REVIEW ARTICLE

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Knowledge, Attitude, Practice and Associated Factors Related to Diabetic Foot Ulcer among Nurses: A Systematic Review

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ABSTRACT

Background: Diabetic foot ulcers (DFUs) are among the most severe complications of diabetes mellitus, contributing to high morbidity, mortality, and healthcare costs globally. DFU prevalence around the world was estimated at 6.3%, with prevalence in Asia at 5.5%. Nurses play a pivotal role in DFU care and prevention. However, their knowledge, attitudes, and practices (KAP) vary widely across settings. This systematic review aims to synthesise evidence regarding the level of KAP and associated factors among nurses in managing DFUs.
Methods: A systematic search was conducted using Scopus, ScienceDirect, and Google Scholar for studies published between 2014 and April 2024. The search followed PRISMA 2020 guidelines. Inclusion criteria included observational and interventional studies focusing on nurse-related KAP on DFU management. Exclusion criteria included systematic review, meta-analyses, conference abstracts, editorials, theses, or book chapters. Quality was appraised using the Joanna Briggs Institute (JBI) checklist.
Results: This review found that, of the 6,932 studies initially screened, only 30 met the predefined inclusion criteria. The majority employed cross-sectional designs, with sample sizes ranging from 8 to 4,011 participants. Although several studies demonstrated moderate to high levels of knowledge among respondents, notable deficiencies were identified, particularly in practice and formal DFU training. Knowledge was positively associated with education, recent training, and working environment. However, attitude and practice did not always correlate with expertise. Barriers included excessive workload, limited resources, and restricted access to continuing education.
Conclusion: There is wide variability in nurses' KAP on DFU care, influenced by sociodemographic, institutional, and professional factors. Structured, standardized and comprehensive DFU training framework and integration of DFU care into continuing nursing education is essential to improve patient outcomes.

Keywords: Attitude; Diabetic foot ulcer; Knowledge; Nurses; Practice

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INTRODUCTION

Diabetes mellitus (DM) has emerged as a critical global public health challenge, impacting both developed and developing nations due to its rising prevalence and extensive complications. The global prevalence of diabetes among adults aged 20–79 was approximately 10.5% (536.6 million) in 2021 and alarmingly projected to surge to 12.2% (783.2 million) by 2045 without substantial and effective preventive interventions (1). Notably, nearly half (44.7%; 239.7 million) of those affected were undiagnosed, underscoring the pressing need for early detection and management to mitigate complications and premature mortality.

Malaysia mirrors this global trend with an escalating diabetes burden (2). The National Strategic Plan for Non-Communicable Diseases anticipates that by 2025, over 7 million Malaysians aged 18 and above (approximately 31.3% of the adult population) will be living with diabetes (3). The economic implications are considerable, with diabetes management costs projected to reach USD 6.3 billion annually. Meanwhile, the pooled prevalence of diabetes in Malaysia stands at 14.39%, surpassing neighbouring countries such as Singapore (5.5%) and Indonesia (6.2%) (4). Among the myriad complications of diabetes, DFUs present a significant clinical and economic burden (5). Despite relatively low reported DFU prevalence (1.00% in 2023), DFUs represent the leading cause of diabetes-related hospitalisations and are linked to prolonged hospital stays, increased costs, and elevated mortality (6,7).

In light of the increasing diabetes prevalence in Malaysia, particularly in the East Coast state of Pahang, where 5.32% of the population is diabetic and DFU prevalence is on the rise (2), there is an urgent need to assess the competencies of nurses in managing DFUs. Inadequacy in nursing knowledge and practice can consequently delay wound healing, elevate amputation rates, and substantially burden healthcare systems (10,11).

Despite the critical role of nurses in DFU care, there is a lack of systematic evaluation regarding their knowledge, attitudes, and practices (KAP), especially within Malaysian teaching hospitals. Existing literature in Malaysia has largely focused on the general public or diabetic patients, with limited focus on nursing professionals (13,14). Without targeted insight into nurses' KAP, the implementation of evidence-based practices and patient education may be compromised, contributing to prolonged hospital stays and increased risk of complications, including amputation.

Therefore, this systematic review aims to synthesize existing evidence regarding the KAP of nurses toward DFU management, and to explore the associated sociodemographic and institutional factors influencing their competence. Understanding these dimensions is essential for informing workforce training, clinical protocols, and health policy interventions aimed at reducing the DFU burden in Malaysia and globally.

METHODS

Study Design

This systematic review was conducted in accordance with the PICOS (Population, Intervention, Comparison, Outcomes, Study design) criteria as shown in the **Table** 1 and The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (15). The purpose of this review was to synthesise current global evidence on nurses' knowledge, attitudes, and practices (KAP) in managing diabetic foot ulcers (DFUs), and to identify sociodemographic and institutional factors influencing these domains.

Table 1: PICOS Criteria Employed to Design the Review

Criteria	Description
Population / Participants	Registered nurse
Intervention/Exposure	Knowledge, Attitude, Practice regarding DFU management
Comparison/ Context	Studies focusing on DFU care in any clinical setting
Outcomes	Mean scores, percentage of nurses with adequate/poor KAP, correlation between KAP, or factors influencing KAP
Study design	Observational/Descriptive quantitative studies and qualitative/mixed-methods studies that assess KAP

Eligibility Criteria

Inclusion and Exclusion Criteria

To ensure the relevance and quality of the studies included in this systematic review, a set of inclusion and exclusion criteria was established. Eligible studies were those that presented original primary research, whether employing quantitative, qualitative, or mixed methods designs. Only studies that specifically focused on nurses or nursing professionals involved in the management of diabetic foot ulcers (DFUs) were considered. Furthermore, included studies needed to assess at least one of the core components of knowledge, attitude, and/or practice (KAP) related to DFU care. The publication window was restricted to studies published between January 2014 and April 2024 to ensure the inclusion of recent and relevant data. All studies had to be published in English and be accessible in full-text format. Studies were excluded if they were systematic reviews, meta-analyses, conference abstracts, editorials, theses, or book chapters, as these do not provide primary data. Research that focused on populations other than nurses, such as patients or the general public, without providing specific disaggregated data for nurses, was also excluded. Additionally, studies that addressed diabetes-related complications not specific to foot ulcers or that did not evaluate any element of KAP were excluded from consideration.

Search Strategy

A comprehensive search strategy was conducted to identify eligible articles. Three electronic databases were searched: Scopus, ScienceDirect, and Google Scholar. The last search was performed in April 2024. Keywords were developed based on Medical Subject Headings (MeSH). Boolean operators were used to optimise search sensitivity:

("Diabetic Foot Ulcer") AND ("Knowledge" OR "Attitude" OR "Practice") AND ("Nurse")

Filters were applied to restrict results to studies published between 2014 and 2024 and written in English. Manual searches of the reference lists of selected studies were also performed to identify any additional relevant publications.

Study Selection Process

A total of 6,932 records were initially retrieved. After removing duplicates and performing title and abstract screening, 38 full-text articles were reviewed in-depth for eligibility. Following this assessment, 30 studies met the inclusion criteria and were retained for analysis. Studies were excluded if they did not report distinct KAP findings for nurses or did not focus on DFU-related care. The study selection process is detailed in the PRISMA 2020 flow diagram as shown in the **Figure** 1.

The review team conducted the screening and selection independently. Discrepancies between reviewers were resolved through discussion and consensus, ensuring the reliability of the selection process.

Data Extraction

Data from each of the included studies were systematically extracted using a standardized data extraction form developed by the review team. This form was designed to ensure consistency and comprehensiveness in capturing relevant information across studies. The extracted variables included the names of authors, the year of publication, the country in which the study was conducted, and the specific study setting. Additionally, details regarding the study design such as whether it was cross-sectional, quasi-experimental, or qualitative were documented.

Information about the sample size and the sampling method used in each study was also recorded. Further, the characteristics of participants were extracted, including demographic details such as age, level of education, and years of clinical experience. The instruments or tools used to measure KAP were noted, along with the key findings related to each KAP domain. Where available, data on factors associated with KAP outcomes such as sociodemographic or institutional variables were also captured.

Following extraction, studies were grouped and organised according to their relevance to the KAP domains. Thematic categorisation facilitated a more structured and meaningful synthesis of the findings across diverse study populations and settings.

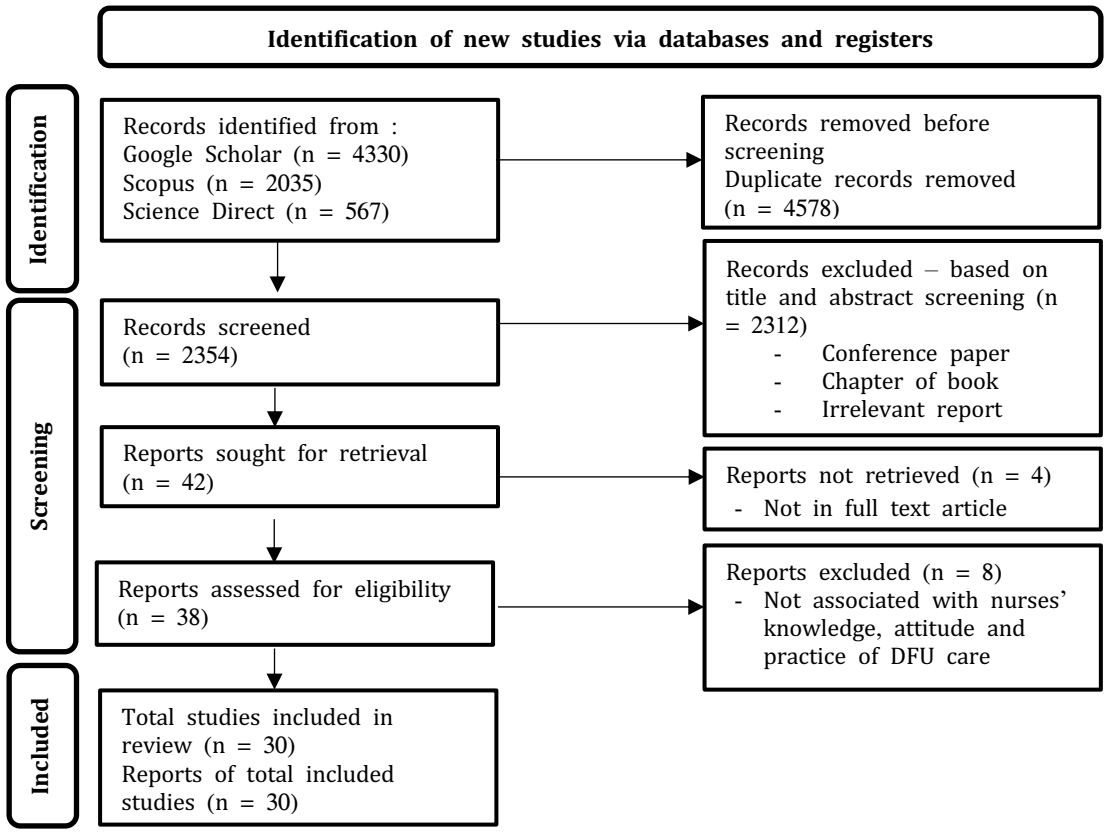
Quality Appraisal

All included studies underwent a rigorous quality appraisal using the analytical cross sectional and qualitative Joanna Briggs Institute (JBI) critical appraisal tools (16). Each study was assessed for methodological robustness, clarity of aims, adequacy of sample size, appropriateness of measurement tools, and validity of findings. Studies were categorized as

high, moderate, or low quality based on cumulative scores.

The quality appraisal process ensured that only methodologically sound studies contributed to the synthesis, thereby increasing the reliability of the review's conclusions. The appraisal was conducted by using the JBI table as shown in **Table** 2.

Figure 1: PRISMA Chart for Literature Searching (2020)



Data Synthesis

Given the heterogeneity in study design, measurement instruments, and statistical methods, a narrative synthesis approach was adopted. This method allowed for the thematic organisation and descriptive comparison of findings. Quantitative results were summarised using frequencies, percentages, mean scores, odds ratios (OR), and p-values as reported in the original studies. Associations between KAP levels and factors such as education, experience, training, and workplace environment were highlighted where applicable. Studies were grouped into three key thematic areas: 1) Levels of knowledge, attitude, and practice (KAP) among nurses related to DFU care, 2) Factors associated with KAP, including demographic and institutional variables, and 3) Relationship between knowledge and attitude/practice, exploring how knowledge influences behaviour. Where available, statistical significance was extracted and reported to support conclusions. Findings were presented in both tabular as shown in **Tables** 3 and **Table** 4 and narrative formats to enhance interpretability.

RESULT

Study Selection

A total of 6,932 records were retrieved from the initial search. After removing duplicates and screening titles and abstracts, 38 articles were retained for full-text review. Following further eligibility assessment, 30 studies were included in this review based on the inclusion criteria. Eight studies were excluded due to an insufficient focus on nurses or a lack of specific data related to KAP regarding DFU care. The PRISMA 2020 flow diagram in the **Figure** 1 summarises the selection process.

Characteristics of Included Studies

The included studies were published between 2014 and 2024, with the majority conducted in Asia (*n* = 19), followed by Africa (*n* = 5), the

Middle East (*n* = 4), South America (*n* = 1), and North America (*n* = 1). The majority employed cross-sectional designs (*n* = 22), while others used quasi-experimental (*n* = 4), qualitative (*n* = 3), and mixed-methods (*n* = 1) approaches. Sample sizes varied considerably, ranging from 8 to 4,011 participants.

Most studies specifically focused on nurses (*n* = 26), while others included mixed healthcare professionals with disaggregated data for nurses. Instruments used for KAP assessment included structured questionnaires, observation checklists, and validated scales. Study outcomes were generally presented as mean scores, percentages, or categorized as "good," "moderate," or "poor" levels of knowledge, attitude, and practice.

Knowledge of DFU

The assessment of nurses' knowledge levels showed wide variation; some studies reported good to high scores (above 80% to 100%), particularly among nurses with formal wound care training, (12,17,43) whereas others highlighted moderate to poor knowledge (less than 80%) in settings characterized by limited training (11,18,45). Knowledge was consistently found to be influenced by educational attainment, years of service, prior DFU training, and work environment (hospital vs. community setting) (27,32).

Attitude and Practice toward DFU Management

Attitude and practice levels were less consistent across the literature. While some studies reported a positive attitude (above 80%) among nurses toward DFU care, (19,26) others indicated that nurses viewed DFU management as time-consuming or burdensome (11,20). Practices such as regular foot assessments, patient education, and wound documentation were not routinely performed, even among nurses with adequate knowledge.

Table 2 : Summary of Quality Assessment of The Included Studies Using JBI Appraisal Tools

No	Author	Study Design	Quality Appraisal	Risk of Bias
1.	Hu & Jiang (21)	Cross-sectional	High	Low
2.	Li et al (30)	Cross-sectional	Moderate	Moderate
3.	Shi et al (18)	Observational	High	Low
4.	Wang et al (33)	Cross-sectional	High	Low
5.	Flor et al (34)	Validation Study	High	Low
6.	Ramzan et al (24)	Interventional	High	Low
7.	Ranuve & Mohammad (35)	Qualitative	Moderate	Moderate
8.	Alkhatieb et al (28)	Cross-sectional	High	Low
9.	Sari et al (19)	Cross-sectional	Moderate	Moderate
10.	Alsaigh et al (27)	Cross-sectional	High	Low
11.	Gharsangi et al (37)	Cross-sectional	High	Low
12.	Lidiany et al (36)	Interventional	High	Low
13.	Pourkazemi et al (38)	Cross-sectional	High	Low
14.	Bondi et al (13)	Interventional	High	Low
15.	Fuiji et al (26)	Cross-sectional	Moderate	Moderate
16.	Mafusi & Egenasi (29)	Cross-sectional	High	Low
17.	Samadi et al (39)	Qualitative	Moderate	Moderate
18.	Ng et al (11)	Cross-sectional	Moderate	Moderate
19.	Abate et al (31)	Cross-sectional	High	Low
20.	AlWahsh & Almaani (40)	Cross-sectional	High	Low
21.	Kielo et al (41)	Observational	High	Low
22.	Alhaiti et al (42)	Cross-sectional	Moderate	Moderate
23.	John & Buloala (22)	Cross-sectional	Moderate	Moderate
24.	Bilal et al (12)	Cross-sectional	High	Low
25.	Kaya & Karaca (20)	Cross-sectional	High	Low
26.	Kumarasinghe et al (43)	Cross-sectional	Moderate	Moderate
27.	Abdullah et al (25)	Observational	High	Low
28.	Davis, M (44)	Observational	High	Low
29.	Alotaibi et al (32)	Qualitative	Moderate	Moderate
30.	Shil et al (45)	Cross-sectional	High	Low

Table 3: Summary of Studies' Findings on Knowledge, Attitudes and Practices

No.	Author	Year	Study Setting	Participants	Focus Findings
1.	Hu & Jiang (21)	2024	China	Nurses	High K, Good A, Good P, Significant KAP correlation
2.	Li et al (30)	2024	Gansu Province, China	Diabetes Specialist Nurses	High K
3.	Mafusi & Egenasi (29)	2024	South Africa	Nurses	Moderate K, Good A, Good P , Significant K-A correlation
4.	Wang et al (33)	2023	China	Healthcare worker	Poor K, Good A, Good P, Significant KAP correlation
5.	Flor et al (34)	2023	Mexico	Nurses	Good K, Good A
6.	Shi et al (18)	2022	China	Orthopaedic Nurses	Moderate-Low K
7.	Ramzan et al (24)	2022	Pakistan	Nurses	High K , Good P
8.	Ranuve & Mohammad (35)	2022	Fiji	Healthcare worker	Low K
9.	Alkhatieb et al (28)	2022	Saudi Arabia	Nurses	Moderate K, Poor A, Significant K-A correlation
10.	Sari et al (19)	2022	Indonesia	Nursing students	Good K, Good A
11.	Alsaigh et al (27)	2022	Saudi Arabia	Healthcare worker	Good K, Poor P
12.	Lidiany et al (36)	2021	Brazil	Nurses	Good K
13.	Gharsangi et al (37)	2021	India	Nurses	Good K
14.	Pourkazemi et al (38)	2020	Iran	Healthcare worker	Poor K, Poor P, Significant K-P correlation
15.	Bondi et al (13)	2020	Sabah, Malaysia	Healthcare worker	Significant KAP correlation
16.	Samadi et al (39)	2020	Iran	Nurses	Good K,Good P
17.	Fuiji et al (26)	2020	Japan	Healthcare worker	Low K, Poor A, Poor P, Significant K-P correlation
18.	Ng et al (11)	2020	Johor, Malaysia	Nurses	Low K, Good A
19.	Abate et al (31)	2020	Ethiopia	Nurses	Good K, Good A
20.	AlWahsh & Almaani (40)	2020	Jordan	Nurses	High K
21.	Kielo et al (41)	2019	Finland	Nurses, Podiatrist	Good K
22.	Alhaiti et al (42)	2019	Saudi Arabia	Nurses	Moderate K, Good A
23.	John & Buloala (22)	2018	Nigeria	Nurses	Moderate K
24.	Bilal et al (12)	2018	Pakistan	Nurses	High K, Good A, Good P
25.	Kaya & Karaca (20)	2018	Turkey	Nurses	High K, Poor P
26.	Kumarasinghe et al (43)	2018	Sri Lanka	Nurses	Good K, Good A
27.	Abdullah et al (25)	2017	Saudi Arabia	Nurses	High K &Poor P, Significant K-P correlation
28.	Davis, M (44)	2017	United State	Nurses	Good K, Good P
29.	Alotaibi et al (34)	2017	Saudia Arabia	Nurses	Moderate K
30.	Shil et al (45)	2014	Bangladesh	Nurses	Low K

K = Knowledge, A= Attitude, P= Practice

Factors Associated with Knowledge, Attitude, and Practice (KAP)

Fifteen studies included in this review examined the relationship between sociodemographic and institutional variables and nurses' knowledge, attitudes, and practices regarding diabetic foot ulcer (DFU) care. Several key factors were identified as significantly influencing KAP outcomes.

Education level emerged as a consistent determinant across multiple studies. Nurses with higher levels of education were found to possess better knowledge and more positive attitudes towards DFU care, suggesting that academic qualifications contribute to enhanced clinical competence and awareness.

Years of professional experience demonstrated mixed associations with KAP. In some studies, nurses with fewer years of service have shown better knowledge, which may be attributed to their recent exposure to updated clinical guidelines and academic training. (21) Conversely, other studies found that more experienced nurses demonstrated better practical skills (28-30), likely due to accumulated hands-on experience and familiarity with patient care (22).

Gender was also reported as an influencing factor in certain contexts. Some studies have noted that male nurses have higher knowledge scores with *p*-value less than 0.05 are more engaged in foot care practices compared to their female counterparts (21,23). These findings, however, may be influenced by sociocultural or occupational dynamics specific to the study settings.

Lastly, formal training in diabetic foot care was strongly and consistently associated with improved knowledge and clinical practices. Nurses who had received specialised education or participated in structured wound care programs were significantly more competent and confident in managing DFUs (12,24). This highlights the crucial importance of ongoing professional development and targeted training interventions in improving the quality of DFU management.

Relationship Between Knowledge, Attitude, and Practice

Twelve studies investigated the interrelationship between knowledge, attitude, and practice. While some found significant positive correlations, (25,26) others reported that high knowledge did not always translate to positive attitudes or practices. (11,20,27) These discrepancies suggest that systemic barriers such as workload, lack of resources, or institutional culture may impede the application of knowledge in practice.

Table 4: Summary of Studies on the Association Between Associated Factors and Knowledge, Attitude and Practice of Nurses on DFU

Author (Year)	Study setting	Participant	Associated Factor	Finding
Lan Hu and Wen Jiang (2024)	Hospitals in China	4011 Nurses	- Years of experience - Marital status - Work environment - Gender - Level of education - Employment status	- Factors associated with better KAP: Experience (1-5 years), advanced educational degrees , single marital status, hospital work environment , male gender - Male nurses showed greater knowledge and better practices ; nurses with more experience were less likely to be knowledgeable , possibly due to outdated training
Li., et al (2024).	Hospital in Ganzu Province, Western China	178 diabetes specialist nurses	- Age - Gender - Education level - Technical tittle - Experience in diabetes care - Current work department	Correlations between knowledge, attitudes, and practices: Education level and years of experience in diabetes-related care were significant predictors of knowledge, skills, and attitudes.

			- Teaching experience - Level of hospital - Endocrine work experience	
Mafusi and Egenasi. (2024).	Public health centres within Sol Plaatje Municipality in the Frances Baard District, Northern Cape.	128 nurses	- Gender - Age - Profession/ rank - Year of practice	- Attitudes towards diabetic foot care were significantly associated with the profession of the participants , and wound care experience was associated with years of practice
Shi, et al. (2023)	Public hospital in China	363 orthopaedic clinical nurses	- Education level - Professional title - Years of experience - Training Factors - Instituitional factor	- Factors associated with better KAP: Presence of diabetes specialist nurses or outpatient treatment , type of diabetes-related training received, familiarity with and adherence to current treatment guidelines
Wang et al., (2023)	Endocrinology department of Xiangya Hospital of Central South University Diabetic Foot Prevention and Control Alliance Hospital	1100 healthcare workers	- Education level - Professional title - Years of experience - Training Factors - Institutional Factors	Knowledge: male, tertiary hospital , relevant training Attitudes: 6-10 years of experience , undergraduate , master and above, patient uncooperative, relevant training Practices: 6-10 years of experience , undergraduate level II hospital , tertiary hospital, relevant training, insufficient relevant knowledge, working hours, lack of relevant screening tools, patient uncooperative
Maram et al., (2022)	King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia	172 nurses	- Sex - Marital status - Duration of work in the department - Training to educate patient - Training to perform foot examinations	- Factors associated with better KAP: Educational background and training courses.
Sari et al., (2022)	Three nursing college located on Java, Sulawesi, and Kalimantan island	940 nursing students	- Age - Gender - Level of education - History of wound care training - Interest in diabetic ulcer care - Source of knowledge	- Factors associated with better KAP: Education level (clinical phase students had better knowledge) , sharing with peers as a source of knowledge (improved attitudes) - Male students were less likely to have a positive attitude than female students
Ng et al., (2020).	Segamat Hospital, Malaysia	101 staff nurses	- Gender - Department - Qualification	Factors associated with better/worse KAP: Poor knowledge was associated with

			- Years of Service - Involvement in DFU care - Last formal training in DFU - Main sources of knowledge updates	a lack of formal training ; positive attitudes were not strongly correlated with good knowledge
Abate et al., (2020).	4 hospitals in Bahir Dar, North West Ethiopia	219 nurses from FHRH, 18 nurses from Addisalem hospital, 28 nurses from Adinas hospital, 12 nurses from Gamby hospitals	- Sex - Age - Marital status - Monthly income - Work experience - Qualification - Learning program - Graduate institution - Current working Hospital - Current working unit - Source of knowledge update	- Factors associated with better KAP: Age less than 30 years , graduation from a governmental institution
Al-Wahsh, Z. & Al – maani, M (2020)	9 MOH hospitals in Jordan	256 nurses	- Age - Gender - Profesional Qualification - Working experience - Area of practice - Course training of DFU	- Factors associated with better KAP: Age groups 31-40 years and 41-50 years. - Factors associated with worse KAP: Working in outpatient clinics.
Lilly et al, (2018)	University of Port Harcourt Teaching Hospital Rivers State Hospitals Management Board Hospitals, Nigeria	100 nurses	- Age - Academic qualification - Years of practice	- Factors associated with better KAP: more than 10 years of experience
Kaya, Z. & Karaca, A (2018)	Private hospital in Istanbul, Turkey	435 nurses	- Age - Gender - Marital status - Educational background - Unit - Working time - Position	- Factors associated with better KAP: Training in diabetic foot care , age (nurses aged 40 and higher) , and education level (undergraduate education)
Kumarasinghe et al, (2017)	3 teaching hospital in Sri Lanka	200 nurses	- Age - Gender - Professional qualification - Receive wound care training - Unit of work - Working experience	Significant associations with nursing experience, wound care experience, and unit type ; significant difference in attitudes by age
Shil et al, (2014)	Bangladesh Institute of Research and	218 nurses	- Age - Gender - Religion	Factors associated with worse KAP: - diploma-level education

	Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital	- Level of education - Marital status - Area of practice - Duration of practice - Have taking care of DFU patient	- lack of formal training on prevention and management of diabetic foot ulcers. - No correlation between years of practice and level of knowledge.

DISCUSSION

This systematic review synthesised evidence from 30 studies across Asia, Africa, the Middle East, South America, and North America, exploring nurses' knowledge, attitudes, and practices (KAP) related to diabetic foot ulcer (DFU) care. The findings reveal substantial variability in KAP levels, influenced by diverse demographic, institutional, and educational factors.

Knowledge of Diabetic Foot Ulcer Care

The level of knowledge among nurses varied across geographical regions and institutional contexts. Nurses in China (18), Pakistan (12), and Saudi Arabia (28) demonstrated moderate to high knowledge levels, particularly when they had formal training in wound care. Similar findings were observed among nursing students in Indonesia, where clinical exposure was found to have a significant influence on knowledge acquisition (19). These regional successes may reflect the prioritization of specialized content within nursing curricula and sufficient healthcare funding to support mandatory, ongoing professional development.

Conversely, studies from Malaysia (11) and Nigeria (22) highlighted pronounced deficits in knowledge, attributed to a lack of access to formal training, limited continuing education opportunities, and insufficient manpower. Such deficits often stem from systemic challenges, including institutional cultures that do not prioritize preventative care, or national healthcare funding models that inadequately support specialized training and safe nurse-to-patient ratios.

These results collectively emphasize the critical need for structured DFU-related training programs, tailored to nurses' professional development stages, and must be addressed via reforms in national nursing curricula and increased institutional investment in continuing education and staff resources.

These findings underscore the urgent need for standardized, structured training programs that address regional knowledge gaps and enhance nurses' professional development.

Attitudes and Practices in DFU Management

Attitudinal responses towards DFU care were mixed. Positive attitudes were generally reported among nurses with prior experience and training (12,19). However, other studies, particularly from Malaysia (11) and Turkey (20), noted a reluctance to engage in DFU care, with many nurses perceiving it as time-consuming or outside their scope. These perceptions reflect underlying motivational and systemic challenges, including workload, limited recognition, and lack of institutional support.

Practical application of knowledge particularly in routine foot examinations, patient education, and documentation—was inconsistently reported. Notably, even when knowledge levels were adequate, many nurses did not translate that into clinical practice. For example, 77.5% of nurses did not perform foot examinations for diabetic patients despite possessing sufficient theoretical knowledge (20). Similar gaps were observed in South Africa (29), where nurses acknowledged the importance of recording foot assessments but failed to implement them consistently.

These findings suggest that improving knowledge alone is insufficient without addressing the institutional and behavioral barriers that prevent the translation of knowledge into practice.

Association between Sociodemographic factors with Knowledge, Attitude and Practice

Multiple studies examined demographic and institutional variables that influence KAP. Education level emerged as a consistent predictor of higher knowledge and more positive attitudes (21,30).

Interestingly, several studies reported that nurses with less than five years of experience had better knowledge than those with longer service, possibly due to more recent exposure to updated clinical guidelines (18).

Gender was another influencing factor; male nurses were reported to have higher knowledge and better practices in some contexts (21,23). Marital status, work environment, and departmental support were also found to impact both knowledge and attitudes, suggesting that personal and institutional support systems may play a role in shaping professional behavior (31).

Institutional barriers such as high workload, inadequate staffing, and lack of access to updated resources were cited as key obstacles to effective DFU management (30,32). These challenges reflect a need for healthcare system-level interventions that go beyond individual competencies.

Correlation Between Knowledge, Attitude and Practice

Twelve studies explored the interrelationship between knowledge, attitude, and practice. While some studies demonstrated a statistically significant correlation, particularly between knowledge and practice (25,26) while others have not observed any meaningful association (11,12). This suggests that while knowledge is a foundational component, it does not guarantee behavioral change unless supported by conducive work environments, continuous mentorship, and institutional commitment.

Attitude, in particular, appeared to act as a mediating factor. Nurses with positive attitudes were more likely to practice effective foot care, even when knowledge levels were not exceptional (19,29). This highlights the potential value of fostering motivational and empathetic training interventions aimed at changing perceptions and attitudes toward chronic wound care.

Strengths and Limitations

This systematic review has several strengths. It followed the PRISMA 2020 guidelines and employed the Joanna Briggs Institute (JBI) critical appraisal tools to ensure methodological rigor. A wide range of databases and geographical contexts were included, enhancing the generalizability of the findings.

However, several limitations must be acknowledged. The included studies employed diverse tools and scales to measure KAP, making direct comparison challenging. Variability in study design, sample size, and outcome reporting further limited meta-analysis or data pooling. Additionally, most studies were cross-sectional in nature, precluding causal inferences.

Implications for Practice and Research

The findings of this systematic review highlight several critical implications for both clinical practice and future research in the management of DFUs. Firstly, there is a clear need to develop and implement standardised DFU training modules within both undergraduate nursing curricula and hospital induction programs. These modules should focus on equipping nurses with evidence-based knowledge and practical competencies essential for effective DFU prevention and management.

Secondly, the review emphasises the importance of regular continuing education to keep clinical knowledge current and to reinforce positive attitudes toward foot care practices. Structured refresher courses and workshops can help bridge the knowledge-practice gap frequently reported across healthcare settings.

In addition, organisational support mechanisms must be strengthened to sustain high-quality DFU care. This includes the formation of dedicated wound care teams, availability of clinical resources, and the implementation of mentorship programs that allow less experienced nurses to learn from clinical experts in the field.

From a research perspective, there is a pressing need to expand the scope of inquiry beyond cross-sectional studies. Longitudinal and interventional research designs should be employed to evaluate the long-term effectiveness of educational interventions, clinical mentorship, and institutional policies on improving nurses' knowledge, attitudes, and practices.

Ultimately, understanding the persistent gaps between knowledge and practice provides a valuable foundation for educators, clinical leaders, and policymakers. These insights can guide the development of targeted, evidence-based strategies aimed at empowering nurses to deliver high-quality, consistent DFU care, thereby reducing complications, hospitalisations, and overall burden among diabetic populations.

CONCLUSION

This systematic review highlights critical gaps and variations in the knowledge, attitudes, and practices of nurses regarding diabetic foot ulcer (DFU) care across diverse geographical and healthcare contexts. While several studies reported moderate to good levels of knowledge, there remains a persistent disparity between what nurses know and what they practice. Attitudes also varied, often influenced by

institutional culture, training opportunities, and workload. Several factors, including education level, clinical experience, prior training in wound care, and institutional support, were found to significantly affect nurses' KAP levels.

The findings underscore the urgent need for targeted interventions to enhance nursing competencies in DFU care. Specifically, there is a pressing requirement to standardize diabetic foot care education within both undergraduate and continuing professional development programs. Institutional policies should also support skill reinforcement through workshops, clinical mentorship, and integration of evidence-based guidelines into daily practice. Addressing organizational barriers such as staffing shortages and lack of time allocated for foot assessments is equally critical.

In light of the increasing burden of diabetes and DFUs, especially in regions like Malaysia, healthcare systems must prioritize the capacity building of nurses as frontline caregivers. Future research should consider longitudinal or interventional studies to evaluate the impact of structured training programs on clinical practice outcomes. Additionally, the development and validation of standardized tools for measuring nurses' KAP across different healthcare systems would enhance comparability and benchmarking.

Ultimately, empowering nurses through education, supportive policies, and clinical mentorship will not only improve DFU management outcomes but also contribute to the broader goal of reducing diabetes-related complications and healthcare costs worldwide.

CONFLICT OF INTEREST

This review was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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AUTHOR CONTRIBUTIONS

HH: Guided in drafting the manuscript, reviewed and finalised the manuscript
SNO: Prepared and revised the manuscript comprehensively.
MAMKB: Reviewed the manuscript.
SHAH: Reviewed the manuscript.

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