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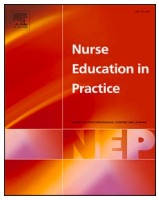

# Knowledge and teaching-learning methods regarding venous leg ulcers in nursing professionals and students: A scoping review

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ABSTRACT

*Aim:* According to our scoping review questions, three aims were formulated to synthesize the evidence published on: (1) the content (2) the best or most appropriate teaching-learning methods for training nurses and undergraduate nursing students in venous leg ulcer care, and (3) to identify the level of knowledge in nurses and undergraduate nursing students about venous leg ulcer care.

*Background:* A venous leg ulcer can be defined as a skin lesion on the leg or foot that occurs in an area affected by ambulatory venous hypertension. Hence, nurse visits are the main driver of Venous Leg Ulcer-related healthcare costs. Optimal levels of knowledge obtained with appropriate methodologies tend to improve care. Nonetheless, the time devoted to chronic wound education in undergraduate nursing curricula has been considered insufficient and inadequate.

*Methods:* For this scoping review, a search was performed in January 2021. To identify sources of evidence, a systematic search was conducted in MEDLINE, Embase, CINAHL, Web of Science, Scopus, Cuiden, ERIC and ScienceDirect. All types of evidence associated with knowledge, teaching and/or learning methods regarding venous leg ulcers in nursing were included.

*Results:* Finally, 19 documents were included. In these articles, the content mostly widely included in teaching-learning methods was compression therapy (14/19), anatomy, physiology, aetiology and/or pathophysiology (10/19) and topical treatment and care (8/19); various other topics were mentioned but less frequently. Teaching/learning methods and interventions were heterogeneous in modality, content, and duration but the majority showed better results after implementation. When looking at knowledge level, studies mainly focused on nursing staff. In general, it seems that there is a lack of knowledge and skills.

*Conclusions:* Regarding our three pivotal questions: (1) There is no uniform type of content over the studies analysed and the most referred was compression therapy. (2) The educational interventions studied have demonstrated effectiveness, but there is insufficient data to determine which is the most effective. (3) This scoping review has highlighted the lack of knowledge among nurses and nursing students about venous leg ulcer care. Additionally, we felt that there is no ideal assessment tool to quantify knowledge, skills, attitude, confidence, and commitment in this context.

*Tweetable abstract:* A scoping review that synthesise the evidence on the level of knowledge and teaching-learning methods in nursing regarding of people with venous leg ulcers shows lack of knowledge and variability in programs.

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## 1. Introduction

### 1.1. Rationale

A venous leg ulcer can be defined as a skin lesion on the leg or foot that occurs in an area affected by venous hypertension (O'Donnell et al., 2014). With an estimated population prevalence of between 0.5 % and 0.8 % (Marinel.lo Roura and Verdú Soriano, 2018), this condition constitutes a public health problem, given the associated pain and functional limitations for patients, impacting their quality of life, and major costs for society and the health system in general. Hence, nurse visits are the main driver of venous leg ulcer-related healthcare costs, with an estimated annual cost of £ 67.8 million in the United Kingdom (UK) (Phillips et al., 2020), and moreover, the number of patients with a venous leg ulcer increased by 101 % between 2012/2013 and 2017/2018 (from 27,800 to 56,000 patients) (Guest et al., 2020). That is, it is a rapidly growing health issue.

Optimal levels of knowledge obtained with appropriate methodologies tend to improve care. Nonetheless, the time devoted to chronic wound education in undergraduate nursing curricula has been considered insufficient and inadequate (Abuleal, 2018; Moore and Clarke, 2011). In particular, Abuleal (2018) stated that students possess poor wound care decision-making skills. The European Credit Transfer and Accumulation System (ECTS) express the volume of learning based on the defined learning outcomes and their associated workload, one credit corresponding to 25–30 h of work (ECTS Users' Guide, 2015). Currently, based on Tobajas-Senõr et al. (2017), it is difficult to ascertain the ECTS credits corresponding to chronic wounds in programs of nursing faculties in Spain. Among the Spanish nursing faculties that were analysed and had information accessible, the majority were found to award less than 2 credits (94.64 %) in compulsory subjects, while in the case of universities that award 3 or more credits, these were from optional subjects. During the 2021/2022 academic year, five Spanish universities will offer this topic as an optional subject (information obtained by personal communication with the coordinator at each university). Usually, the provision of education on wound management is provided to undergraduate nursing students through face-to-face classes (88 %) and practical demonstrations (52 %), with other teaching methodologies rarely being used, such as discussion forums and online lectures (Moore and Clarke, 2011).

One literature review (Ylönen et al., 2014), that explores nurses' knowledge about venous leg ulcer care, was found. However, it did not include nursing students or consider teaching-learning methods.

The Kirkpatrick Model (Kirkpatrick and Kaiser, 2016) was founded on the belief that training professionals can create and demonstrate the organisational value of their training. The goal is to show you how to do it yourself. In the New Model, the simplicity of the original four levels is retained in order to retain its temporary appeal, flexibility and ease of implementation for all types of programmes. Its practicality provides the practitioner with a logical approach to conducting and evaluating training and development outcomes.

To ensure relevant learning outcomes are achieved in training programmes, there is a need to analyse the topics most widely covered, the teaching-learning methods used and the level of knowledge acquired.

### 1.2. Objectives

According to our scoping review questions, three aims were formulated to synthesize the evidence published on: (1) the content (2) the best or most appropriate teaching-learning methods for training nurses and undergraduate nursing students in venous leg ulcer care, and (3) to identify the level of knowledge in nurses and undergraduate nursing students about venous leg ulcer care.

## 2. Methods

Considering the (Arksey and O'Malley, 2005) and the updated methodological framework of (Levac et al., 2010) for scoping reviews, the following research questions was addressed:

### 2.1. Scoping review questions

According with our aims, 3 review questions were elaborated:

1) What content, concerning the care of people with venous leg ulcers, is the most widely covered in teaching-learning interventions during undergraduate nursing education?
2) What might be the best or most appropriate teaching-learning methods for training nurses and undergraduate nursing students in venous leg ulcer care?
3) What is the level of knowledge in nurses and undergraduate nursing students about this topic?

### 2.2. Protocol and registration

The protocol was drafted in accordance with PRISMA-ScR guidelines (Peters et al., 2020; Tricco et al., 2018) and registered at https://osf.io/: (doi 10.17605/osf.io/84bmr).

### 2.3. Eligibility criteria

#### 2.3.1. Population

In accordance with the objectives, both nurses and nursing students were acceptable study populations for studies to be included in this review. Papers were excluded, however, if the results were described in conjunction with those for other professions and it was not possible to extract data for the target population. No geographical restrictions were imposed. Studies describing the extent of knowledge, or methods of learning or teaching about the care of people with venous leg ulcers were included, while those from which no specific venous leg ulcer data could be obtained were excluded.

#### 2.3.2. Concepts

Teaching is a formal and organized process of transmitting knowledge to a person or group. In this review, teaching was considered to include any methodology that improves the knowledge, attitude and/or practice of the recipients and the content considered relevant was analysed. Learning is a relatively permanent change in behaviour that is the result of experience or practice. For this study, learning was considered to refer to the acquisition of knowledge. In this context, the term knowledge refers to knowledge of information, but also attitudes and behaviours associated with health-related issues such as pathological processes or diseases, their prevention and treatment. The process of this study also included the analysis of the tools used for the assessment of the scope of competences.

#### 2.3.3. Context

According to analysis of where the training takes place, interventions are conducted as part of undergraduate programmes in universities and this is an ideal location. On the other hand, nurses receive postgraduate training on demand from various sources and levels of training. In this review, both undergraduate and postgraduate training were considered.

#### 2.3.4. Type of design

All types of study design related to knowledge, teaching-learning methods and interventions were considered. Specifically, we included both qualitative and/or quantitative studies reported in English and Spanish up to December 2020.

### 2.4. Information sources

The following databases were systematically searched to identify relevant evidence: MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science (WOS), SCOPUS, Cuiden and Educational Resource Information Center (ERIC). In addition, ScienceDirect was hand-searched.

### 2.5. Search

First, two researchers identified a list of search terms. Initial search terms were identified through scoping literature searches. Table 1 shows the keyword matching. Second, the keywords were combined with AND and OR operators to provide a search strategy in the databases. Table 2 lists the databases consulted, search equation, results of the targeted search and time period. The search was conducted in January 2021.

### 2.6. Selection of sources of evidence

Relevant literature was obtained according to the aforementioned search strategy and imported into Mendeley (Version 1.19.8). After removing duplicates, two researchers, independently, examined titles and abstracts and, then, excluded irrelevant articles. According to the inclusion and exclusion criteria, all the researchers selected potentially relevant articles by reading the abstracts independently. Finally, two researchers further screened the literature by reading the full text. Any disagreements on the inclusion of articles were discussed by all researchers until consensus was reached.

### 2.7. Data charting process

Data from the articles included were transcribed into an "ad hoc" form, using Microsoft Excel software, by the first author, and internal validation of the data entered was completed by a second author. Data extracted from the studies included were: the author/s, year of publication, country of origin, title, aim, study design, sample size, characteristics of participants, data collection date, teaching-learning intervention, data collection instrument and variables, blinding, knowledge outcomes and authors' conclusions. Characteristics of each study were extracted independently by two researchers.

### 2.8. Data items

Data were abstracted on study demographics (author/s, year of publication, country of origin and study design); in addition to population, characteristics (nursing staff or students). The content and structure of the training programmes from the educational interventions carried out were grouped by content/topics. Information was extracted on the existence or non-existence of teaching-learning interventions. If interventions of interest were found, the type of intervention was recorded. The tool used to assess the level of knowledge was recorded. Finally, quantitative data were extracted on the level of knowledge.

**Table 1**
Key words.

| CONCEPT | Medical Subject Headings (MeSH) | |
|---|---|---|
| Knowledge | Knowledge | |
| Teaching | Teaching | |
| Learning | Learning | |
| Venous Leg Ulcer | Varicose ulcer | |
| | Leg ulcer | |
| Nursing | Nursing | Nurs* |
| Nursing students | Students, Nursing (Nursing student) | |
| | Nursing education research | |
| | Education, Nursing, Baccalaureate | |

**Table 2**
Databases consulted, search equation, results of the targeted search and time period.

| DATABASE | SEARCH EQUATION TESTED | RESULTS FOUND | SEARCH PERIOD |
|---|---|---|---|
| MEDLINE (via OVID) | (("leg ulcer" [MeSH] or "varicose ulcer" [MeSH]) and nurs* and (knowledge [MeSH] or learning [MeSH] or teaching [MeSH])) Limit [(English)(Spanish)] | 157 | 1946–2020 |
| Embase Classic +Embase (via OVID) | ((leg ulcer [MeSH] or varicose ulcer [MeSH]) and nurs* and (knowledge [MeSH] or learning [MeSH] or teaching [MeSH])) Limit [(English)(Spanish)] | 147 | 1947–2020 |
| Cinahl | (MH leg ulcer or varicose ulcer) AND (MH knowledge or learning or teaching or education) AND (MH nurse or nurses or nursing) Limit [(English)(Spanish)] | 465 | 1988–2020 |
| Web of Science (WOS) | TS= ((leg ulcer or varicose ulcer) and nurs* and (knowledge or learning or teaching)) Limit [(English)(Spanish)] | 94 | 1900 (1995) to 2020 |
| SCOPUS | (leg ulcers OR varicose ulcer) nurs* AND (knowledge OR learning OR teaching) Limit [(English)(Spanish)] | 188 | 1968–2020 |
| Cuiden | Úlceras de la pierna AND enfermería AND conocimiento OR enseñanza OR aprendizaje Limit [(English)(Spanish)] | 13 | 2010–2020 |
| Educational Resource Information Center (ERIC) | leg ulcer and nurses or nursing education or nursing students or nursing research and Knowledge Level and Teaching Methods Limit [(English)(Spanish)] | 0 | To 2020 |
| TOTAL | | 1064 | |
| ScienceDirect | leg ulcer or varicose ulcer and nursing and knowledge or education or learning Limit [(English)(Spanish)] | 64 | To 2020 |
| TOTAL | | 1128 | |

### 2.9. Critical appraisal of individual sources of evidence

For this purpose, a critical appraisal method was not applied, that is, all sources of evidence were included.

### 2.10. Synthesis of results

The articles were grouped according to their proposed structure and contents and the type of intervention described for teaching-learning, differentiating between whether it was theoretical, practical or both. The grouping allowed the analysis of cross interventions between different educational programmes. They were also grouped by the tool used for the assessment of knowledge and the results.

Results were presented in a narrative synthesis and summarized in tables and figures.

## 3. Results

### 3.1. Selection of sources of evidence

The database searches identified 1128 articles, and of these, 536 were found to be duplicates and excluded. Subsequently, 540 articles

were excluded after title and/or abstract screening.

The full-text versions of the remaining 52 articles were hand-searched and assessed separately by the first two authors. After that, 33 full-text records were excluded for various reasons related to eligibility. The PRISMA flowchart (Fig. 1) illustrates the process.

### 3.2. Characteristics of sources of evidence

Two different papers (Ylönen et al., 2017, 2019) reported what seemed to be the same study, as both the sample and intervention were the same, but they presented different results of interest. For this reason, one paper was included regarding teaching-learning and both regarding knowledge.

Details of the articles included (n = 19) are charted in Table 3. Eight studies (44.4 %) were conducted in the United Kingdom, and regarding research methods, seven (38.9 %) were descriptive in design. All selected articles were written in English, however, is plausible that the content was treated in the main language of the country.

### 3.3. Results of individual sources of evidence

#### 3.3.1. Study participants

Approximately 2615 nurses and 346 nursing students participated in the studies. The minimum and the maximum number of both nursing professionals and students included in the studies was 12/1225 and 106/240 respectively. Four studies did not state the number of participants, due to their design (Bianchi, 2007; Maylor, 2012; Pokorná et al., 2017; Probst et al., 2019). All studies included nurses, while only two included nursing students.

#### 3.3.2. Structure and contents related to venous leg ulcers in nursing programmes

Three studies (Maylor, 2012; Pokorná et al., 2017; Probst et al., 2019) have put forward proposals for a common training programme (curricula for nurses), in the case of the latter two, as part of a common European framework advanced by the European Wound Management Association (EWMA).

The EWMA curriculum aims to provide the students with theoretical and practical skills to support appropriate decision making (evidence-

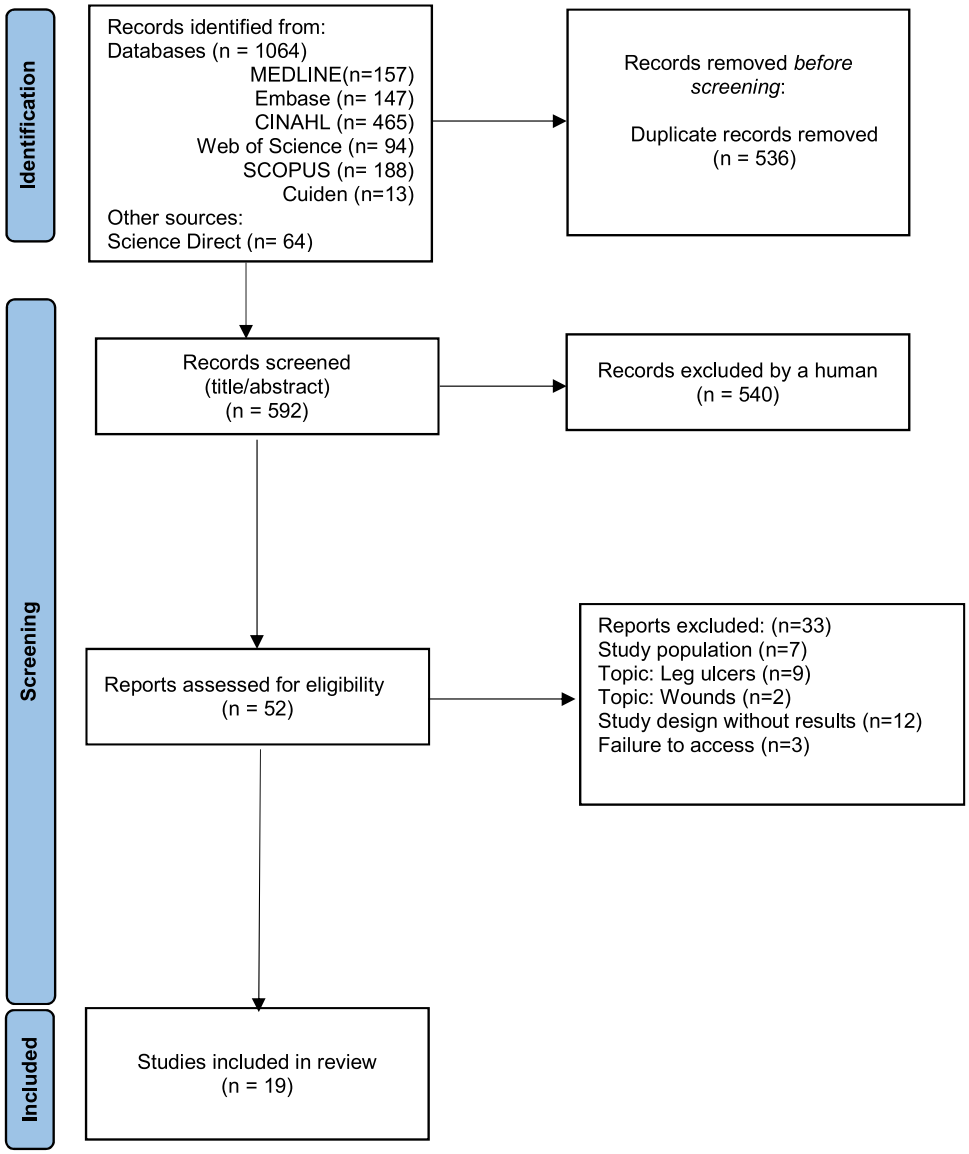


**Fig. 1.** PRISMA flow diagram.
Adapted from: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

**Table 3**
Details of the articles included.

| Author (s)/ Year/ Country | Aim | Study design | Participants | Structure and contents | Intervention Teaching/Learning | Assessment methods/ tools | Key findings |
|---|---|---|---|---|---|---|---|
| Ylönen et al. (2019) Finland | To assess the congruence between nurses perceived and theoretical knowledge before and after an internet-based continuing education (CE) program about venous leg ulcer nursing care (eVLU). | Quasi-experimental | Nurses<br>IG 50<br>CG 40 | Aetiology and pathophysiology.<br>Healing process.<br>Assessment.<br>Topical care<br>Compression therapy. | Implementation of eVLU, a lecture and discussion about using eVLU, and a 6-week period of distance learning for home healthcare teams of 8–12 nurses | Perceived Knowledge, Attitudes and theoretical Knowledge (PKAK) | The congruence increased in both groups during the study, but the increase was statistically significant in more items in the intervention group than in the comparison group<br>The effect may be short-lived, and this underlines the importance of continuing education (CE). |
| Probst et al. (2019) UK<br>Pokorna et al. (2017) UK | To increase the understanding of the common causes of leg ulceration including; venous factors influencing the diagnosis and treatment of lower leg ulcers. | Expert consensus | – | Classification of types of leg ulcers<br>Varicose veins and varicosities<br>Peripheral arterial occlusive disease<br>Chronic venous insufficiency<br>Mixed pathology<br>Venous oedema<br>Lymphatic oedema<br>Pyoderma gangrenosum<br>Rare causes of lower leg ulcers<br>Prophylaxis/prevention<br>The fundamentals of compression therapy (hosiery and bandages)<br>Different techniques of compression therapy and practical learning<br>Local therapeutic options<br>Role of drugs/medication in treatment<br>Surgery<br>Practical examples. | – | – | Depending on the educational level of the undergraduate qualification of the participants (nursing students), the European Wound Management Association (EWMA) curricula can be adapted to meet the competencies expected at level 5, 6 or 7.<br>On completion of the unit of study, a student will be able to overcome learning outcomes |
| Ylönen et al. (2017) Finland | Effectiveness of an Internet-based education programme about venous leg ulcer | Quasi-experimental | Nurses<br>IG 50<br>CG 39 | VLU recognition, aetiology and pathophysiology.<br>VLU healing and assessment of healing process.<br>Assessment of VLU infection.<br>Principles of VLU topical care.<br>VLU topical care products and dressings.<br>Compression therapy. | Implementation of eVLU,<br>A lecture delivered by a researcher and discussion about using eVLU, and a 6-week period of distance learning | PKAK | Statistically significant differences between comparison and intervention groups found in several subscales of perceived and theoretical knowledge, with changes from baseline to first and second measurements in the intervention group while levels remained unchanged over the study in controls. There were no differences between the groups in attitudes at any measurement time points. |
| Tidhar et al. (2017). Israel | To evaluate the effectiveness of a training workshop on compression bandaging | Quasi-experimental | Nurses<br>37 | Anatomy and physiology of the venous and lymphatic systems.<br>Compression principles.<br>Contraindications.<br>Wound healing. | Four-hour training session (First hour: background lecture and a bandaging demonstration with elastic bandage) | PicoPress® device | Practice with the PicoPress device in nurse training was effective immediately after the session.<br>With a significant difference from baseline, the percentage of nurses who bandaged optimally decreased over the 6-month follow-up. |

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**Table 3** (*continued*)

| Author (s)/ Year/ Country | Aim | Study design | Participants | Structure and contents | Intervention Teaching/Learning | Assessment methods/ tools | Key findings |
|---|---|---|---|---|---|---|---|
| Heyer et al. (2017). Germany | To compare knowledge and practical skills of participants with further training with those of participants who had no such training. | Quasi-experimental | Nurses 1225 | Upholstered with padding materials.<br>Knowledge of the users about multi-component systems and ulcer stocking systems.<br>Commonly prescribed pressure values. | Workshops and seminars participants who had no specific expertise and those with specific expertise.<br>Short stretch bandages | 4 questions were asked verbally<br>PicoPress® device | Nurses with specific expertise in hospitals (17.8 %) and outpatient care (10.7 %) had the highest knowledge about padding.<br>Nurse with and without specific expertise in outpatient care had the highest knowledge about multi-component and stocking systems.<br>Nurses in elderly care showed a lack of knowledge.<br>A huge lack of knowledge and practical skills concerning compression therapy being performed by nurses. |
| Mitchell, (2017). UK | To assess the value of accredited leg ulcer education in influencing changes in practice | Descriptive | Nurses 12 (before) 8 (after) | Epidemiology.<br>Aetiology.<br>Classification.<br>Assessment of leg ulcers.<br>Practical sessions surrounding assessment, ABPI, Doppler and compression bandages | Practice-based audit and an OSCE in a simulated environment. | Before: Questionnaire<br>After: Interview aligned to the Kirkpatrick model | Before the intervention, the rationale for choosing the course: update date skills and knowledge, were 50 %.<br>The module appeared to increase the knowledge and skills of primary care nurses, suggesting that nurses benefit from formal leg ulcer training to make improvements in practice. |
| Leocadio et al. (2016). Brazil | To assess the knowledge of nursing students on vasculogenic lesions. | Cross-sectional and descriptive | Nursing students 106 | Treatment and recognition of the lesion. | – | 76-item questionnaire, with response options of "true," "false" or "I do not know" | The highest number of correct answers regarding venous lesions was related to the colouration in perilesional area (74.5 %); and the lowest to the use of ultrasound for wound healing (5.7 %).<br>The questions most often answered incorrectly involved treatment and recognition of the lesion. |
| Maylor, (2012). UK | To gain consensus about what the content of a curriculum might be. | Expert consensus | – | Leg ulceration<br>Basic mechanisms of leg ulceration<br>Tests and diagnosis<br>Principles of treatment<br>Types of bandages and compression<br>Policy, guidelines, and referral pathways | – | – | A lack of mandatory training in tissue viability has serious implications for patient safety and care quality.<br>The curriculum provides a checklist that tissue viability nurses can use as a basis for training colleagues.<br>Trusts and education providers should agree and implement a curriculum and standards of competence. |
| Van Hecke, et al. (2011). Belgium | To develop and test the psychometric properties of an instrument to assess venous leg ulcer lifestyle knowledge. | Item-analysis, construct validity and stability were assessed. | Nurses 110<br>Nursing Students 240 | Leg elevation.<br>Physical activity/leg exercises.<br>Compression therapy.<br>Pain management. | – | Multiple choice (psychometrically validated) questionnaire to assess knowledge.<br>Patient cases to assess complex cognitive skills. | Only 38 % of respondents knew that compression therapy was a lifelong treatment for venous leg ulcers, while 33 % thought that compression for up to 1 month after healing was sufficient.<br>These misconceptions can lead to suboptimal care.<br>The groups that were (theoretically) expected to be more experienced lacked in-depth knowledge<br>Among the response options, a high rate of use of the option "I don't know" indicated misconceptions about lifestyle advice for leg ulcer patients. |
| Barrett et al. (2009). Ireland | To examine the professional knowledge and management practices that public health nurses | Descriptive | Nurse 132 | Background and working practices<br>Knowledge and | – | 26-item questionnaire | The concepts underlying graduated compression therapy are not known.<br>A significant number did not use Doppler to |

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**Table 3** (*continued*)

| Author (s)/ Year/ Country | Aim | Study design | Participants | Structure and contents | Intervention Teaching/Learning | Assessment methods/ tools | Key findings |
|---|---|---|---|---|---|---|---|
| | use when managing patients with VLUs in the community setting in Ireland. | | | management practices<br>Clinical examination<br>Cleansing<br>Compression therapy<br>Theory of compression<br>Dressings<br>Seeking advice<br>Factors inhibiting the provision of best practice<br>Education and training | | | measure ABPI before applying compression.<br>The most commonly used dressing categories were silver and iodine, which ignores publications recommending simple, inexpensive dressings for uncomplicated leg ulcers. |
| Van Hecke et al. (2009). Belgium | To describe venous leg ulcer care regarding compression, pain management and lifestyle advice in community settings and to identify factors that predict the provision of lifestyle advice by nurses. | Descriptive-correlational | Nurses<br>742 | Current leg ulcer care in community settings<br>Compression therapy<br>Pain management<br>Lifestyle advice<br>Predictive factors on provision of lifestyle advice | – | 24-item questionnaire (5-point Likert-type response) | Knowledge and skill levels were 56.4 %.<br>Lifestyle advice on leg ulcer lifestyle is not usually given by community nurses.<br>Community nurses' perceived knowledge and skills are predictors of health education in patients with leg ulcers.<br>Community nurses who found leg ulcer care unrewarding, rarely successful or difficult provided less health education.<br>Community nurses should integrate ongoing pain assessment and management into their daily practice and should also determine whether the patient is taking their pain medication as directed. |
| Bianchi, (2007). UK (Scotland) | To examine the theoretical and practical aspects of four such courses at university | Descriptive | – | Theoretical elements common to all courses<br>Aetiology<br>Epidemiology<br>Physiology<br>Surgical aspects<br>Dermatological aspects<br>Evidence-based practice<br>Vascular assessment<br>Wound assessment<br>Theory of vascular assessment<br>Theory of bandaging | – | – | Bridging the theory-practice gap has been considered by the programme developers for each course.<br>Course types were face to face in ¾ cases and distance learning in ¼<br>Methods used to develop practical skills at the four institutions are:<br>Clinical competency framework<br>Mentorship<br>OSCE (Doppler and bandaging) |
| Ameen et al. (2005). UK | To assess the impact of the provision of expert tele-advice to community nurses in enhancing their knowledge of leg ulcer care. | Randomized controlled trial | Nurses<br>38 | Dressings,<br>Management<br>Physiology | IG:<br>Expert wound care tele-advice<br>CG:<br>Usual wound care | 40-item multiple choice questionnaire | Pre-intervention scores differed between topics, suggesting that nurses may lack knowledge in some areas of their practice.<br>The results suggest that tele-counselling can be very beneficial for community nurses in improving their knowledge of leg ulcer care practice. |
| Wong, (2003). China (HK) | To examine the:<br>● Effect of the teaching programme on community nurses' knowledge of leg ulcer management<br>● Relationship between leg ulcer knowledge and nurses' clinical experience. | Quasi-experimental pre-test/post-test | Nurse<br>42 | Prevalence of leg ulcers.<br>Implications of leg ulcers on health care and patients' quality of life<br>Pathology of leg ulcers<br>Clinical signs and differentiation between types of leg ulcer<br>Leg ulcer assessment:<br>● Introduction of leg ulcer | 3-hour education programme:<br>Teaching<br>Discussion<br>Literature sharing and discussion<br>Slides and picture show<br>Demonstration<br>Videotape<br>Return demonstration | 30-item questionnaire | Before the programme, only five (12 %) nurses scored ≥ 15 out of a total score of 30. The median score was 10 (range: 4–21) and the mean score 10.3, with a standard deviation of 3.54.<br>In the post-education test, 37 nurses (93 %) scored ≥ 15. The median score was 20.5 (range: 10–27) and the mean score 20.4, with a standard deviation of 3.66. |

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**Table 3** (*continued*)

| Author (s)/ Year/ Country | Aim | Study design | Participants | Structure and contents | Intervention Teaching/Learning | Assessment methods/ tools | Key findings |
|---|---|---|---|---|---|---|---|
| | | | | assessment form<br>● Use of Doppler<br>Leg ulcer management (venous and arterial)<br>Compression bandaging<br>Patient education<br>Skill practice and questioning | | | |
| Graham et al. (2001). Canada | To assess nursing providers and practice in chronic leg ulcer care | Descriptive | Nurses 124 | Client assessment and treatment.<br>Nurses' skills, knowledge and attitudes.<br>Importance of various sources of information. | – | 17-item questionnaire with Likert-type response options | Best practice should include a thorough diagnostic assessment of the aetiology of the leg ulcer and the application of compression bandaging for ulcers with venous aetiology.<br>Individuals with leg ulcers should be screened for arterial disease by Doppler measurement of the ABPI. |
| Dealey, (2001). UK | To distinguish the levels of knowledge of nurses providing care for patients with leg ulcers within an acute hospital setting. | Descriptive | Nurses 29 | Nursing skills<br>Quality of life<br>Pain | – | 12-item questionnaire<br>6 case study<br>Observation of the care provided for patients with leg ulcers | Lack of nursing knowledge and skills, in use of a compression bandage, as well as access to a Doppler and its use. |
| Taylor and Taylor, (1998). UK | To assess the bandaging skills | Prospective | Nurses 16 | Bandage pressure applied, using the standard four-layer high-compression bandaging regimen | Training session | Three bandage pressure sensors | Inconsistency in bandaging proficiency within this sample of nurses, less than 50 % of those examined showing good bandaging skills at the initial assessment.<br>'On-the-job' training, coupled with feedback information from the pressure monitor, allowed 81 % to progress to adequate or good proficiency. |
| Bell, (1994). Ireland | To identify the knowledge gaps among registered general nurses and to look at ways of addressing these deficits. | Descriptive observational | Nurses 18 | Physiology of wound healing. (Stages of healing. Phases of healing)<br>Names of the cells involved in granulation tissue formation.<br>Primary vitamins and minerals that assist wound healing.<br>Factors that enhance wound healing in venous leg ulcers.<br>Five most important factors affecting venous ulcers.<br>Pictures of venous ulcers. | – | 13-item interview schedule | The results suggest a lack of knowledge regarding factors affecting venous ulcers. |

IG: intervention group; CG: control group; ABPI: ankle-brachial pressure index; OSCE: Objective Structured Clinical Examination; PKAK: Perceived Knowledge, Attitudes and theoretical Knowledge

based nursing and practice, problem-based learning and practical-based learning). The curriculum summarises the required learning goals related to managing individuals with wounds.

They propose common units of study content at all levels and different learning outcomes. Nonetheless, from the whole pool of documents, the content/topics included in the studies has been grouped by frequency of citation and is presented in Table 4.

#### 3.3.3. Teaching/learning methods for training, interventions and assessment tools

As many as seven different types of teaching-learning methods were identified, and these can be summarised as follows:

- Training sessions based on skills or practical demonstrations, for instance, how bandages should be applied, with two different approaches: directly showing how to apply them or a 1-hour theoretical lecture and then a bandaging demonstration (Taylor et al., 1998; Tidhar et al., 2017)
- e-Learning methods (e-venous leg ulcer) consisting of receiving a learning programme available on the internet over 6-week periods (Ylönen et al., 2017, 2019)
- Workshops and seminars based on meetings between partners who answered trigger questions (Heyer et al., 2017)
- A theoretical education programme, consisting of 3-hour master classes (Wong, 2003)
- A practice-based audit and objective structured clinical examination (OSCE), this being an examination format that assesses professional competence in a simulated environment and is carried out using successive stations that simulate real clinical situations (60 min long) (Mitchell, 2017)
- Finally, in a study carried out at four United Kingdom universities, face-to-face courses in three out of the four institutions and distance learning in the other one, with methods used to develop practical skills being a clinical competency framework, mentorship and an objective structured clinical examination for Doppler and bandaging skills (Bianchi, 2007).

Regardless of the methods, all types of interventions were associated with increased knowledge in the immediate post-intervention evaluation, though Tidhar et al. (2017) showed that the percentage of nurses who bandaged optimally fell over a 6-month period. Based on the data available, it is not possible to determine which are the best methods.

In four studies, no assessment tools were used (Bianchi, 2007; Maylor, 2012; Pokorná et al., 2017; Probst et al., 2019). Among the others, three studies used bandage pressure sensors (two of them the PicoPress® device) while two used validated questionnaires to assess perceived and theoretical knowledge: Van Hecke et al. (2011) developed and psychometrically validated a new instrument using multiple choice questions and patient cases, having reviewed questionnaires reported in the literature, including those of Bell et al. (1994), Dealey (2001), Graham et al. (2001) and Ameen et al. (2005); and more recently, Ylönen et al., (2019, 2017) used an instrument they called the Perceived Knowledge, Attitudes, theoretical Knowledge (PKAK) based on translations of the tools used by Graham et al. (2001) and Van Hecke et al. (2011). All the other studies, ten in total, used various questionnaires (not validated) as a tool to measure knowledge, practice and skills with various structures.

#### 3.3.4. Level of knowledge about the care of people with venous leg ulcers

The results suggest a general lack of knowledge and skills. Wong (2003) reported that before the programme, 12 % of nurses scored $\geq 15$ out of a total of 30. In the post-education test, 93 % scored $\geq 15$. Consistent with the above, the study by Ylönen et al. (2017) showed that, in the intervention group, the level of knowledge was significantly higher except on the subscales of healing, infection and topical care at the first follow-up measurement compared to baseline. There were no statistically significant changes in the level of knowledge on any subscale between the first and second follow-up measurements. Perceived levels of knowledge on all subscales, except infection, were significantly higher at the second follow-up measurement compared to baseline. Levels of theoretical knowledge only remained significantly higher at the second follow-up measurement (both $p < 0.001$) in the subscales of assessment and compression therapy. In addition, the same authors in their second study found that congruence between theoretical and perceived knowledge increased after the intervention on items in the subscales of compression, pathophysiology, aetiology and healing, topical care and patient assessment (Ylönen et al., 2019).

Concerning compression therapy: Two studies reported that only between 38.0 % and 58.7 % of nurses stated that they would use a compression bandage to treat a venous leg ulcer (Dealey, 2001; Van Hecke, Grypdonck, Beele, De Bacquer, and Defloor, 2009). On the efficacy of compression types, the proportion of nurses who answered correctly ranged from 21 % to 81 % (Graham et al., 2001). According to Barrett et al. (2009), 93 % used compression therapy appropriately in venous leg ulcers. Nonetheless, 95 % were unfamiliar with Laplace's law and only 7.5 % described compression therapy accurately. In another study, only 38 % of the respondents knew that compression therapy is a lifelong treatment for venous leg ulcers (Van Hecke et al., 2011).

Heyer et al. (2017) compared knowledge of compression therapy products and methods between participants with specific experience and without specific experience and differences were not significant (multicomponent systems $p = 0.535$; median systems $p = 0.172$). Other studies (Taylor et al., 1998; Tidhar et al., 2017) found that, in the application of compression therapy, at baseline, between 5.4 % and 50 % of nurses bandaged in the optimal pressure range. After a workshop, during which nurses practised with a pressure monitoring device, between 58 % and 81 % bandaged within the optimal levels, with a median of 41 mmHg and 86 % of those examined at recall achieved this level. Tidhar et al. (2017) reported that after 6 months, 37 % of nurses bandaged within the optimal range. There was a statistically significant difference between pre- and post-training pressure ($p \leq 0.001$). No statistically significant difference was found between pressure immediately after training and 6 months later ($p = 0.454$). In Heyer et al. (2017), 89.1 % of participants with specific experience and 97.1 % of those without specific experience gave no specific answer regarding the pressure values prescribed for patients with venous leg ulcer compression bandaging. Unspecific responses included the statement that bandages should be applied using the Pütter technique, or powerful or strong compression. In the study by Mitchell (2017), post-intervention responses indicated more confidence in the use of compression therapy, as well as the consideration of compression systems earlier and use of alternative systems to the 4-layer system, such as short stretching.

About anatomy, physiology, aetiology and/or pathophysiology: Regarding a study on physiology, Bell et al. (1994) found significant deficits but the overall scores were satisfactory. In another study, the pre-intervention knowledge level was reflected in 53.33 % of correct responses in the intervention group and 58.24 % in the control group; however, the improvement was not significant after the intervention ($p = 0.23$) (Ameen et al., 2005). In Mitchell's qualitative study (2017), participants became more confident: "Helped with location of foot pulses…".

Regarding local topical treatment or care: Regarding their ability to treat leg ulcers, in one study, more than half of the respondents felt confident in their ability (58.5 %), although almost all (92.7 %) indicated that they could benefit from further training (Graham et al., 2001), 66.7 % reported that the aetiology of venous leg ulcers was identified in less than half of the clients referred for home care and 24.6 % reported inadequate knowledge of wound care products. In Barrett et al. (2009), the majority (60 %) routinely cleaned wounds, while 39 % did sometimes and one admitted never cleaning them. Further, as primary dressings for venous leg ulcers, they responded that the three most used dressing categories were silver (88 %), iodine (81 %) and hydrogel (79

**Table 4**
The topics covered.

| Topic/Content | Frequency (%) * | Reference |
|---|---|---|
| Compression therapy | 14/19 (73.7) | (Barrett et al., 2009; Dealey, 2001; Graham et al., 2001; Heyer et al., 2017; Maylor, 2012; Mitchell, 2017; Pokorná et al., 2017; Probst et al., 2019; Taylor et al., 1998; Tidhar et al., 2017; Van Hecke et al., 2011, 2009; Wong, 2003; Ylönen et al., 2017) |
| Anatomy, physiology, aetiology and/or pathophysiology | 10/19 (52.6) | (Ameen et al., 2005; Bell, 1994; Bianchi, 2007; Maylor, 2012; Mitchell, 2017; Pokorná et al., 2017; Probst et al., 2019; Tidhar et al., 2017; Wong, 2003; Ylönen et al., 2017) |
| Local topical treatment or care | 9/19 (47.3) | (Ameen et al., 2005; Barrett et al., 2009; Graham et al., 2001; Leocádio Oliveira et al., 2016; Maylor, 2012; Pokorná et al., 2017; Probst et al., 2019; Wong, 2003; Ylönen et al., 2017) |
| Wound assessment and wound healing | 7/19 (36.8) | (Bell, 1994; Bianchi, 2007; Graham et al., 2001; Mitchell, 2017; Tidhar et al., 2017; Wong, 2003; Ylönen et al., 2017) |
| Differential diagnosis, ankle-brachial pressure index and use of Doppler | 7/19 (36.8) | (Barrett et al., 2009; Dealey, 2001; Graham et al., 2001; Leocádio Oliveira et al., 2016; Maylor, 2012; Mitchell, 2017; Wong, 2003) |
| Classification of ulcer types | 4/19 (36.8) | (Mitchell, 2017; Pokorná et al., 2017; Probst et al., 2019; Wong, 2003) |
| Pain | 3/19 (36.8) | (Dealey, 2001; Van Hecke et al., 2011, 2009) |
| Evidence-based practice | 3/19 (36.8) | (Bianchi, 2007; Graham et al., 2001; Maylor, 2012) |
| Epidemiological data | 3/19 (36.8) | (Bianchi, 2007; Mitchell, 2017; Wong, 2003) |
| Aspects of surgery | 3/19 (36.8) | (Bianchi, 2007; Holloway et al., 2020; Probst et al., 2019) |
| Patient and lifestyle education and training | 3/19 (36.8) | (Van Hecke et al., 2011, 2009; Wong, 2003) |
| Nursing skills | 3/19 (36.8) | (Dealey, 2001; Graham et al., 2001; Wong, 2003) |
| Quality of life | 2/19 (10.5) | (Graham et al., 2001; Mitchell, 2017) |
| Venus leg ulcer infection | 1/19 (5.2) | (Ylönen et al., 2017) |
| Limb elevation and physical activity/exercise | 1/19 (5.2) | (Van Hecke et al., 2011) |
| Nutrition | 1/19 (5.2) | (Bell, 1994) |

*Some references are repeated in different topics

%). In another study, the questions with the most incorrect responses were those related to treatment and lesion identification (Oliveira et al., 2016).

Surprisingly, regarding the level of knowledge of dressings and management, correct response rates were 79.6 % and 83.59 % in the intervention group and 82.23 % and 84.83 % in the control group. In this case, the post-intervention improvements were close to significant ($p = 0.05$) (Ameen et al., 2005).

In reference to wound assessment and wound healing: Concerning factors that enhance healing, Bell et al. (1994), found that only two respondents answered all four answers correctly. The results also suggest a lack of knowledge of the healing stages, the cells involved in granulation tissue and minerals that help healing. In another study, the intervention resulted in increased confidence in biofilm management due to its recognition (Mitchell, 2017). Graham's study identified barriers to healing, without assessing participants' knowledge (Graham et al., 2001).

In regards to differential diagnosis, ankle-brachial pressure index and use of Doppler: Regarding evaluation, less than half (17.2 %−44 %) of nurses used Doppler ultrasound (Barrett et al., 2009; Dealey, 2001) and 77.5 % reported that less than half of clients referred for home care had undergone Doppler ultrasound assessment (Graham et al., 2001). Oliveira et al. (2016) reported that questions involving the recognition of the lesions were most likely to be answered incorrectly.

On the other hand, Mitchell et al. (2017) reported improvements in being able to carry out more patient assessments, e.g., blood tests, diabetes screening, wound assessment, and underlying cause analysis, as well as wound management. It was reported in the post-course interview that the intervention had "helped with location and assessment of foot pulses and sound for diabetic assessments". Following the intervention, participants reported that ankle-brachial pressure index (ABPI) assessments were now performed.

## 4. Discussion

### 4.1. Summary of evidence

We identified nineteen studies that met the selection criteria detailed in the protocol for this review.

Most of the studies focused on nursing staff, and less research was conducted in undergraduate than postgraduate students. This situation could be explained by the fact that the types of content of interest are lacking at the undergraduate level, and thus, research about knowledge among these students is not considered relevant. Therefore, further research at the undergraduate level could be of interest.

It can also be said that the content/topic most widely included, based on how often it was cited, was compression therapy. Other topics appearing in course content, though less frequently, were anatomy, physiology, aetiology and/or pathophysiology related to venous leg ulcers, local topical treatment and care, wound assessment and healing, diagnosis and/or tests to recognise lesions such as the use of Doppler to determine the ankle-brachial pressure index. Numerous studies have shown that active learning increases students' retention of information, improves performance on course assessments, and increases standardised test scores (for example, Styers et al., 2018; Ulrich et al., 2017). Nonetheless, in this review, teaching/learning interventions were found to be hugely varied in modality, content and duration. Among the specific tools to assess knowledge, there are several scales but most have yet to be validated. Specifically, Van Hecke et al. first used a modified version of Graham et al. (2001) and then produced a validated questionnaire modifying various previously used questionnaires (Van Hecke et al., 2009, 2011), and more recently, Ylönen et al. (2019) developed and validated the Perceived Knowledge, Attitudes, theoretical Knowledge tool. Nonetheless, most studies to date have used ad hoc questionnaires, which were piloted but not subjected to a validation process, and had different types of response options, without determining the most suitable for the assessment. In contrast, in the case of other chronic wounds such as pressure ulcers, there are several validated scales for assessing knowledge: Pieper Pressure Ulcer Knowledge (PPKUT) (Pieper and Zulkowski, 2014), Pressure Ulcer Knowledge Assessment Tool (PUKAT) (Manderlier et al., 2017) and Pressure Injury Prevention Knowledge (PIPK) (Lopez-Franco et al., 2020). Finally, to assess skills acquired in the use of compression therapy, in isolation or within an objective structured clinical examination, pressure sensors were used to assess appropriate pressures objectively.

Effective training can be defined as well-received training that provides relevant knowledge and skills to participants and the confidence to apply them on the job. (Kirkpatrick and Kaiser, 2016). In accordance with this definition, three reasons to evaluate training programmes are to improve the programme, to maximize the transfer of learning to behaviour and subsequent organizational results and to demonstrate the value of training to the organization (Kirkpatrick and Kaiser, 2016). In

this context, this review evidences a lack of theoretical knowledge, which is reflected in deficits in practice. This was shown in all studies included in this review that assessed the level of knowledge. Further, in some subscales, there is no significant difference in knowledge between the intervention and control groups.

A literature review of a similar nature to this scoping review concluded that there is a lack of knowledge related to venous leg ulcer physiology, the healing process and how this influences care and treatment (Ylönen et al., 2014) A systematic review assessing knowledge of pressure injury prevention reported rates below the recommended level, and the knowledge of staff nurses was higher than those of students (Dalvand et al., 2018). In our case, the limitation of knowledge is evident in both nursing staff and students, but due to the difference in sample size, the results cannot be compared statistically.

In particular, studies show that compression therapy is applied in ranges that are not always acceptable, the pressure tending to be lower than desired. There is a lack of knowledge regarding the theory governing compression. On the other hand, teaching and training do improve the results in the short term. Regarding anatomy, physiology, aetiology and/or pathophysiology, the results show knowledge deficits, and moreover, a lack of significant improvements after educational interventions.

Overall, the studies evidenced an unacceptable level of knowledge for the nursing community. Having knowledge increases the confidence of those who care for venous leg ulcers. Concerning local topical treatment or care, a high percentage of participants in the studies analysed did not have enough knowledge and this was reflected in a failure to perform adequate cleaning or use an appropriate primary dressing. Moreover, a lack of theoretical knowledge is reflected in weaknesses in practical skills in etiological assessment using Doppler, this tool not being widely used to establish a differential diagnosis in lower limb injuries. Comparing this review with studies related to other chronic wounds, the results show that nurses are inadequately prepared to care for patients with this pathology (Goudy-Egger and Dunn, 2018). This is important as improvements in knowledge would likely have a positive impact on the care of people with venous leg ulcers, improving diagnosis, treatment, and recovery and reducing referral times, among other benefits.

### 4.2. Limitations

Here there are two types of limitations. Those coming from the studies reviewed and, also, the potential limitation of our review.

There is a geographical limitation, as most of the studies found were from the United Kingdom. Further, one of the limitations of the studies analysed in this review was a lack of rigour. Among the studies included, none were randomised controlled trials, and only four were quasi-experimental studies with pre- and post-tests. The sample sizes of the studies were small ($n < 132$), except in three cases, and the nursing students' sample was smaller than those of staff nurses. Those limitations could have an impact on the generalisability of the results.

Among the studies included in this review, there is great heterogeneity in methods and measures of knowledge assessment. Scoping reviews do not routinely quantify the quality of evidence and are therefore open to a wide range of study designs and methods, some of which may be of low quality.

Another point to consider is that there is no way to measure how much didactic material is covered by nursing medical/surgical textbooks and tested in colleges of nursing (and subsequently not reported in the literature), no way to measure if this material is covered as a component of annual education for nurses in practice settings this limits the generalizability of our findings.

Finally, this review focused only on articles published in English and Spanish, and likely, some research made in other languages could be lacked.

## 5. Conclusions

In relation to the first question, the topics covered remain varied, although there is now a consensus at European level to implement a common training programme by levels. The European Qualifications Framework offers levels of descriptors (Europass Europe Union, 2022). Each level descriptor provides a generic statement of typical expectations of the achievements and competences associated with the qualifications that represent the end of that cycle. The EWMA has developed curricula referring to wound-related EQF levels 4–7. Currently, nursing degree curricula are very heterogeneous. Legislative changes to homogenise teaching blocks would increase standardisation and excellence of nursing degrees (Ruiz-Rojo, 2022).

It can be argued that the incorporation of these programmes into undergraduate education is likely to be beneficial to nursing students as future nurses, promoting the achievement of level four of Kirkpatrick's pyramid in the care of people with venous leg ulcers.

Regarding the second question; the educational interventions studied have been shown to be effective, but there is insufficient evidence to determine which are the most effective; educators could better integrate teaching/learning modalities into curricula by researching and implementing new educational methodologies.

For the third question, it can be said that there is no ideal assessment tool to quantify knowledge, skills, attitude, confidence and engagement in this population. This scoping review has highlighted the lack of knowledge among nurses and nursing students about the care of people with venous leg ulcers.

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