



ORIGINAL ARTICLE

Nurses' knowledge on diabetic foot ulcer disease and their attitudes towards patients affected: A cross-sectional institution-based study

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Aims and objectives: To assess nurses' knowledge on diabetic ulcer disease and their attitudes towards patients suffering from it and to identify factors which influence them.

Background: Diabetic wound care is an evolving specialty with the rising prevalence of diabetes foot complications. As nurses play a key role in wound care, their knowledge and attitudes are important in providing optimum care to patients.

Design: Descriptive cross-sectional survey design.

Methods: The study was conducted in three teaching hospitals. Data were collected using a pretested, validated, self-administered questionnaire from purposively recruited, voluntarily participating nurses ($n = 200$) who were in diabetic wound care practice for ≥ 1 year.

Results: Lack of formal wound care training was reported by 91.2%. Mean knowledge score was 77.9 (range 53.3–100 on a scale from 0–100) with 57.8% of nurses obtaining $\geq 80\%$. Nurses demonstrated an overall positive attitude towards caring for diabetic ulcer patients (median = 41, range 23–50 on a scale from 10–50). However, the study identified deficits in core knowledge and some negative attitudes such as insensitivity to pain. Statistically significant associations were seen between nurses' knowledge and duration of nursing, wound care experience and the type of unit they are attached to. In-service education (77.2%) and knowledge sharing with peers (77.9%) were the most popular knowledge-updating sources. Although 98.6% of nurses were interested in wound care, only 8.3% wished to engage in research. No correlation was observed between nurses' knowledge and attitudes.

Conclusion: Gaps in core knowledge and negative attitudes may be attributed to inadequate training, suboptimal update of knowledge and lack of interest in wound care research.

Relevance to clinical practice: Wound care training should be made mandatory to improve quality of care given by nurses to patients with diabetic ulcers. Continuous professional development, evidence-based practices and wound care research should be encouraged.

KEYWORDS

attitudes, diabetic leg and foot ulcers, knowledge, nurses, wound care

1 | INTRODUCTION

Diabetes mellitus (DM) is an escalating health problem globally. In Sri Lanka, both the diabetes prevalence (Katulanda et al., 2008) and hospitalisation due to diabetes (Premaratne, Amarasinghe, & Wickremasinghe, 2005) are projected to have an upward trend with time. Diabetic foot ulcer (DFU) disease is a common, preventable complication of DM (Boulton, Vileikyte, Ragnarson-Tennvall, & Apelqvist, 2005). Although peripheral neuropathy is considered the predominant aetiological factor for DFUs (Boulton et al., 2005; Ulbrecht, Cavanagh, & Caputo, 2004), ischaemia and neuroischaemia are also known to play a role (International best practice guidelines: Wound management in diabetic foot ulcers, 2013). Irrespective of the aetiology, DFU is a principal reason for hospital admission, amputation and mortality in DM patients. DFU impose an economic impact to the patients, their families and the society (Boulton et al., 2005) with cost of DFU care increasing with ulcer severity, number of hospitalisations and number of amputations. Furthermore, not only the DFU patients but also their caregivers are found to have a low quality of life (Gilpin & Lagan, 2008; Goodridge, Trepman, & Embil, 2005; Nabuurs-Franssen, Huijberts, Kruseman, Willems, & Schaper, 2005), especially due to fear of re-ulceration, repeated infections and potential lifelong morbidity (Price, 2004).

Wound care is a rapidly growing specialty (Ennis, 2012). Accurate wound assessment is mandatory to plan and carry out management regimens and to evaluate care (Ousey & Cook, 2011). To provide high-quality care, the caregivers need proper working environments, education and training (Department of Health, 2008). Previous research has shown optimal wound management by a multidisciplinary foot care team at an independent wound care centre (Gottrup, 2001). Although the health team should ideally comprise specialist physicians, wound care nurses and allied health professionals, nurse-led wound care has shown to improve patient outcomes (Harrison et al., 2005). As nurses' roles in wound management is vital (Boxer & Maynard, 1999), they need to have objective education on wound management and should be empowered in their role among the other team members (Corbett, 2012).

2 | BACKGROUND

Previous studies have reported gaps in wound care knowledge of many healthcare professionals including nurses (Coetsee, Coetsee, & Hagemester, 2010; Miyazaki, Caliri, & Santos, 2010; Zarchi, Latif, Haugaard, Hjalager, & Jemec, 2014). Broad areas in which knowledge deficits were identified include, positioning and staging of patients (Chianca, Rezende, Borges, Nogueira, & Caliri, 2010), ulcer assessment (Oseni & Adejumo, 2014), documentation (Ylönen, Stolt, Leino-kilpi, & Suhonen, 2013) and knowledge on new wound dressing material (Couilliet, Michel, Fuchs, Haller, & Guillaume, 2001). Studies carried out on nurses from different settings seem to show variations in wound care knowledge (Haram, Ribu, & Rustøen, 2003; Oseni & Adejumo, 2014; Sharmisthas, Wongchan, & Hathairat, 2014)

What does this paper contribute to the wider global clinical community?

- Although the overall knowledge was good in the cohort of Sri Lankan nurses studied, knowledge deficits were identified in core areas.
- Wound care nurses largely depend on in-service education and knowledge sharing with peers to update their knowledge.
- The lack of interest observed towards wound care research should be addressed to promote evidence-based practices.

which can be attributed to the experience they receive. Nurses in community healthcare services believe that their knowledge on treatment of leg and foot ulcers is insufficient (Haram et al., 2003) probably due to the limited nursing practice they are exposed to and dependence on colleagues for knowledge. Knowledge update through colleagues may be unsatisfactory (McIntosh & Ousey, 2008), unless the colleagues themselves possess up-to-date evidence-based knowledge by continuous learning.

Although knowledge on wound assessment and documentation are considered as important areas in continuity of care (Dowsett, 2009) and improving healing rates, and in reducing wound care cost (Carville & Smith, 2004), these were found to be inadequate even among hospital nurses (Oseni & Adejumo, 2014). Nurses were not aware of what tools to use and what exactly to document. In a study conducted on 218 Bangladeshi nurses, Sharmisthas et al. (2014) have reported a very unsatisfactory level of knowledge on prevention and management of DFU. In this study, minimal knowledge was evident in detecting loss of protective sensation using Semmes-Weinstein monofilament and caring of callus to avoid DFU formation. Unsatisfactory knowledge found in this study was attributed to the inadequacies of their nursing education and training. Most nurses in this sample were diploma holders with no specialised knowledge on diabetic ulcer care (Sharmisthas et al., 2014). Although improvement of knowledge is expected with increasing nursing experience, surprisingly insufficient knowledge on pressure ulcer prevention (Gunningberg et al., 2015) was reported in a study where the majority were experienced nurses. Although most of the nurses had more than 10 years of experience, only a few of them had received specialised training in wound care (Gunningberg et al., 2015). Lack of wound care training would be the principal reason for the unacceptable knowledge levels in these nurses. Minimal time spent on wound management during basic nurse training (Fourie, 2013) further warrants the need of an educational campaign on wound management for wound care nurses.

Beneficial effects of wound care training in improving nurses' knowledge in relation to wound care have been observed in many studies (Dowsett, 2009; Nuru, Zewdu, Amsalu, & Mehretie, 2015; Saleh, Qaddumi, & Anthony, 2012). Better education and specific

training in relation to wound management could optimise wound care (Dugdall & Watson, 2009) and enhance healing, helping to reduce not only the burden on the patient and the family, but also the cost of care. A study comparing the pre- and post-training knowledge on wound care practices of nurses has shown that knowledge can be improved by structured educational interventions (Dowsett, 2009).

In addition to knowledge, attitudes of nurses also contribute to the optimum management of chronic ulcers. Nurses' attitude towards pressure ulcer prevention has been widely investigated (Beeckman, Defloor, Schoonhoven, & Vanderwee, 2011; Demarre et al., 2012; Uba, Alih, Keever, & Lola, 2015). Although attitudes demonstrated by nurses were generally positive towards ulcer prevention and care in previous studies, the investigators have emphasised that positive attitudes itself are not adequate to change the practice (Källman & Suserud, 2009; Moore & Price, 2004; Tubaihsat, Aljezawi, & Al Qadire, 2013). As negative attitudes are associated with poor treatment outcomes, they should be changed through education to improve the quality of care and quality of life of the patients and to reduce the cost of the disease (Gagliardino, González, & Caporale, 2007).

In most circumstances, wound care is left to nurses and often unsupervised (Coetzee et al., 2010). Lack of evidence-based wound care prolongs healing times of ulcers causing extended hospital stay and waste of health resources (Patel et al., 2008). Wound care is reported to be a neglected field in Sri Lanka with unsatisfactory practices on chronic ulcer management (Kumarasinghe, 2004). Furthermore, there are no reported local studies assessing nurses' knowledge, attitudes and practices specifically on diabetic ulcer care. In this study, our aim was (i) to assess nurses' knowledge on DFU disease, (ii) to assess nurses' attitudes towards patients with DFUs and (iii) to identify factors which influence the nurses' knowledge on DFU disease and attitudes towards patients with DFUs.

3 | METHODS

3.1 | Study design and setting

This study is a nonexperimental descriptive cross-sectional survey conducted in three teaching hospitals located in the Western Province of Sri Lanka.

3.2 | Study sample

A total of 200 registered nurses employed in surgical wards and dressing rooms of outpatient departments (OPDs) who were directly involved in diabetic wound care management for more than 1 year were recruited for the study. The participation was entirely voluntary.

3.3 | Study instrument

The questionnaire which included three sections was developed and validated by the authors. It was initially prepared in English language

and translated into Sinhala, the language spoken by majority employed in government hospitals of the country. Medical terms were given in both Sinhala and English languages to facilitate understanding and to increase the response rate. The first section was focused on covariates that may affect wound care knowledge of nurses which included gender, age, professional qualifications and experience, level of training, place of work and knowledge-updating sources used by them.

The second section of the questionnaire assessing the knowledge of nurses on diabetic ulcer disease was developed by referring to relevant literature in wound management (Coetzee et al., 2010; International best practice guidelines: Wound management in diabetic foot ulcers, 2013) and by obtaining inputs from wound care experts to tailor the instrument to suit the local hospital settings. This section comprised 15 multiple-choice questions (MCQs) on most pertinent areas of diabetic ulcers: (i) predisposing factors for ulcers (questions 1–3), (ii) characteristics of ulcers (questions 4–6), (iii) complications of ulcers (questions 7–9) and (iv) diabetic ulcer care (questions 10–15). MCQs had three answer options, "true," "false" and "do not know." The third option was included to minimise guessing and to prevent leaving questions unanswered (Qaddumi & Khawaldeh, 2014). When scoring, correct answers scored 1 point each, while incorrect answers and "do not know" options scored zero (Sharmisthas et al., 2014). The total number of correct answers was computed to a percentage score and categorised according to McDonald's standard learning outcome measured criteria (McDonald, 2002) to evaluate the knowledge level of nurses (Uba et al., 2015). Nurses' wound care knowledge in four domains was categorised into two groups considering the mean score obtained for each. The knowledge score \geq mean was considered as "good knowledge," and knowledge score $<$ mean was considered as "poor knowledge" (Nuru et al., 2015).

The third section was formulated to assess nurses' attitudes towards diabetic ulcer care. This consisted of 10 questions to be answered on a five-point Likert scale developed with bipolar adjectives (strongly agree and strongly disagree) at the two extremities. Of the 10 questions in this section of the questionnaire, a few questions were directly extracted from the published literature of a similar study (Moore and Price) and the rest developed by authors with consultation of experts in the field. All questions in this section were worded in a negative manner so that the best possible attitude for a question would score 5 points. As a result, the lowest and highest total scores possible were 10 and 50, respectively. The median score was used to distinguish positive attitudes from negative attitudes (positive attitude = subject score \geq median score, negative attitude = subject score $<$ median score) (Moore & Price, 2004). In addition, a single question focusing on nurses' interest towards wound care (Coetzee et al., 2010) included in this questionnaire was answered on a five-point scale with responses varying from "not interested" to "very interested."

Validity of the instrument was established prior to data collection through content validation by an expert team including a physiologist, a general surgeon who manages patients with diabetic ulcers,

and a nursing practitioner who is specialised in wound care management. The instrument was modified by the comments of this expert team. Pretesting was carried out by administering the instrument on 10 wound care nurses who were not involved in the study. Reliability of the instrument was assessed using the data of the first 50 subjects. As the Cronbach's alpha values of .704 for the knowledge section and .728 for the attitude section were considered acceptable (Danielsen et al., 2015), it was decided to continue data collection until the required sample size was achieved.

3.4 | Data collection

The questionnaire was self-administered on purposively recruited 200 nurses. Prior permission was obtained from institutional authorities of relevant hospitals. The questionnaires were hand-delivered to ensure a higher response rate. The completed questionnaires were collected on the same day within 4 hr of distribution to improve data quality. The principal investigator checked all questionnaires for completeness.

3.5 | Data analysis

Data were analysed using Statistical Package for the Social Sciences (SPSS) version 21. Frequencies, percentages, means and standard deviations were used for demographic variables and to describe the scores of the study variables. As knowledge and attitude scores were skewed, nonparametric tests were performed and median values were presented. Associations between nurses' knowledge scores and categorical variables with two categories (sex, age groups, professional qualifications, nursing experience, wound care experience, wound care training, unit of work) and more than two categories (wound care interest) were determined by Mann-Whitney *U*-test and Kruskal-Wallis test, respectively. The relationship between knowledge and attitude scores was determined by Spearman's correlation coefficient. Level of significance was accepted at $\alpha < .05$ for statistical tests.

3.6 | Ethical considerations

Ethical approval for the study was obtained from the Ethics Review Committee of the University of Sri Jayewardenepura. Permission to recruit participants and collect data was obtained from relevant hospital authorities. Participants took part voluntarily in the study, and informed written consent was obtained prior to participation. Data were collected and stored anonymously to ensure confidentiality.

4 | RESULTS

4.1 | Characteristics of participants

Of the total 200 nurses invited, 147 participated in the study (response rate = 73.5%). Their demographic characteristics are shown in Table 1. The majority of the participants were female ($n = 137$,

93%) and were below 40 years ($n = 114$, 77.6%). Most nurses in the study sample were employed in surgical wards ($n = 121$, 82%), while the others were employed in dressing rooms of the OPD where wound care is provided to outdoor patients.

The nurses' knowledge on diabetic ulcers assessed by 15 MCQs showed that 10.2% ($n = 15$) of nurses had very low, 14.3% ($n = 21$) had low, 17.7% ($n = 26$) had moderate, 41.5% ($n = 61$) had high and 16.3% ($n = 24$) had very high knowledge. The mean knowledge score was 77.9 ($s = 10.6$). The nurses' knowledge on individual questions on diabetic ulcers is shown in Table 2. Of the 15 items tested, eight items were answered correctly by more than 80% of participants. All nurses in the study sample knew that infected, highly exuding wounds should be cleansed daily. However, the items on the impact of ischaemia in increasing the risk of amputation in diabetic ulcer

TABLE 1 Demographic characteristics of the participants ($n = 147$)

Variables	<i>n</i>	%
Sex		
Female	137	93.2
Male	10	6.8
Age (in years)		
≤30	72	49.0
31–40	42	28.5
41–50	27	18.4
51–60	6	4.1
Professional qualification		
Diploma	131	89.1
Post-basic diploma	2	1.4
Degree	14	9.5
Nursing experience (in years)		
≤5	66	44.8
6–10	32	21.8
11–15	21	14.3
16–20	11	7.5
>20	17	11.6
Wound care experience (in years)		
≤5	76	51.7
6–10	35	23.8
11–15	18	12.2
16–20	8	5.5
>20	10	6.8
Formal training in wound care		
Yes	13	8.8
No	134	91.2
Current professional development activities		
No	100	69.4
In-service education	24	16.7
In a degree programme	19	13.2
Other	1	0.7

patients and the importance of mechanical off-loading in ulcer healing were answered correctly by <50% of nurses in the study.

The mean knowledge scores of four domains, predisposing factors, characteristics of ulcers, complications of ulcers and ulcer care were 80.5 ($s = 22.0$), 73.0 ($s = 26.3$), 75.9 ($s = 20.6$) and 81.4 ($s = 13.3$), respectively. Figure 1 shows the percentage distribution of nurses having good versus poor knowledge with regard to the knowledge in four domains.

4.2 | Factors associated with nurses' knowledge

The nurses' knowledge showed significant associations with their experience in nursing as well as in wound care and the attached unit of work. However, no associations were seen between knowledge and their gender, age, professional qualifications and whether they have received wound care training (Table 3).

4.3 | Nurses' self-rated knowledge

Only a minority of nurses rated their knowledge on diabetic ulcers either as excellent (1.4%) or as poor (0.7%). The majority (65.6%) rated as satisfactory and 32.4% as good.

4.4 | Nurses' knowledge-updating sources

In-service educational activities (77.2%) and knowledge sharing with peers (77.9%) were the most popular modes used by this cohort of nurses to update their knowledge. Scientific journals were used by 55.2%, and 62.8% relied on books. Internet was used only by 34.3%. However, a significant association was not seen between overall knowledge and knowledge-updating sources.

4.5 | Nurses' attitudes towards diabetic ulcer care

The range of attitude scores from extreme negative to extreme positive is 10–50. According to the findings of this study, the overall attitude of nurses towards caring of patients with diabetic ulcers was positive (median = 41, range 23–50). Table 4 shows scores obtained by nurses for individual questions. When examining the attitudes in different aspects of diabetic ulcer care, it is interesting to note that most nurses were satisfied by caring for diabetic ulcers (95.2%), did not like to avoid caring for diabetic ulcers (95.3%), considered regular diabetic ulcer assessment as necessary (94.5%) and felt that it is their responsibility to educate patients on reducing re-ulceration (90.5%). However surprisingly, about 50% of nurses did not consider pain experienced by the patient as important when cleaning wounds.

There was a significant difference in nurses' attitudes in relation to their age ($p = .041$). Nurses who were <40 years had more positive attitudes (median = 42.00) than older nurses (median = 40.00). However, nurses' attitudes were not significantly different with their gender and their wound care experience. There was no correlation between nurses' knowledge and attitudes (Spearman's $\rho = .136$).

4.6 | Nurses' interest towards ulcer care

Except for two nurses, all others (98.6%) showed some degree of interest in diabetic ulcer care. Most nurses (66%) were interested and wished to follow a training course in ulcer care. However, only a minority (8.3%) were interested in engaging in ulcer care research. Nurses' interest in ulcer care was significantly associated with their knowledge ($p = .044$) and attitudes ($p = .0001$). Nurses who had a good knowledge and positive attitudes were interested in following a training course in ulcer care or engage in research in this area.

TABLE 2 Frequency and percentage distribution of nurses' knowledge on diabetic ulcer disease ($n = 147$)

Item	Response rate		
	Correct (%)	Incorrect (%)	Don't know (%)
1. Neuropathy is the predominant factor responsible for diabetic ulcers (True)	61.6	27.4	11.0
2. Sensory neuropathy results in unnoticed skin damages which lead to formation of ulcers (True)	97.3	2.0	0.7
3. Autonomic neuropathy is associated with dry skin which predisposes to ulcer formation (True)	83.0	10.2	6.8
4. Diabetic neuropathic ulcers are typically found on weight bearing areas of the foot (True)	69.4	26.5	4.1
5. Diabetic ischemic ulcers are less painful than diabetic neuropathic ulcers (False)	71.4	22.5	6.1
6. Neuropathy can be excluded if the foot skin is cool and pulses are absent (False)	78.3	12.9	8.8
7. The risk of amputation is higher when diabetic foot ulcer is associated with limb ischemia (True)	40.1	51.7	8.2
8. Presence of slough is not an indication of infection in diabetic ulcers (False)	97.9	1.4	0.7
9. Presence of osteomyelitis impairs healing of diabetic ulcers (True)	89.2	5.4	5.4
10. Wound healing progress is unsatisfactory if the wound bed appears pink (False)	87.8	10.8	1.4
11. Mechanical off-loading should be advised to facilitate ulcer healing (True)	46.3	50.3	3.4
12. Hyperbaric oxygen therapy is recommended for ulcer healing even in a well-perfused foot (False)	94.5	4.1	1.4
13. Infected, highly exuding wounds should be cleansed daily (True)	100	0.0	0.0
14. Iodine dressings are effective for wounds with clinical signs of infection (True)	71.3	21.9	6.8
15. Hydrogel dressings are useful to rehydrate the wound bed and control the moisture in wounds (True)	89.1	8.2	2.7

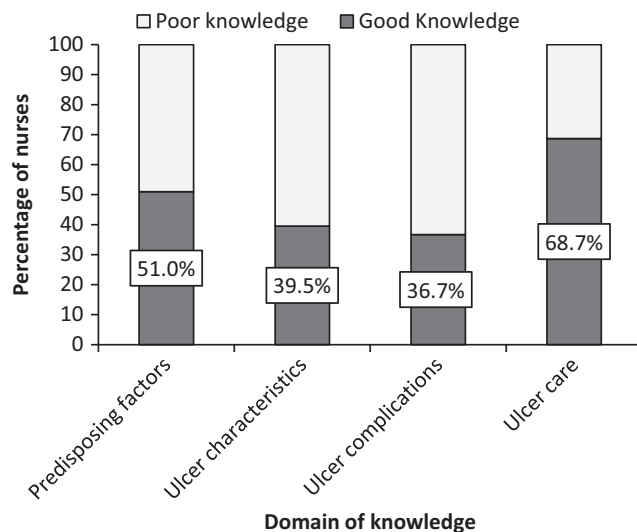


FIGURE 1 Proportions of nurses (%) representing the knowledge levels regarding four areas of knowledge assessment

TABLE 3 Factors associated with nurses' knowledge

Characteristics	n	Median	IQR	p-Value
Sex				
Female	137	80.0	13.3	.253
Male	10	73.3	26.7	
Age				
≤30 years	71	80.0	20.0	.065
>30 years	76	80.0	13.3	
Professional qualification				
Diploma	133	80.0	13.3	.242
Degree	14	73.3	26.7	
Nursing experience				
1–5 years	65	73.3	20.0	.009*
> 5 years	82	80.0	13.3	
Wound care experience				
1–5 years	75	73.3	20.0	.007*
>5 years	72	80.0	13.3	
Wound care training				
Yes	13	73.3	20.0	.540
No	134	80.0	20.0	
Hospital unit				
OPD	25	73.3	26.7	.036*
Surgical wards	122	80.0	13.3	

IQR, interquartile range; OPD, outpatient department.

*Significant at $p < .05$.

5 | DISCUSSION

This is the first reported study that describes nurses' knowledge and attitudes towards diabetic ulcer care in a Sri Lankan setting. Although studies on pressure ulcer prevention and care are reported

extensively, the literature on diabetic ulcers is sparse even globally. A gender disparity with a female preponderance is seen in the study sample, which is a common finding in nurses' studies even in other settings (Gunningberg et al., 2015; Uba et al., 2015). About 75% of nurses in the study sample were <40 years with wound care experience for <10 years. About 90% of the nurses in the study were diploma holders. With the recent introduction of nursing degree programmes in some state universities, it can be expected that more nurses will obtain nursing degrees in future. Most nurses (91.2%) not having formal training in wound care and 68 of 147 not engaged in any professional development activity currently are unsatisfactory. Lack of learning resources (Nuru et al., 2015; Uba et al., 2015) and time constraints during their working hours owing to staff shortage (Kumari & De Alwis, 2015) are possible reasons for it.

Findings of this study revealed that 57.8% of nurses were adequately knowledgeable (score range 80–100) according to ratings on McDonald's standard learning outcome measured criteria (McDonald, 2002). Most studies on pressure ulcer prevention and care have reported comparable results (Nuru et al., 2015; Uba et al., 2015). Very low knowledge on diabetic ulcer disease reported in a survey conducted in Bangladeshi nurses can be attributed to their lack of training and knowledge update (Sharmisthas et al., 2014). Also, surprisingly low knowledge scores were reported in Jordanian nurses, although all of them were degree holders (Qaddumi & Khawaldeh, 2014). Despite the difference in type of the ulcer studied, deficiency of knowledge could lead to suboptimal care (McIntosh & Ousey, 2008). On examining the knowledge on the four domains separately, the highest mean score observed was in the domain on ulcer care with 68.2% having a score above the mean. This may be attributed to the direct link between the knowledge assessed in this domain and the nurses' day-to-day practice.

All the nurses in this study were aware that infected, highly exuding wounds should be cleansed daily. We can assume that nurses have acquired this knowledge by their routine practice. However, some similar questions that can be answered through practical knowledge such as questions on identifying a healing wound and indications of various dressing materials were not optimally answered. Although importance of adequate perfusion and mechanical off-loading in ulcer healing are core knowledge areas of nurses, it is rather unsatisfactory that <50% of nurses in the study answered these questions correctly. Despite these being primary evidence-based recommendations for diabetic wound care (International best practice guidelines: Wound management in diabetic foot ulcers, 2013), absence of such specific contents in basic diploma and degree curricula (Uba et al., 2015) may be the reason for this deficit in vital knowledge. In the midst of these knowledge gaps in chronic ulcer management, it is unlikely that patients with diabetic ulcers would get the best possible treatment and care (McIntosh & Ousey, 2008).

Knowledge gaps seen in nurses in the present study may be attributed to lack of formal training in diabetic wound care management. Findings indicated that a vast majority of nurses (91.2%) have not received any formal training in wound care. As knowledge on wound care obtained in basic nurse training is insufficient for nurses

TABLE 4 Nurses' attitudes towards diabetic ulcer care (*n* = 147)

Item	Strongly agree <i>n</i> (%)	Agree <i>n</i> (%)	Neither agree nor disagree <i>n</i> (%)	Disagree <i>n</i> (%)	Strongly disagree <i>n</i> (%)
1. I think diabetic ulcer treatment is more important than ulcer prevention	5 (3.4)	4 (2.7)	7 (4.8)	71 (48.3)	60 (40.8)
2. I do not think it is necessary to assess diabetic ulcers regularly	2 (1.4)	2 (1.4)	4 (2.7)	74 (50.3)	65 (44.2)
3. Diabetic ulcer care is too time consuming for me to carry out	1 (0.7)	12 (8.2)	23 (15.6)	78 (53.1)	33 (22.4)
4. In comparison with other areas of nursing care, diabetic ulcer care is a low priority task for me	1 (0.7)	4 (2.7)	13 (8.8)	69 (46.9)	60 (40.9)
5. If I have the opportunity, I would like to avoid caring for diabetic ulcers	2 (1.4)	1 (0.7)	4 (2.7)	38 (25.8)	102 (69.4)
6. I do not have time to advise each patient individually on how to look after their ulcers	2 (1.4)	10 (6.8)	15 (10.2)	74 (50.3)	46 (31.3)
7. It is not my responsibility to educate patients with diabetic ulcers on how to reduce re-ulceration	0.0	5 (3.4)	9 (6.1)	83 (56.5)	50 (34.0)
8. I cannot think about pain when cleaning diabetic ulcers	2 (1.4)	48 (32.6)	23 (15.6)	62 (42.2)	12 (8.2)
9. I do not like to care for diabetic ulcers in my practice	0.0	11 (7.5)	23 (15.6)	87 (59.2)	26 (17.7)
10. I do not get satisfaction by caring for diabetic ulcers	0.0	0.0	7 (4.8)	85 (57.8)	55 (37.4)

who are managing chronic wounds (McIntosh & Ousey, 2008), and specialised training has proven to improve wound care knowledge and practice (Dowsett, 2009; Harrison et al., 2005), wound care training should be considered mandatory for nurses dedicated for chronic wound care. As wound management education and training is very minimal in medical undergraduates and practitioners (Coetzee et al., 2010; Ennis, 2012; Fourie, 2013), care of wounds has become a responsibility of nurses further stressing this need.

In the present study, significant associations were observed between nurses' knowledge and years of nursing experience, years of wound care experience and the hospital unit (surgical wards vs. OPD) which they are attached to. Previously, higher knowledge scores have been reported in nurses attached to inpatient clinical nursing units (Chianca et al., 2010) compared to OPD, possibly due to more exposure they get in wound care. This shows that more experienced nurses in wound care have demonstrated higher knowledge than less experienced nurses. Most of the previous studies have also demonstrated a similar association between work experience and knowledge (Nuru et al., 2015; Uba et al., 2015). Contrasting findings were observed by Zarchi et al. (2014) probably due to inclusion of home care nurses in the study sample. The present study did not identify the nurses' age, professional qualifications and whether they had received wound care training as factors associated with their knowledge. Professional qualifications did not vary much in the study sample as about 90% of them were diploma holders. Many investigators (Dowsett, 2009; Nuru et al., 2015; Saleh et al., 2012) have demonstrated significantly higher knowledge in nurses who had undergone formal training than nontrained nurses. However, these findings are not surprising as knowledge is influenced not only by training, but by many factors (Qaddumi & Khawaldeh, 2014).

In the cohort of nurses we studied, almost all rated their knowledge as either good (32.4%) or satisfactory (65.6%). These values are much higher than the self-perceived knowledge in other reported

studies (Gillespie, Chaboyer, Allen, Morely, & Nieuwenhoven, 2014; Haram et al., 2003). Although this implies that the nurses in the study are confident about their own knowledge, it is important that they become aware of the gaps in their knowledge (McIntosh & Ousey, 2008). The most popular knowledge-updating sources in these nurses were in-service education and knowledge sharing with peers. These are the popular modes reported even in other studies (Ashton & Price, 2006; Haram et al., 2003; McIntosh & Ousey, 2008). As a large proportion relies on colleagues for wound care knowledge, a mechanism should be there to deliver up-to-date evidence-based knowledge to at least a proportion of nurses. Even with the rapid advancements in technology, Internet was used only by one-third of the study sample which may be attributed to unavailability of Internet facilities in their workplace which is common even in developed settings (Gillespie et al., 2014).

As in other reported studies (Moore & Price, 2004; Uba et al., 2015), we found that the overall attitude of nurses regarding chronic ulcer care was positive. The findings in a recent study reporting unsatisfactory attitudes of nurses regarding pressure ulcer prevention (Kaddourah, Abu-Shaheen, & Al-Tannir, 2016) may be attributed to the scale used in the study, as a simple dichotomous scale is not adequately sensitive to assess attitudes (Moore & Price, 2004). More than 50% of nurses in our study did not consider pain experienced by the patient during ulcer cleaning as an important aspect in ulcer care. This is not acceptable as it is important to have strategies to minimise pain during dressing changes (International best practice guidelines: Wound management in diabetic foot ulcers, 2013). In the present study, age was found to be a factor which influenced the attitude of nurses. Younger nurses demonstrated more positive attitudes than older nurses. However, no correlation was observed between nurses' knowledge and attitudes. In a previous study on knowledge and attitudes on pressure ulcer prevention in Belgian nurses (Beckman et al., 2011), actual application assessed by clinical

observations significantly correlated with attitudes but not with knowledge. Positive attitudes of nurses in this study may indicate the commitment they have towards chronic ulcer care. However, as it is argued that positive attitudes are not adequate to change the practice (Moore & Price, 2004), future research is needed to find out whether good knowledge and positive attitudes of these nurses are reflected in their actual practice.

Finally, findings of the study revealed that the majority of the nurses were very interested in wound care and the nurses' interest in wound care was significantly associated with their knowledge and attitudes. Although 66.7% of nurses are interested in following a training course, only 8.3% wished to engage in research in this area. Nurses should be encouraged to engage in research as practice should ideally be evidence-based.

5.1 | Limitations

Due to unavailability of a validated questionnaire to explore the objectives of the study, a self-developed questionnaire was used for data collection. Although the validity and reliability of the instrument were established, it would have been better if a larger sample was used for validation. Further, assessment of in-depth knowledge of nurses was not possible as the number of questions in the questionnaire was limited. Due to social desirability bias, the possibility of over-reporting good behaviour and vice versa should be accounted for when interpreting results. As good knowledge and positive attitudes always do not ensure best practice (Gillespie et al., 2014), future studies should be designed to assess diabetic ulcer care practices of these nurses. Unavoidable factors such as lack of adequate time and staff must be considered when assessing attitudes and practices. Furthermore, the results of the study cannot be used to generalise the finding to all Sri Lankan nurses as the study was conducted in three teaching hospitals in a single province. Hence, national-level studies are warranted.

6 | CONCLUSIONS

Nurses in the study demonstrated suboptimal knowledge which may be attributable to the level of exposure they get on ulcer care. Nurses' knowledge seems to be associated with the on-the-job experience they have acquired during their career. The study helped to identify gaps in core knowledge of nurses which must be addressed when designing training programmes for them. Despite advances in technology and availability of Web-based information, nurses tend to depend largely on traditional knowledge-updating sources such as in-service education and knowledge sharing with peers. The overall attitude of nurses towards caring of patients with DFUs was positive, and there was no association between nurses' knowledge and attitudes. Although almost all nurses in the study were interested in ulcer care, only a minority were interested in engaging in research. This needs serious consideration as nursing research is considered vital for their

professional development and optimal nursing practice (Tingen, Burnett, Murchison, & Zhu, 2009). The findings of the study can be used globally to optimise the contribution of nurses to the wound care team.

7 | RELEVANCE TO CLINICAL PRACTICE

Although diabetic ulcers should ideally be managed by a multidisciplinary healthcare team (Thewjitcharoen et al., 2014), the primary responsibility is with the nurses globally (Fourie, 2013). Optimum knowledge and positive attitudes of nurses are necessary for best practice on diabetic ulcer care (Gagliardino et al., 2007). Knowledge deficits and negative attitudes identified in this study would be helpful when designing formal training courses that should be made mandatory for nurses caring for chronic ulcers. Continuous professional development, evidence-based practices and wound care research should be encouraged and rewarded for improvements in the quality of care.

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DISCLOSURE

The authors have confirmed that all authors meet the ICMJE criteria for authorship credit (www.icmje.org/ethical_1author.html), as follows: (1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be published.

CONFLICT OF INTEREST

The authors confirm that they do not have any conflict of interests.

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