

Research article

Assessment of nurses' level of knowledge of the management of chronic wounds

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ABSTRACT

Background: Chronic wounds are a challenge and a major cause of morbidity. A wound is considered chronic if healing does not occur within the expected time frame depending on the etiology and location of the wound.

Objective: To assess the level of knowledge about chronic wound management of postgraduate nurses in different areas of the health system and their previous satisfaction with the training received during their undergraduate studies.

Design: Cross-sectional study of a health system of 95,000 inhabitants and 557 nursing professionals working in it.

Participants: Nurses working in the study health system and in areas with care for patients with chronic wounds in social, primary and hospital care.

Results: Survey results described a low knowledge of chronic wound management in general. Data on knowledge according to area of work showed that nurses in primary care had the highest knowledge of wound etiology. Nurses working in health and social care were most knowledgeable in diagnostic knowledge. Hospital nurses showed the lowest knowledge overall. A relationship was observed when nurses had a master's degree followed by an expert with better knowledge in the test. In addition, nurses reported little training in chronic wounds during their university studies (69.73 %, $n = 106$).

Conclusions: Therefore, a review of this point should be considered to improve the management of chronic wounds and their correct approach among nursing students. A review of continuing and even specialised training needs in the clinical care setting should also be considered.

1. Introduction

Despite advances in medicine, chronic wounds remain a challenge and a major cause of disability, mortality and morbidity. Chronic wounds are those that do not progress through a normal, orderly, and timely sequence of repair. Various alternative terms have been proposed, such as "refractory wound," "refractory wound," "nonhealing wound," and "complex wound" (Kyaw et al., 2018). "Chronic wounds"

are generally defined as "wounds that are not properly repaired in a timely manner to establish anatomical and functional integrity after 3 months" (Dubhashi and Sindwani, 2015). However, the term has met criticism for its uncertainty regarding the duration of chronicity (Pai and Simerjit, 2013). They are often incorrectly treated. The morbidity and associated costs of chronic wounds highlight the need to implement prevention and appropriate treatment for each as well as prevalence studies to determine healthcare expenditure and associated quality of

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life. A German study found a 2 % to 3 % prevalence of chronic non-healing wounds in the general population (Bowers and Franco, 2020).

2. Background

The progressive ageing of the population increases the risk of suffering from chronic diseases. This, in turn, favours the development of wounds of different aetiologies, especially in the lower extremities, such as venous and arterial ulcers, diabetic foot and arteriopathies (Gethin et al., 2020; Gupta et al., 2017). Chronic wounds do not follow a linear healing process and tend to stagnate in the inflammatory phase because the chronic pathology was not addressed. These wounds do not heal with dressings, but epithelialise when the chronic process is resolved. Their management must be unequivocally based on a correct aetiological diagnosis (González de la Torre et al., 2017).

Patient-centred multidisciplinary teams should carry out the management of difficult-to-heal wounds. The international perspective on chronic wounds has seen significant advances in recent decades, not only in the advancement of new therapies, but also in the multidisciplinary approach and in wound technology and monitoring (Patricios et al., 2023). As part of these teams, there should be a wound nurse specialist. However, the National Group for the Study and Advice on Pressure Ulcers and Chronic Wounds in Spain (GNEAUPP) one of the main national wound associations indicates that most Health Areas in Spain do not have a specific unit (García-Fernández et al., 2018). In other words, there is no specialised chronic wound unit within the public health system (Romero-Collado et al., 2015; Lana-Pérez et al., 2018). Currently in Spain, the care levels where patients with chronic wounds are cared for are Primary Care (PC), Hospital Care (HC) and Social and Health Care (SHC), the latter for people requiring long stays and specialised geriatric care. Postgraduate training, both in the form of University Expert and Master's degrees, has experienced a significant increase, due to the fact that professionals seek the necessary specialization to carry out their work with quality. Although some forms of specialization have been developed in some healthcare areas, such as Advanced Practice Nursing (APN) for wounds (Welsh and Lusher, 2022), it is not enough. Wound training in Spain is mainly at postgraduate level, in contrast to the scarcity of knowledge imparted in this area during undergraduate university education (Romero-Collado et al., 2015). Only 5.45 % of undergraduate nursing degrees have an elective course on chronic wound management (Welsh, 2018; Weller et al., 2020; Kiel-Viljamaa et al., 2021). It is a potentially viable avenue for improving current nursing processes and procedures in wound care. Because improving and updating undergraduate education based on etiological, diagnostic and best treatment evidence will not only strengthen the knowledge base of nurses in undergraduate education but could also lead professionals towards a responsibility in their postgraduate continuing education to improve the quality of care in this area in the long term.

Therefore, there is a need for evidence on the current level of wound knowledge in practising professionals and their satisfaction with their undergraduate training (Kuhnke et al., 2019; Sandoz, 2022).

In this study, the aim was to assess the level of knowledge about chronic wound management of postgraduate nurses in different areas of the health system of Castilla y León and their previous satisfaction with the wound training received during their undergraduate studies.

3. Methods

3.1. Design

A cross-sectional study was carried out of the Castilla y León health system, Spain with 95,000 inhabitants and 557 nursing professionals working there. This area is comprised of two Hospitals, 14 Primary Care centers and one Social and Health Care.

Non-probabilistic convenience sampling was used. The hospital

services considered to have the highest prevalence of patients with chronic wounds (Internal Medicine, General Surgery, Traumatology, Neurology, Otorhinolaryngology, Urology), an urban Primary Care area and a socio-health centre with the highest number of residents where patients with wounds are frequent were selected. The sample size was calculated on a sample of 557 nurses with a confidence level of 95 %, an accuracy of 3 %, requiring a sample of 155 nurses for the study.

3.2. Data collection

Data collection on wound knowledge was conducted using the Delphi method and feedback from a panel of wound experts on a questionnaire that could assess wound knowledge. The process consisted first of selecting four experts whose expertise was based on having a master's degree in chronic wounds, at least two scientific publications on the topic and working in the field of care. In the second phase, questions were designed that were considered relevant to the topic of the study and a first round was conducted where feedback on the questions and their interpretation was solicited to avoid doubts that future study subjects might have. A second round that included suggestions for modifying or adding new questions followed this. Subsequently, an analysis of the responses from the second round was carried out and a consensus was reached between the experts and the questions where there were discrepancies or a need for clarification, of which there were four. The last stage of the process was based on consensus and validation of the process with a final thorough reading by the experts, which showed the finalization of the process. This was then passed to 15 non-expert chronic wound nurses as a pilot test to ensure that the questions were correct in syntax and structure.

The questionnaire was administered in the last quarter of 2021 through the official dissemination channels of the different care areas from which permission was requested. Once permission was obtained, an informative note was prepared to inform the supervisor or head of each unit of the purpose of the study, who was responsible for the dissemination, delivery and collection within an established period of approximately 15 days from the delivery of the study. Subsequently, the principal investigator was responsible for collecting the questionnaires.

We have called this tool the Chronic Wound Knowledge Test (CWKT). It was subjected to a statistical reliability analysis. Once the statistical analysis had been carried out, a Cronbach's alpha of 0.77 was obtained, which determines the acceptance of the consistency of the questionnaire. It is an instrument consisting of three blocks (Annex I). The first covers three aspects: area of work (HC, PC and SHC), seniority, stratified into low (0–10 years), medium (11–20) and high (>21). In addition, the degree of previous training in wound care, ranging from no training (0), courses of up to 20 h (1), university expert (2) and university Master's degree (3).

The second block constitutes the body of the tool and consists of three areas with 30 questions on wound knowledge that fall under the different areas of knowledge. Each question has five answer options and only one is correct. These areas are etiology (E), diagnostic methods (D) and treatment (T). The first area includes items E1, E9, E13, E19, E26, E27 that are questions aimed at assessing the respondents' knowledge of wound etiology and a maximum score of 6 can be obtained. The second one on diagnostic methods includes items D2, D5, D6, D8, D10, D14, D15, D16, D17, D18, D20, D23, D25, D28, D29, D30, which assess the respondents' knowledge of diagnostic methods, and a maximum score of 16 can be obtained. The third area is about knowledge of treatment and includes items T3, T4, T7, T11, T12, T21, T22, T24, a maximum score of 8 can be obtained. The maximum score that can be obtained in knowledge block 2 is 30 points.

Finally, the third block consists of three questions that aim to determine the degree of satisfaction with the training received in the subject, both at university level and in the workplaces where the professional works, as well as the perceived need for training by the professional (Annex I).

3.3. Ethical and legal considerations

Participation in the study was voluntary. The participants were informed about the study and data processing and protection according to the EU general data privacy regulation (EU, 2016/679). The anonymity of the participants was maintained and the confidentiality of the data was maintained according to the Organic Law 3/2018, of 5 December, on the Protection of Personal Data and Guarantee of Digital Rights (LOPD-GDD) and the Helsinki declaration. Ethical approval was obtained from the University Ethics Committee Ref. CIEC 002104, including approval for the creation of an expert panel group for the Delphi process.

3.4. Statistic

Collected data were analyzed using IBM SPSS v. 26.0 software. A descriptive statistical analysis was carried out using absolute and relative frequencies of the variables, as well as measures of central tendency such as mean, median and mode.

The quantitative variables were described as mean ± standard deviation (SD), while the qualitative variables were described with absolute and relative frequencies. Changes in clinical variables were compared before and after performing the educational intervention, using Student's *t*-test for continuous variables and the Chi-square test for qualitative variables. A *p*-value < 0.05 was considered statistically significant.

4. Results

4.1. Characteristics of the subjects

Finally, 152 nurses participated in the study. The 13 % (*n* = 20) were men and 87 % (*n* = 132) women, with a mean age of 40 years and in the range of 22–60 years.

The 56.57 % (*n* = 87) worked in HC, 33.55 % (*n* = 51) in PC and 9.86 % (*n* = 51) in SHC.

The professionals participating in the study had a mean of 17.22 ± 13.20 years of professional experience in a range of (0–43). Work experience was classified as low (0–10 years) in 40.13 % (*n* = 61) medium (11–20 years) in 19.07 % (*n* = 29) and high (>20 years) in 40.78 % (*n* = 62) indicating that 59.85 % (*n* = 91) of the respondents had >10 years of experience. When analyzing professional experience by level of

care, we found a mean of 15.56 ± 12.653 years of experience in HC, 20.73 ± 13.380 years in PC and 14.87 ± 12.380 years in SHC.

Regarding wound training, 29.60 % (*n* = 45) acknowledged no specific training in chronic wounds, 65.13 % (*n* = 99) had courses of up to 20 h, 4.60 % (*n* = 7) had university expert training and only 0.65 % (*n* = 1) had a university master's degree in wounds.

4.2. Analysis of the chronic wounds knowledge test

The results of the mean scores obtained in the overall test in each area of work and for each variable analyzed are shown in Table 1. The data analyzed on wound knowledge by area of work showed that nurses working in primary care had the best results, with the highest scores for knowledge of wound etiology as shown in Table 1. Nurses working in social health centers stood out in their knowledge of diagnosis.

Although we can say that, there was no significant association between the area of work and the test result, except in the questions of the treatment section (*p* < 0.001). Nurses with more experience obtained better results in the total test. The variable analyzed with respect to the three dimensions of knowledge of etiology, diagnosis and treatment of the test showed a strong significance when the nurses had completed a university master's degree followed by an expert.

4.2.1. Knowledge of etiology, diagnosis and treatment of chronic wounds

We analyzed block two of the CWKT, which can be seen in Fig. 1. Questions 3T and 24T had the highest number of correct answers 89.5 % (*n* = 136), both related to acimetalloprotease. The question with the highest number of errors was 13E (*n* = 120) on the characteristics of pyoderma gangrenosum ulcers, followed by 30D (*n* = 111) on which method to use to diagnose chronic wound infection and on knowledge of the Clinical-Ethiological-Anatomical-Anatomical-Pathophysiological (CEAP) 13 classification to classify open wounds with signs of venous insufficiency in the lower extremities.

4.3. Analysis of the hits and misses between the different variables of CWKT

The results showed that PC nurses (18.92 ± 4.30) obtained the highest percentage of correct answers and HC nurses (15.30 ± 4.96) obtained the worst results, as shown in Table 1. Questions 2D, 6D, 4T, 7T and 24T, related to the diagnosis and treatment of ulcers were those with the highest number of correct answers among PC nurses, questions 2D

Table 1
Results of the Chronic Wound Knowledge Test (CWKT) in each of the areas with the variables analyzed.

	Etiology		Diagnosis		Treatment		Total	
	Mean/SD	p value	Mean/SD	p value	Mean/SD	p value	Mean/SD	p value
Level of care where you work								
Hospital care	2.62 ± 1.15	0.289	8.00 ± 3.17	0.076	4.48 ± 1.42	<0.010	15.30 ± 4.96	0.544
Primary care	3.29 ± 1.39		9.45 ± 2.76		6.00 ± 1.46		18.92 ± 4.30	
Socio-health centre	2.80 ± 1.01		10.20 ± 2.24		6.00 ± 1.66		17.40 ± 2.97	
Work experience								
Low	2.67 ± 1.16	0.050	8.41 ± 2.94	0.543	5.05 ± 1.45	0.710	16.72 ± 4.86	0.226
Medium	2.48 ± 1.40		8.86 ± 2.73		5.24 ± 1.70		16.13 ± 4.59	
High	3.23 ± 1.19		8.92 ± 3.32		5.05 ± 1.79		17.32 ± 4.84	
Wound training level								
Untrained	2.91 ± 1.27	< 0,010	9.02 ± 3.04	0.173	5.31 ± 1.69	0.316	17.32 ± 4.87	0.002
Course up to 20 h	2.91 ± 1.27		9.02 ± 3.04		5.31 ± 1.69		17.32 ± 4.87	
University expert	3.86 ± 1.57		7.71 ± 4.23		5.43 ± 1.27		17.29 ± 6.31	
University master	5.00		13.00		6.00		24.00	
Total test	2.86 ± 1.250		8.70 ± 3.580		5.09 ± 1.64		16.72 ± 4.86	

Note: maximum test score 30; maximum score in the area on etiology (E) 6 points, in diagnostic methods (D) 16 points and in the area on treatment knowledge (T) 8 points. This table shows the mean and the standard deviation (std) for all variables. The results were analyzed by scoring each correct item with 1 point and each incorrect item with 0 points.

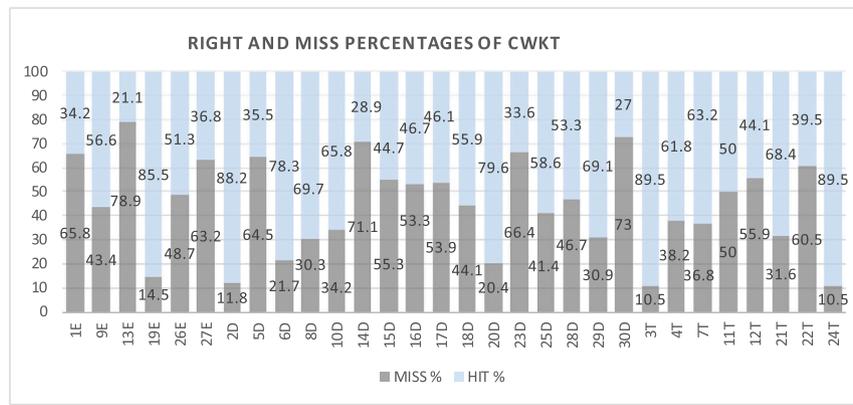


Fig. 1. Percentage of correct and incorrect responses for each item in block two of the Chronic Wound Knowledge Test (CWKT). Note: Etiology items (E) (1, 9, 13, 19, 26, 27); diagnostic methods items (D) (2, 5, 6, 8, 10, 14, 15, 16, 17, 18, 20, 23, 25, 28, 29, 30) and treatment knowledge items (T) (3, 4, 7, 11, 12, 21, 22, 24).

and 24T among EC nurses and questions 2D, 10D, 7T and 24T in the case of CSS nurses (Table 2).

The nurses from the SHC had the highest number of correct answers to the question related to biofilm (86.7 %) (n = 100) p = 0.010 and to the question on the approach to necrotic plaque on the heel (80.0 %) (n = 96) p = 0.007. PC nurses had the highest number of correct answers to the questions on the most prevalent etiology of lower limb wounds (51 %) (n = 26) p = 0.002, the two questions related to the value of ITB as a diagnostic method (96.1 %) (n = 49) p = 0.049 and the values of ITB for the diagnosis of PAD (62.7) (n = 32) p = 0.006. Better results were also obtained in the question that tries to identify the etiology of the lesions (92.1 %) (=47) p = 0.012, in the question that asks about the incompatibilities of silver-containing dressings (86.3 %) (n = 44) p <

Table 2
Items of the knowledge areas analyzed in block 2 and the variables of block 1 of the Chronic Wound Knowledge Test (CWKT).

Items CWKT	Area of work			p
	Hospital care hit percentage/error	Primary care hit percentage/error	Sociohealth care hit percentage/error	
1E	29.1/70.9	51/49	6.7/93.3	0.002
2D	82.6/17.4	96.1/3.9	93.3/6.7	0.049
3T	86/14	94.1/5.9	93.3/6.7	0.29
4T	47.7/52.3	86.1/13.7	60/40	<0,001
5D	33.7/66.3	45.1/54.9	13.3/86.7	0.068
6D	72.1/27.9	92.1/7.8	66.7/33.3	0.012
7T	52.3/47.7	76.5/23.5	80/20	0.007
8D	67.4/32.6	76.5/23.5	60/40	0.371
9E	52.3/47.7	62.7/37.3	60/40	0.474
10D	55.8/44.2	76.5/23.5	86.7/13.3	0.01
11T	38.4/61.6	74.5/25.5	33.3/66.7	<0.001
12T	37.2/62.8	54.9/45.1	46.7/53.3	0.128
13E	18.6/81.4	29.4/70.6	6.7/93.3	0.115
14D	25.6/74.4	29.4/70.6	46.7/53.3	0.25
15D	34.9/65.1	62.7/37.3	40/60	0.006
16D	46.5/53.5	39.2/60.8	73.3/26.7	0.066
17D	37.2/62.8	58.8/41.2	53.3/46.7	0.041
18D	48.8/51.2	66.7/33.3	60/40	0.12
19E	84.9/15.1	84.3/15.7	93.3/6.7	0.661
20D	79.1/20.9	74.5/25.5	100/0	0.097
21T	62.8/37.2	76.5/23.5	73.3/26.7	0.228
22T	34.9/65.1	51/49	26.7/73.3	0.1
23D	30.2/69.8	31.4/68.6	60/40	0.441
24T	84.9/15.1	100/0	80/20	0.009
25D	58.1/41.9	54.9/45.1	73.3/26.7	0.441
26E	47.7/52.3	52.9/47.1	66.7/33.3	0.382
27E	29.1/70.9	47.1/52.9	46.7/53.3	0.076
28D	60.5/39.5	47.1/52.9	33.3/66.7	0.083
29D	64/36	78.4/21.6	66.7/33.3	0.203
30D	27.9/72.1	21.6/47.1	40/60	0.352

0.001 and in the question that refers to collagenase as a method of enzymatic debridement (100 %) (n = 51) p = 0.009. They also obtained better results in the question related to contraindications to compressive therapy (74.5 %) (n = 38) p < 0.001. With regard to professional experience, nurses with high professional experience had a higher number of correct answers to the question related to risk factors for dependency-related injuries (91.9 %) (n = 57) p = 0.048). The questions on treatment showed a statistically significant association between work area and wound training.

4.3.1. Analysis of the satisfaction and quality of training received on wounds

A high percentage of 94.73 % (n = 144) of those surveyed considered that specific training in wound healing was necessary in undergraduate nursing training. 83.55 % (n = 127) of the nurses interviewed believed that wound training was necessary for both doctors and nurses, only 13.81 % (n = 21) considered it necessary only for nurses. The nurses who work in PC and CSS are the ones who mostly believe that training is necessary for both professional categories with a statistical significance of p = 0.029. The satisfaction of the nurses participating in our study with the training received on chronic wounds by the health institutions in which they work was low (80 %) compared to 4 % who said it was adequate. There was a significant relationship between the level of training received and the perception of the training as bad p = 0.007.

5. Discussion

Currently, concerns are raised about nursing preparation for wound care clinical skills due to their fragmentation and lack of objectives in the undergraduate curriculum (Redmond et al., 2018). However, concerns are also evident in postgraduate education.

The learning objectives and content of wound care training are not always clearly defined (Redmond et al., 2018) and there has even been a consensus among experts as to what the learning objectives should be for the best training (Kielo-Viljamaa et al., 2022a, 2022b). The foundation of wound care competence of registered nurses is built during their undergraduate nursing studies. However, we cannot forget the continuity of this learning during postgraduate studies.

5.1. Discussion of the results

From the findings of this study, there is a need for more specialised training in undergraduate and postgraduate nursing practice. It is important to gain greater control in the management of chronic wounds through knowledge of the etiology, diagnosis and treatment of chronic wounds. Our study assessed nurses' general knowledge on the

management of chronic hard-to-heal wounds with a slightly higher percentage of correct answers than other studies (Gonçalves et al., 2015; Schmidt et al., 2020). Considering the workplace, hospital-based professionals scored the lowest, with those working in PC having the best efficacy, with an average level of correct answers. A statistically significant association was found between work centre and total test score (<0.01) agreeing with Kumarasinghe et al. (2018). Despite having a greater representation of nurses in the sample who work in HC, compared to AP and SHC, the former showed less knowledge in chronic wounds, specifically in their treatment. These results are consistent with those obtained in other studies (Dugdall and Watson, 2009).

This leads us to believe that more training is needed in the hospital setting, as perhaps the length of stay of patients is shorter and they do not have as much continuous follow-up over time. Wound care requires in-depth knowledge and very specific skills (Kielo et al., 2020). With sufficient knowledge (Brölmann et al., 2012), it should be possible to improve both the quality of care and patient safety, reducing the healing time of difficult wounds and the costs of care (Milne, 2016). Wound treatment is a significant health and financial burden, accounting for $> \$10$ billion of annual healthcare expenditure in the United States (Rosenbaum et al., 2018). In Spain, treatment of pressure ulcers alone exceeds €600 million each year (Soldevilla-Agreda et al., 2022).

Work experience could also be an added factor to the lower knowledge shown by the hospital-based professionals in this study. This may lead us to think that the problem may lie in the lack of specialised continuing education. This is in line with similar studies (Dugdall and Watson, 2009; Kielo-Viljamaa et al., 2022a, 2022b) which show that nurses prefer experience, clinical practice and learning from colleagues, i.e. they rely on low-level evidence rather than using evidence-based guidelines. Hospital professionals had the lowest level of training, in contrast to PC professionals who had the highest number of university experts and masters. We affirm that among the participants in this study, having a higher level of specialised wound training, namely a master's degree and an expert, is associated with better knowledge outcomes (<0.01). This is consistent with Jiménez-García et al. (2019), who also demonstrated that nurses with specialised wound training not only reduced the time required for wound healing, but also reduced healthcare costs. However, the study by Welsh and Lusher (2022) found no distinction between specialist and generalist nurses in their approach to wounds. This leads us to consider other determinants.

The analysis of the knowledge of etiology, diagnosis and treatment, using the CWKT questionnaire, allowed us to know the level of difficult-to-heal wounds in a more specific way. Despite the existence of questionnaires such as the Pieper-Zulkowski Pressure Ulcer Knowledge Test (Moharramzadeh et al., 2021) and the pressure ulcer knowledge assessment tool questionnaire (Dalli et al., 2022), we did not use them due to their focus mainly in pressure ulcers.

Nurses working in the PC setting obtained the highest percentage of correct answers. This reinforces that in Spain PC nurses have a heavy burden in the care of the elderly and in the follow-up of chronic wounds at home, something that also exists in other countries such as the UK (Welsh, 2018), where there is an increasing decentralisation of community health and social care and where they are responsible for wound management (Kelechi and Johnson, 2012; Mosti et al., 2020).

The nurses participating in our study showed a higher level of correct answers on diagnosis and treatment than on the etiological causes of wounds. This may suggest that many of the practitioners gain their knowledge through unregulated procedures and based on the products of treatment and observation rather than on substantiation and identification of the cause of the injury.

It is striking that those with the least training get the most correct answers to the questions on products and treatment (Beyene et al., 2020); but not on etiology and diagnosis. These results could be related to the training they receive from the pharmaceutical company, but not as official master's and expert training. These results are consistent with those obtained in the study by Weller et al. (2020) who conclude that

nurses base their actions on the experiences of others or on non-formal training from the pharmaceutical industry.

Regarding the satisfaction and opinion of respondents with the training received throughout their professional career in chronic wounds evaluated in the third block of the CWKT we highlight that of professionals believe that the implementation of a specific subject in wounds in undergraduate training is necessary. Coinciding with the low dedication of ETCS credits that Spanish universities dedicate to wound training at both academic and postgraduate level (Tobajas-Señor et al., 2017).

In our study, we observed that the least educated considered the training received for healthcare personnel in general by healthcare institutions to be sufficient. This contrasted with the opposite opinion of the expert nurses with a master's degree in chronic wounds, who considered it insufficient. This suggests that the lower the level of knowledge, the lower the awareness of its deficiency.

The generation of knowledge and development of new technologies and treatments for the care of people with hard-to-heal chronic wounds has made significant advances. Hence the need for constant updating of knowledge based on scientific evidence (Dhar et al., 2020). While time of experience may be one aspect that contributes to improved practice and knowledge, it is not sufficient. There may also be motivational and individual factors, related to the desire to continuously learn and train, which have a direct impact on the healing and resolution outcomes of chronic wounds in patients (Bergersen et al., 2016; Frykberg and Banks, 2015). As well as the need for greater institutional involvement.

5.2. Strengths and limitations

We have not differentiated statistically by gender to avoid biased extrapolation of the results. Due to the high participation of women versus men in this study. It is more difficult to generalize to the whole population in a non-probability sample as we have done with the study participants. However, it is quicker to do and more economical if the researcher has a good knowledge of the field of study, as in our case. In addition, the nurses participating in the test came from different levels of health care, reducing this possible limitation. It is important to note that all participating nurses had or had cared for patients with complex chronic wounds. This is considered a strength when assessing wound knowledge based on evidence of being part of nursing work at different levels of care, and not to take samples from other fields of work where this need is not evident.

Another limitation may be that in each country, there are differences in the training and competencies of undergraduate and postgraduate wound care nurse educators, although we consider that these findings can be extended to all those countries subject to the European Union Directives because they have similar competency criteria and professional qualifications (Satu et al., 2013). In addition, to other countries developing their own training and competence programmes in this field (National Pressure Ulcer Advisory Panel, 2014). International organizations, such as the World Health Organization and international medical associations, often provide guidelines and recommendations on chronic wound management, as chronic wound care is an area of health care that transcends borders and has global relevance.

6. Conclusions

The level of knowledge about chronic wound management of post-graduate nurses in different care areas is low. Our results show dissatisfaction with the wound training received during undergraduate studies. The nurses in the study consider it important to promote and improve specific training in chronic wound management from undergraduate studies. This specific knowledge is integrated in a transversal way in different subjects of the studies; however, it should be further enhanced as a specific area.

PC nurses are more knowledgeable about chronic wound

management and management of chronic wounds than EC are nurses. The fact that there is a highly experienced nurse referral in wound management at all levels of care, and especially in the hospital, may influence the management and management of chronic wounds. It should be considered for future studies to examine the potential of mandatory continuing education in the field of nursing practice. Perhaps including the use of asynchronous virtual lessons that can reach a greater number of practitioners with objective measures of assessment that address evidenced knowledge shortages.

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CRedit authorship contribution statement

Ana Fernandez-Araque: Conceptualization, Funding acquisition, Supervision, Writing – original draft. **Mercedes Martinez-Delgado:** Data curation, Formal analysis, Investigation, Validation, Visualization. **Jose-Maria Jimenez:** Formal analysis, Methodology, Writing – review & editing. **María López:** Formal analysis, Resources, Software. **Maria Jose Castro:** Data curation, Investigation. **Estela Carnicero Gila:** Conceptualization, Investigation, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare no conflicts of interest.

Data availability

All data generated or analyzed during this study are included in the published article.

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