

INVESTIGATIVE REPORT

Significant Differences in Nurses' Knowledge of Basic Wound Management – Implications for Treatment

Kian ZARCHI, Seemab LATIF, Vibeke B. HAUGAARD, Ida R. C. HJALAGER and Gregor B. E. JEMEC
Department of Dermatology, Roskilde Hospital, Health Science Faculty, University of Copenhagen, Denmark

Wounds represent a growing healthcare problem due to an aging population. Nurses play a key role in wound management and their theoretical understanding of basic wound management may be expected to influence the quality of wound therapy fundamentally. In this study, we evaluated the level of knowledge of wound management in 136 Danish nurses working in 3 different settings: advanced wound care clinics, home care and general hospital departments. We found that hospital nurses had less theoretical knowledge than home care nurses and nurses working at advanced wound care clinics. We also found that the length of experience (adjusted for workplace and education) did not have any impact on nurses' knowledge. Nurses' knowledge of clinical investigations was consistently lower than their knowledge of therapy and clinical symptoms. This study provides benchmarking information about the current status of wound management in Denmark and suggests how improvements might be achieved. *Key words: wound management; knowledge; nurses; wound clinics; experience; educational programs.*

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Kian Zarchi, Department of Dermatology, Roskilde Hospital, Koegevej 7–13, DK-4000, Roskilde, Denmark. E-mail: kian_zarchi@yahoo.com

Wounds are an ancient problem. From ancient civilisations to our modern world, many have strived to optimise wound therapy. Wounds cause morbidity, complications and mortality (1–4). Wounds are associated with pain and social and emotional impairment which can have a substantial negative impact on quality of life (5, 6). Chronic non-healing wounds are associated with venous and arterial diseases, diabetes, neoplasia, immobility and age (7–11). With prevalence rates around 1% for leg ulcers, chronic wounds are relatively common (12). As elderly citizens represent a rapidly growing segment of the population in the Western countries and the incidence of life-style diseases is increasing (13–15), it is expected that more people will suffer from chronic wounds in the future. Increasing wound prevalence will lead to an increasing demand for treatment and will have substantial implications for healthcare systems.

Nurses are key healthcare providers of wound treatment. It is fair to expect that the quality of wound management depends highly on the level of knowledge of those who diagnose and treat patients. Nurses often inspect, investigate, diagnose and treat patients with wounds, and evidence from previous studies suggests that many physicians rely heavily on their opinions, evaluations and guidance (16, 17). Accordingly, it may be hypothesised that treatment outcome is influenced by nurses' knowledge and practice of wound care. In this study, we aimed to investigate the level of knowledge of wound management of Danish nurses in different settings. In addition we sought to identify factors associated with level of knowledge.

MATERIAL AND METHODS

Questionnaire

A 26-item questionnaire was developed by a team of experienced wound care specialists, consisting of doctors and nurses from the Department of Dermatology, Roskilde, Denmark. The items were based on a literature review of current evidence-based medicine in wound management and attempted to assess whether nurses possess the level of knowledge required to optimally manage patients with wounds. Each question addressed one of the following categories: 1) basic knowledge/symptom recognition, 2) clinical investigation and 3) treatment. The categories were selected to evaluate nurses' overall ability to recognise cardinal symptoms, conduct relevant clinical examinations and reveal their knowledge about basic wound therapy. Of the 26 items, 16 addressed treatment, 6 addressed basic knowledge/symptom recognition, and 4 addressed clinical investigations. All questions were of multiple-choice type, offering 5 options with only one correct answer (Table I).

Participants

Registered home care nurses from two Danish municipalities (with a total population of 81,000) were invited to participate in this study. They were approached to take part in the study during meetings arranged by their employers during March 2011–March 2012. All eligible home care nurses were included in this study. In the same period, random sampling was undertaken for registered nurses from 2 Danish hospitals working at clinical departments where managing wounds would be expected of the nursing staff. Each hospital department was approached by the investigators during one shift where the nurses present were invited to participate. In order to obtain homogeneity among participants, certified wound care nurses, who had undertaken a post-registration degree in wound management, were excluded from the study.

All participants were asked to complete the questionnaire in one session and without consultation or assistance from their

Table I. A sample of the multiple-choice questions used to evaluate the level of knowledge among nurses

1. Which of the following examinations can determine whether arterial disease is the cause of leg ulcer and should be performed when arterial leg ulcer is suspected?
A. Ankle brachial index (ankle blood pressure/brachial blood pressure)
B. Ultrasound examination of the veins
C. Blood pressure measurement in the arm
D. Cutaneous sensibility measurement with a monofilament
E. Biopsy from the ulcer
2. Which of the following rules out the use of compression bandages in leg ulcers?
A. An oedematous leg
B. Exudation of the wound
C. An ankle brachial index <0.5
D. Presence of varicose veins
E. Granulating wound bed

colleagues. Prior to completing the questionnaire, they were asked to report the length of time they had been qualified as a nurse and whether they had participated in any wound care educational programs/courses. The length of experience was categorised in the following 5 categories: 0–4 years, 5–9 years, 10–14 years, 15–19 years, and ≥ 20 years.

To obtain homogeneity within the groups, we chose to separate the hospital nurses working in departments with an advanced wound care clinic from those without. Departments with an advanced wound clinic were defined as those wards to which patients were referred to for wound therapy such as the Department of Dermatology and the Department of Plastic Surgery. We thereby obtained the following 3 groups: 1) advanced wound care clinic nurses, 2) clinical hospital nurses, and 3) home care nurses. The individual test results were treated anonymously.

Statistical analysis

We used a stepwise multiple linear regression model to evaluate the association between the test results and the characteristics of the nurses. Workplace, length of experience, and attendance at wound care educational programs were selected as potentially important predictors. We considered categories as significant predictors if the p -values, after adjusting for other variables, were < 0.05 . Residuals were used to test the assumptions of the linear regression model.

The Kruskal Wallis test was used to analyse the overall difference in the number of correct answers in each question category across the groups and the Wilcoxon rank sum test was used for pairwise comparisons across the groups. Pairwise comparisons of the number of correct answers within the groups were performed using the Wilcoxon signed rank test. A significance level of 0.05 was used for all statistical tests. All analyses were performed in the statistical program R, version 2.15.2 (R Development Core Team, 2013).

Table II. The characteristics of the nurses

Group	Participants <i>n</i>	Experience level, years					Correct answers %
		0–4 % (<i>n</i>)	5–9 % (<i>n</i>)	10–14 % (<i>n</i>)	15–19 % (<i>n</i>)	≥ 20 % (<i>n</i>)	
Advanced wound clinic nurses ^a	15	20 (3)	7 (1)	7 (1)	20 (3)	46 (7)	94
Hospital department nurses ^b	57	28 (16)	9 (5)	17 (10)	11 (6)	35 (20)	65
Home care nurses	64	8 (5)	23 (15)	16 (10)	16 (10)	37 (24)	79

^aRepresenting the departments of Dermatology and Plastic Surgery.

^bRepresenting the departments of Surgery and Cancer, Orthopedic Surgery, Urology, Internal Medicine, Neurology, Geriatrics, Nephrology, and Hematology.

RESULTS

Table II presents the characteristics of the nurses. A total of 136 nurses completed the questionnaire and were included in the analyses. Of those, 64 worked in home care settings, 57 were hospital nurses representing 8 clinical departments and 15 worked in departments with an advanced wound care clinic.

The highest percentage of correct answers was achieved by the advanced wound care clinic nurses (24.4/26, 94%, SD 5%). The home care nurses ranked second (20.5/26, 79%, SD 11%), while the clinical hospital nurses scored the lowest (17.0/26, 65%, SD 16%).

The question categories

Among the 3 categories (1) basic knowledge/symptom recognition, 2) investigation and 3) treatment), the treatment category received the highest mean of correct answers (78%, SD 17%) followed by the basic knowledge/symptom recognition (76%, SD 21%) and the investigation (59%, SD 24%). Pairwise comparisons across the categories revealed that these differences were statistically significant ($p < 0.0001$ for the difference between the basic knowledge/symptom recognition and the investigation, $p = 0.044$ for the difference between the basic knowledge/symptom recognition and the treatment, and $p < 0.0001$ for the investigation and the treatment).

Table III presents how the groups performed in each category. The treatment category, which received the highest percentage of correct answers in total, obtained 96% (SD 6%), 83% (SD 11%) and 69% (SD 18%) of the correct answers in the advanced wound clinic group, the home care group and the hospital group, respectively. The overall difference between the groups was statistically significant ($p < 0.0001$). The following pairwise comparisons further showed significant differences among the groups (Table III). The basic knowledge/symptom recognition category received 96% (SD 8%), 78% (SD 17%) and 68% (SD 24%) of correct answers among the advanced wound care clinic nurses, the home care nurses and the hospital nurses, respectively. The overall difference between the groups ($p < 0.0001$) as well as the pairwise differences were statistically significant (see Table III). The investigation category, which received the lowest percentage of correct answers in total, obtained 82%

Table III. The percentage of correct answers in each category across the groups

Categories	All participants %	A. Advanced wound clinics %	B. Hospital nurses %	C. Home care nurses %	<i>p</i> -value
Basic knowledge/symptom recognition	76	96	68	78	<i>p</i> <0.0001 ^{a,b} <i>p</i> =0.009 ^c
Clinical investigation	59	82	49	63	<i>p</i> <0.0001 ^a <i>p</i> =0.0020 ^b <i>p</i> =0.0001 ^c
Treatment	78	96	69	83	<i>p</i> <0.0001 ^{a,b,c}

^aA vs. B. ^bA vs. C. ^cB vs. C.

(SD 18%), 63% (SD 26%) and 49% (SD 18%) of correct answers among the advanced wound care clinic nurses, the home care nurses and the hospital nurses, respectively. The overall difference in the percentage of correct answers between the 3 groups of nurses (*p*<0.0001) as well as the pairwise differences between the 3 groups were all statistically significant (Table III).

Multiple linear regression

Table IV presents the results of the multiple linear regression analysis with test results as the dependent variable. Performing the analysis with all 3 categorical variables (workplace, experience level, and previous attendance at wound care educational programs) as the independent predictors revealed very small and highly non-significant regression coefficients for experience levels. Neither adjusting for a potential interaction between the workplace and experience levels nor the exclusion of the advanced wound clinic nurses from the regression analysis changed this finding. Accordingly, the categorical variable for experience levels was removed from the list of independent predictors and the regression analysis was repeated. As it appears from Table IV, attending educational programs had a small positive impact on the test results (6%) and the impact was statistically significant (*p*=0.02). Moreover, it was apparent that workplace was the most important factor in predicting test results. After adjusting for the impact of educational programs, working in departments with an advanced wound care clinic led to a 26% higher test result (a relative increase of 41%) compared with working at the other clinical departments (*p*<0.0001)

and to a 14% higher test result (a relative increase of 18%) compared with working in a home care setting (*p*=0.0002). Working in a home care setting led to a significantly higher score compared with working at clinical hospital departments (12% higher score and a relative increase of 19%, *p*<0.0001).

DISCUSSION

Nurses play a key role in the management of wounds as they carry out doctors' orders regarding treatment and very often provide the key observations on which decisions about treatments are based. Wound management, therefore, demands a multidisciplinary approach in which making a correct diagnosis and initiating adequate treatment is dependent on a well-functioning collaboration between doctors and nurses; however, the knowledge of wound management among both groups is a poorly described area. There are some studies evaluating the level of knowledge of specific areas within wound management among nurses, such as the management of pressure ulcers (18–20); however, data from well-designed studies of the overall knowledge of nurses in different settings are largely absent in spite of the fact that the majority of wound care is carried out out-side specialised wound care clinics. Therefore, we chose to conduct a cross-sectional study to outline the level of knowledge among nurses working in 3 different settings. As expected, nurses working in departments with an advanced wound care clinic performed best. However, the findings also identified that home care nurses knew more about wound management than those

Table IV. The adjusted linear regression analysis

Categorical variable	Change in test result (regression coefficient)	SE	95% confidence interval	<i>p</i> -value
Workplace				
Advanced wound clinics	Reference			
Clinical hospital departments	-0.26	0.038	-0.34, -0.19	<i>p</i> <0.0001
Home care	-0.14	0.037	-0.21, -0.07	<i>p</i> =0.0002
Attendance at educational programs				
No	Reference			
Yes	0.06	0.025	0.01–0.11	<i>p</i> =0.020

The categorical variable of experience level was excluded (0–4 years: reference, 5–9 years: regression coefficient = 0.03, *p*=0.49. 10–14 years: regression coefficient = -0.005, *p*=0.89. 15–19 years: regression coefficient = 0.001, *p*=0.81. 20 years and more: regression coefficient = -0.01, *p*=0.76.

working in hospital departments without an advanced wound care clinic. This was despite the fact that the latter group represented wards in which wound management would be expected to be performed routinely in every day practice. Our results, therefore, indicate that wound management might not be highly prioritized in many hospital wards and suggest that patients with chronic wounds would benefit from specialist assessment rather than treatment in a general ward. This emphasises the importance of competence development in wound management especially among nurses working in general wards.

The data also revealed a general trend across the groups, indicating limited knowledge about clinical examinations in nurses. In the light of the pivotal role of diagnosis and treatment of the underlying disease which is as important, if not more so, than treatment of the ulcer itself (21), knowledge of clinical investigations among nurses is an area in need of improvement. In a recent consensus report reached among wound care experts, including doctors, nurses and lecturers from 6 European countries knowledge of wound aetiology, underlying cause and treatment options were rated as most important competences in wound care nurses (22). Although doctors may perform the clinical examinations, a basic understanding of rationale behind diagnostic processes among nurses could lead to more patients being referred to appropriate investigations. Furthermore, a poor understanding of how to investigate patients correctly may lead to erroneous observations being reported to the treating physician. Conclusions based on false premises may in consequence lead to incorrect diagnosis, resulting in inadequate treatment. As optimal treatment is highly dependent on making the right diagnosis, this might explain why wounds are frequently being treated inadequately despite nurses having a relatively high level of knowledge about therapeutics. The findings also point out the responsibility of doctors to include nurses in their diagnostic contemplations and decision-making.

In order to speculate about the possibilities of improving nurses' theoretical understanding of wound management, we also investigated which factors might predict the level of knowledge in nurses. Three factors were chosen as potentially important: 1) working place, 2) attendance at educational programs/courses, and 3) experience. In this study, workplace appeared as the most important predicting factor. Considering that certified wound nurses were not included in this study, the finding suggests that working closely with specialists in environments where there is an intense focus on a specific area improves the overall level of knowledge throughout the organisation. Hence, any attempt to optimise wound management should include knowledge sharing and involve nurses in clinical decision processes of the specialists.

Attendance at educational programs, however vaguely defined in this study, was also significantly as-

sociated with the level of knowledge; nevertheless, its impact was less than that of working place. Educational programs vary markedly in duration and quality. The relatively small impact of attendance at educational programs found in our study might be explained by its wide definition, as the factor could represent a wide spectrum of programs from high to low quality. The significant impact found for educational programs emphasises the continuing need for more high-quality educational programs for post-registration nurses as well as nursing students. Previous evaluations have reported the information in many nursing textbooks as sparse and outdated (23), and the basic wound care education in nursing schools as insufficient (24). In the light of the significant impact of attending lectures and reading books on nurses' knowledge (25, 26), improvement of the curriculum in nursing schools would be an important step in the right direction.

We also found that the number of years of experience did not have any impact on the level of knowledge. In a survey study, in which readers of *Advances in skin & wound care* journal and *Nursing 2004* were asked to respond to 23 items about knowledge and practices in wound care, each item with a true or false responding option, answers from 692 readers were evaluated (24). The authors reported that in general nurses had a good knowledge of wound care and the number of years of experience had a positive impact on the level of knowledge. Nevertheless, it is fair to expect that in such survey studies, nurses who are highly interested in wound management, would be more prone to participate; therefore, we included all eligible home care nurses and performed random sampling of hospital nurses in order to eliminate the risk of voluntary response bias. Moreover, the impact of number of years in the profession on level of knowledge was in our study adjusted for other potentially important factors, thereby minimising confounding from those factors. Our results might be surprising for many as it is often assumed that many years' experience in wound management must lead to knowledge. However, when adequate educational feedback is not provided by the organisational leadership and supported by health care policy makers, and knowledge sharing is not pursued across the staff, as might be the case in many clinical settings, many years of experience are no guarantee of competence.

The strength of this study include the relatively high number of participants, the design of the 5-option multiple choice items by a group of specialists, and the evaluation of the overall knowledge about wound management. Moreover, all eligible home care nurses from 2 municipalities and random samples of hospital nurses were included in order to minimise selection bias. The random sampling was performed, since the inclusion of every hospital nurse was not possible due to time restrictions. There are also some limitations in

this study, including the relatively limited number of questionnaire items, the inability to include all hospital nurses, and the vague definition of the predicting factor attendance at educational programs.

In summary, wound care is heavily dependent on a well-functioning multidisciplinary team-work, in which the knowledge of the team members is expected to influence its quality. This study provides benchmarking information about the current status of the level of knowledge in nurses in different settings in Denmark. Similar evaluation of doctors' knowledge of wound management in different settings could provide valuable information about the current status of wound management and should be the aim of future studies.

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