value of coordinated multidisciplinary management (Al Dawish et al., 2016; Al-Rubeaan et al., 2015).

Effective DFU prevention depends not only on specialist services but also on repeated contact with healthcare professionals who can identify risk factors before tissue breakdown occurs. Nurses commonly undertake clinical observation, foot inspection, dressing changes, patient education, reinforcement of treatment plans, and follow-up. Paramedic personnel may contribute to wound management and continuity of care, particularly in facilities where specialist diabetic foot services are not readily accessible. These roles provide opportunities for early recognition of infection, reinforcement of protective behaviors, and timely escalation of care.

The principal biological pathways leading to ulceration include peripheral neuropathy, impaired perfusion, repetitive mechanical stress, and unrecognized trauma. In patients with sensory loss, unsuitable footwear or minor injury may therefore progress without adequate early attention. Comprehensive foot examination and risk assessment are recognized elements of diabetes care, while structured education can support protective self-care behaviors (Boulton et al., 2008). Evidence from multidisciplinary and nurse-led approaches also suggests that coordinated care can improve management and reduce adverse consequences of DFU.

Despite these principles, the extent to which nursing and paramedic activities are consistently incorporated into routine diabetic foot services in Saudi healthcare settings remains insufficiently characterized. Barriers may include differences in professional training, inconsistent use of wound-care protocols, limited referral authority, and variation between institutions. These issues are particularly relevant to health-system transformation and chronic disease management under Saudi Vision 2030.

Accordingly, this study evaluated the reported involvement of nurses and paramedic staff in diabetic foot assessment, education, dressing care, protocol-based management, and specialist referral, and examined their association with selected clinical outcomes among adults with diabetes receiving care in three major Saudi cities.

2. MATERIALS AND METHODS

2.1 Study Material

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A descriptive cross-sectional study was conducted in selected Ministry of Health hospitals in Riyadh, Jeddah, and Dammam, Saudi Arabia, between January and June 2025. Participants were recruited from outpatient diabetic clinics and inpatient wards.

2.2 Sampling Collection

The study included 550 adults with diabetes who were recruited through non-probability consecutive sampling. Eligibility required an age of 18 years or older, a diagnosis of type 1 or type 2 diabetes mellitus, and willingness to provide informed consent. Patients with foot ulcers attributable to non-diabetic causes, individuals unable to communicate because of cognitive or language barriers, and critically ill patients were excluded.

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2.3 Data Collection Instrument

A structured, pre-validated questionnaire was administered by trained research assistants. It covered demographic characteristics, diabetes duration, comorbidities, smoking status, previous DFU, and the type and frequency of nursing or paramedic support. Service-related items addressed routine foot assessment, foot-care education, dressing changes, use of wound-care protocols, and referral to diabetic foot specialists. Clinical outcomes included ulcer healing within eight weeks, recurrence within six months, and infection-related complications. Patient satisfaction with nursing care was also assessed using a five-point Likert scale. Outcomes were self-reported and, when available, checked against medical records.

2.4 Statistical Analysis

Data were analyzed with IBM SPSS Statistics version 26. Categorical variables were summarized as frequencies and percentages, whereas continuous variables were expressed as means and standard deviations. Associations between professional involvement and clinical outcomes were examined using chi-square tests for categorical variables and independent-samples t-tests for continuous variables. A two-sided p-value below 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

3.1 Participant Profile and Care Involvement

The study included 550 adults with diabetes. Mean participant age was 56.4 ± 11.2 years. Most participants had type 2 diabetes (92.4%), and 59.6% reported a previous diabetic foot ulcer. Hypertension was present in 67.4%, while 24.4% reported a smoking history.

Table 1. Demographic and clinical characteristics of the study population (n = 550)

Characteristic	Frequency (%) / Mean ± SD
Age (years)	56.4 ± 11.2
Sex, male / female	290 (52.7%) / 260 (47.3%)
Type 2 diabetes mellitus	508 (92.4%)
History of DFU	328 (59.6%)
Hypertension	371 (67.4%)
Smoking history	134 (24.4%)

Routine nursing foot assessment was reported by nearly two-thirds of participants, whereas just over half had received formal foot-care education. Paramedic involvement in dressing procedures was reported by approximately half of the sample. Specialist referral by nursing staff and use of a formal wound-care protocol were less frequently reported.

Table 2. Reported involvement of nursing and paramedic personnel in diabetic foot care

Care activity	Yes, n (%)	No, n (%)
Foot-care education received	302 (54.9%)	248 (45.1%)
Regular foot assessment by nurses	344 (62.5%)	206 (37.5%)
Dressing performed by paramedic staff	278 (50.5%)	272 (49.5%)
Referral to specialist by nursing staff	188 (34.2%)	362 (65.8%)
Use of a wound-care protocol	267 (48.5%)	283 (51.5%)

3.2 Clinical Outcomes

The available study results indicate a higher proportion of complete ulcer healing within eight weeks among patients who received regular nursing care. Healing was reported in 76.1% of patients with regular nursing involvement compared with 52.4%

among those without such involvement. The source manuscript also reports lower recurrence within six months and fewer infection-related complications among the nursing-involved group.

Table 3. Reported relationship between regular nursing involvement and selected DFU outcomes

Outcome	Regular nursing care	Without regular nursing care
Complete ulcer healing within 8 weeks	76.1%	52.4%
Recurrence within 6 months	Lower rate reported	Higher rate reported
Infection-related complications	Lower rate reported	Higher rate reported

3.3 DISCUSSION

This cross-sectional study highlights the substantial practical contribution of nurses and paramedic personnel to diabetic foot care in Saudi healthcare facilities. The findings show that nursing involvement extended across assessment, education, wound care, and referral, while paramedic staff were frequently involved in dressing procedures. The pattern is clinically relevant because prevention of ulcer progression depends on repeated observation, recognition of early abnormalities, appropriate wound management, and reinforcement of patient self-care.

A notable finding was that regular nursing assessment was more commonly reported than formal foot-care education. Although 62.5% of participants reported regular nursing assessment, only 54.9% reported receiving foot-care education. This difference suggests that opportunities remain to integrate structured education into routine diabetic care rather than providing education only when a foot problem becomes apparent. Education concerning daily inspection, hygiene, footwear, injury prevention, and early reporting of symptoms can complement clinical surveillance.

The study also identified relatively limited nursing involvement in specialist referral. Only 34.2% of participants reported referral by nursing staff. This may reflect differences in institutional policy, professional scope, availability of specialist services, or the absence of standardized escalation pathways. Strengthening referral criteria and clarifying responsibilities within multidisciplinary teams may reduce delays when patients require specialist assessment.

The reported healing difference is clinically important but should be interpreted cautiously. Complete healing within eight weeks was reported in 76.1% of patients receiving regular nursing care compared with 52.4% of those without regular nursing care. The cross-sectional design cannot establish that nursing care itself caused the difference. Other factors—including ulcer severity, diabetes duration, vascular status, comorbidities, treatment adherence, and access to specialist care—may contribute to the observed association.

The findings are broadly consistent with previous literature emphasizing multidisciplinary management and structured diabetic foot assessment. Saudi studies have also identified gaps in diabetic foot knowledge and practice and have highlighted the importance of strengthening professional education and standardized care pathways (Alshammari et al., 2020; Alzahrani & Baig, 2019). International guidance similarly supports systematic foot examination and risk assessment as part of comprehensive diabetes management (Boulton et al., 2008).

From a health-system perspective, the results support continued investment in competency-based training for nurses and paramedics. Practical programs could include standardized foot-screening checklists, wound-assessment competencies, dressing protocols, patient-education materials, and explicit referral algorithms. Such measures may improve consistency across facilities and strengthen continuity between primary, secondary, and specialist services.

3.4 Strengths and Limitations

Strengths: A strength of the study is the inclusion of 550 participants recruited from healthcare facilities in Riyadh, Jeddah, and Dammam, providing observations from more than one Saudi setting. The questionnaire also examined several components of professional involvement rather than focusing solely on wound dressing, allowing assessment of education, screening, protocol use, and referral alongside clinical outcomes.

Limitations: The cross-sectional design prevents temporal and causal conclusions. Several care practices and outcomes were based on participant reports, creating potential recall or reporting bias, although medical records were consulted when available. Differences in staff training and institutional practice between hospitals were not stratified in the analysis. In addition, the incomplete presentation of some outcome statistics in the source manuscript limits the precision with which recurrence and infection findings can be quantified. Future prospective studies should use standardized ulcer severity measures, objective clinical follow-up, and multivariable analyses to better estimate the independent contribution of nursing and paramedic care.

4. CONCLUSION

Nurses and paramedic personnel have an important operational role in diabetic foot prevention and management in Saudi healthcare settings. In this study, regular nursing involvement was associated with a higher reported rate of ulcer healing and with lower reported recurrence and infection-related complications. The findings support strengthening routine foot assessment, structured patient education, protocol-based wound management, and clear referral pathways. Prospective, multicenter research is needed to determine the extent to which these interventions independently improve DFU outcomes.

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AUTHOR CONTRIBUTIONS

Omnia A. M. Higazy: Conceptualization, Methodology, Project Administration, Writing—Original Draft.
Hawa I. A. Hamid: Investigation, Data Curation.
Maha A. A. Ali: Formal Analysis, Validation.
Mohammed K. H. Khalid: Data Curation, Investigation.
Sara E. I. Mohamed: Conceptualization, Supervision, Writing—Review & Editing.
Ghada A. E. A. Eldeeb: Supervision, Writing—Review & Editing.
Somia J. A. Farg: Resources, Software.
Amani M. M. Abdelrahman: Methodology, Validation.
Insaf H. A. Mohammed: Writing—Review & Editing.
Anwar B. E. Ali: Formal Analysis, Data Curation.
Ashraf A. E. Elmdni: Writing—Review & Editing.
Fahmida Khatoon: Supervision, Critical Revision.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

The study protocol was approved by the relevant Institutional Review Board / Research Ethics Committee in Saudi Arabia. Informed consent was obtained from all individual participants included in the study.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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