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GRADUATING STUDENT NURSES' AND PODIATRISTS' WOUND CARE COMPETENCE – AN INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

The objective of this literature review is to describe graduating student nurses' and student podiatrists' wound care competence. This integrative literature review has been conducted with a systematic search process. Original studies were analysed by qualitative content analysis with the following stages: open coding, creating categories and abstraction. The literature search was conducted on May 2016 and reconducted on October 2016 using the Medline/Pubmed, CINAHL, Cochrane Library, Web of Science, Scopus and National Medic databases and 12 original studies were found.

All the studies addressed graduating student nurses' wound care competence. According to original studies, graduating student nurses' wound care competence was inadequate. However, the students showed a positive attitude towards wound care. Subthemes of this literature review were: 1) *Wound care knowledge*, 2) *Attitudes towards wound care*, 3) *Wound care preparedness* and 4) *Wound care education* which created the main theme *Graduating nurses' wound care competence.* No studies were found about graduating student podiatrists' wound care competence.

Graduating student nurses' wound care knowledge was deficient. Wound care education seemed to have a positive relation to students' wound care competence. The findings indicate that more information about graduating student nurses', and especially graduating podiatrists', wound care competence is needed.

Keywords
Graduating nurses, graduating podiatrists, student, nurse, podiatrist, wound care, competence

INTRODUCTION

Wounds are an increasing problem worldwide. In the industrialized world, almost 1–1.5% of the population will have a chronic wound during their lifetime (Gottrup et al., 2010). Especially non-healing wounds in an aging population are a significant problem for health care systems around the world. Wounds can decrease patients' quality of life and they also incur huge costs to health care systems. It has been estimated that the total costs of wound care are 2–4% of the whole health care budgets in European countries (Gottrup et al., 2010; Ousey, 2013).

Wound care, especially chronic wound care, is multidisciplinary work (Gottrup, 2004) and health care professionals should be aware of the expertise of other professions (Burford et al., 2014). Nurses in general work with all possible kinds of wounds depending on the clinical placement. However, podiatrists often focus only on the care of foot ulcers especially in patients with diabetes (Quinton et al., 2015). According to TRIEPoD-UK (Podiatry Integrated Career and Competency Framework for Diabetes Foot Care) (2012), a qualified podiatrist should understand the wound healing process, be able to classify and manage foot ulcers, and know how to prevent foot ulcerations. Previous studies addressing graduated registered nurses have shown that young and less experienced nurses' wound care competences are deficient (e.g. Ayello et al., 2005). Also, nurses working at hospitals are less competent in wound care than nurses working in home care (Zarchi et al., 2014).

In general, *competence* can be defined as 'the ability to do something successfully or efficiently'. *Knowledge* can be defined as 'facts, information and skills acquired through experience or education' or 'theoretical or practical understanding of a subject' (Oxford Dictionaries, 2016). In nursing, Benner (1982, p. 304) has defined competence as 'the ability to perform the task with desirable outcomes under the varied circumstances of the real world'.

However, in practical nursing, the concept of *competence* is multidimensional (Kajander-Unkuri et al., 2013). For example, Cowan et al. (2005, p. 355) define nursing competence as 'the application of complex combinations of knowledge, performance, skills, values and attitude', which was also used as a definition of competence in this review. A graduating student nurse and a graduating student podiatrist were defined as final-stage bachelor's level students studying in their third or fourth year (because these programmes last from three to four years) and includes 180–210 ECTS (depending on the requirements of different countries). For example, in Finland the extension of these both programmes is 210 ECTS (3.5 years) but the curriculum background in both programmes are separate. Student podiatrists were included to this review because podiatrists play a central part in wound care and wound care is multidisciplinary work (Gottrup 2004).

The objective of this literature review is to describe graduating student nurses' and podiatrists' wound care competence. The research question was: *How competent are graduating student nurses and podiatrists in wound care?*

METHOD

This literature review is an integrative literature review. The literature search was conducted systematically on May 2016 using the Medline/Pubmed, CINAHL, Cochrane Library, Web of Science, Scopus and National Medic databases. The following search terms were used (with their Boolean combinations): *nursing student, podiatrist student, student nurse, student podiatrist, podiatric medical student, undergraduate nurse, undergraduate podiatrist, graduating nurse, graduating podiatrist, competence, skill, knowledge, attitude, value, performance, wound, ulcer, decubitus, wound care, wound management, wound assessment and tissue viability*. No time limits were set. In Pubmed/Medline, MeSH-terms were also used and in CINAHL, Cinahl-Headings were used. Studies were also searched for manually from the reference lists of original studies but none were found manually. In total 188 titles were screened by one researcher: 67 articles were screened by abstract. After 37 duplicates were removed, 20 whole texts were read and finally 12 original studies were included in the literature review. Systematic literature searches were reconducted in October 2016 using the same databases in order to check for recently published studies. One new study was found. A flow chart of the selection process is shown in Figure 1.

Studies were included if they 1) were original empirical studies addressing final-stage (third- or fourth-year students or pre-registration students) student nurses' and student podiatrists' wound care competence, skills, knowledge, attitudes or values, 2) had an abstract and 3) were written in English or in Finnish. Studies were excluded if they focused on overall clinical competences or educational intervention studies unless they included competence evaluation, either by knowledge tests or students' perceived knowledge.

(Figure 1 here)

ANALYSIS

The data were analysed with qualitative content analysis (Whittemore, 2005; Elo and Kyngäs, 2008). The analysis process includes three stages according to Elo and Kyngäs (2008): 1) open coding, 2) creating categories and 3) abstraction. At the open coding stage, notes and headings were written in the text while reading it. After the open coding, the lists of categories were

grouped under higher order headings, and at the abstraction stage, categories were named and organised into subthemes and a main theme. The themes are presented in Figure 2.

QUALITY ASSESSMENT

All original studies were evaluated by using a critical appraising tool by Hawker et al. (2002), which is developed for the evaluation of both quantitative and qualitative study assessments. The tool of Hawker et al. (2002) includes nine four-point scale items: *abstract and title, introduction and aims, method and data, sampling, data analysis, ethics and bias, results, transferability or generalizability, and implications and usefulness*. Every item is rated either 1 (very poor), 2 (poor), 3 (fair) or 4 (good) points which means that the minimum score of the tool is 9 and the maximum score is 36. The calculated summary score will be reported as *very poor*, *poor*, *fair* or *good.*

The average score of all studies in this review was 25 out of 36, which means that the average quality of the studies was fair. Scores varied between 16 and 29, which means that the studies varied as their quality ranged from poor to fair. The *abstract and title* and *method and data* items had the highest average scores (3.5/4) and the worst average scores were for the *ethics and bias* item (2.1/4). The average scores of other items were: *introduction and aims* (3.3)*, sampling* (2.8)*, data analysis* (2.6)*, results* (3.4)*, transferability or generalizability* (3.1) and *implications and usefulness* (3.2). The studies' total scores and scores in each question are presented in Table 1.

(Table 1 here)

FINDINGS

A description of the studies

Twelve original studies met the inclusion criteria, of which all assessed student nurses' wound care competence in their final stage of the studies. Eleven of the studies had a quantitative design and one study had a qualitative design (Carvalho Moura and Larcher Caliri, 2013). The studies were carried out between 2003 and 2016. Most of the studies were conducted in Europe (Table 2).

All quantitative studies used a questionnaire as a data collection method. One of the quantitative studies was an intervention study (Beeckman et al., 2008) and the others were observational. In two studies, both nurses and undergraduate nurses were compared (Beeckman et al., 2008; Gunningberg et al., 2013). The qualitative study used focus group discussions. Sample sizes varied between 29 and 217.

Four studies used valid knowledge tests (Larcher Caliri et al., 2003; Beeckman et al., 2008; Cullen Gill and Moore, 2013; Gunningberg et al., 2013; Rafiei et al., 2015; Simonetti et al., 2015) and the other two studies used the authors' own self-evaluation forms for nursing students (Snarska et al., 2005; Ousey et al., 2013; Stephen-Haynes, 2013). Two studies were either instrument development studies (Beeckman et al., 2010a) or validation studies (Florin et al., 2015) with the baseline data of student nurses' wound care competence. The studies are presented in Table 2.

(Table 2 here)

Wound care competence

Graduating student nurses' wound care competence consists of four subthemes: *wound care knowledge*, *attitudes towards wound care*, *wound care preparedness* and *wound care education* (Figure 2). These themes addressed only graduating student nurses' wound care competence because no studies were found focusing on student podiatrists' wound care competence.

(Figure 2 here)

Wound care knowledge

The wound care knowledge of graduating student nurses was assessed to be at an inadequate level (Larcher Caliri et al., 2003; Snarska et al., 2005; Beeckman et al., 2008; Beeckman et al., 2010a; Cullen Gill and Moore, 2013; Gunningberg et al., 2013; Rafiei et al., 2015; Simonetti et al., 2015) in the literature which addressed undergraduate nurses' pressure ulcer prevention and/or treatment knowledge.

Similar pressure ulcer knowledge questionnaires were used in some of the other studies. Two of the studies (Larcher Caliri et al., 2003; Rafiei et al., 2015) used Pieper's (1995) Pressure ulcer knowledge test (PUKT), where the participants are expected to give correct answers to 90% or more of the items in order to be considered competent. In these studies, student nurses' average scores were almost the same: 67.7% (Larcher Caliri et al., 2003) and 67% (Rafiei et al., 2015). However, in the study of Rafiei et al. (2015), the students' rate of correct answers in the pressure ulcer evaluation category was significantly higher (78%) than the correct answers in the pressure ulcer classification (50%) or in the pressure ulcer prevention classification (70%). Two other studies used the pressure ulcer knowledge questionnaire of Beeckman et al. (2010a). In these studies, third-year nursing students' mean scores varied between 12.3/26 (47%) (Beeckman et al., 2010a) and 14.7/26 (56.5%) (Simonetti et al., 2015).

All in all, the mean average scores for wound care knowledge varied between 58% (Gullen Gill and Moore, 2013) and 61% of correct answers (Gunningberg et al., 2013), depending the used questionnaire, test or instrument. However, students had higher scores on nutrition than registered nurses but worse scores in all other categories of pressure ulcer knowledge (Gunningberg et al., 2013) and while student nurses knew better the main causes of pressure ulcers, they knew less about the factors related to the patient's state that could cause pressure ulcers (Snarska et al., 2005). Student nurses' pressure ulcer classification skills were also low in the pre-test but improved after an e-learning intervention (Beeckman et al., 2008).

Attitudes towards wound care

Graduating student nurses showed a positive attitude towards wound care (Stephen-Haynes, 2013). Students showed a positive attitude towards pressure ulcer prevention with the mean score of 40/47, and 59% of the students achieved a score greater than 40. Surprisingly, the attitude and knowledge scores had an inverse relationship (Cullen Gill and Moore, 2013.) Two studies used the same 'Attitude Towards Pressure Ulcer Prevention Instrument' (APuP) of Beeckman et al. (2010b). In these studies, student nurses also showed a positive attitude towards pressure ulcer prevention. The mean scores were 41/52 (Simonetti et al., 2015) and 46/52 (Florin et al. 2016). In the study of Florin et al. (2016), in comparison with nurses, student nurses had lower confidence in their ability to prevent pressure ulcers than nurses, they also rated their training as being less rigorous and they found pressure ulcer prevention to be too difficult. Students also thought that they had a more important task in pressure ulcer prevention than graduated registered nurses.

Wound care preparedness

Wound care preparedness was studied, focusing on final-year nursing students' perceived pressure ulcer prevention knowledge or risk assessment (Snarska et al., 2005; Carvalho Moura and Larcher Caliri, 2013) and students' preparedness to manage patients' skin integrity (Ousey et al., 2013) and tissue viability (Stephen-Haynes, 2013). About 54% of the student nurses evaluated their pressure ulcer prevention knowledge to be insufficient (Snarska et al., 2005) and students also evaluated that they did not apply the presupposed policy or practices of pressure ulcer risk management, even though they were final-year students at nursing school (Carvalho Moura and Larcher Caliri, 2013).

Ousey et al. (2013) and Stephen-Haynes (2013) used their own questionnaires which had only two similar types of question: questions about confidence in undertaking pressure ulcer risk assessments and questions about choosing the appropriate dressing. Pre-registration student nurses' confidence in undertaking pressure ulcer risk assessments was almost the same in the studies and only varied between 83% (Stephen-Haynes, 2013) and 89% (Ousey et al., 2013). However, confidence in dressing selection varied more, falling between 39% (Stephen-Haynes, 2013) and 57% (Ousey et al., 2013).

According to Ousey et al. (2013), pre-registration student nurses felt more confident. Most of the students were confident about undertaking the majority of wound care procedures, such as the aseptic technique (95%) and cleansing of the wound (92%). The lowest scores of confidence were in the dressing selection (57%) and in choosing the appropriate wound product (47%). By contrast, in Stephen-Haynes' (2013) study, most (87%) student nurses felt that they were not well prepared in tissue viability and most of the students were either slightly unconfident (19%) or not confident at all (47%) about the classification of pressure ulcers.

Wound care education

Concerning wound care education during nursing education, it was found that most graduating student nurses assessed that they did not receive sufficient education on tissue viability during their studies (Ousey et al., 2013; Stephen-Haynes, 2013) and that they did not receive enough education on the anatomy and physiology of skin (Stephen-Haynes, 2013). Most of the students reported that they had received less than 10 hours of formal teaching about skin integrity at university. However, most of the students reported that the teaching they received had

developed their knowledge and skills at maintaining skin integrity for all patients (Ousey et al., 2013).

The results of education related to student nurses' pressure ulcer knowledge showed that the third-year students received better scores in the PUKT than first- and second-year students (Simonetti et al., 2015). The students who had had participated in extracurricular activities or sought information from the Internet had better pressure ulcer knowledge scores than those who had not (Larcher Caliri et al., 2013). An e-learning intervention also improved nursing students' PU knowledge. Still, the skills did not become optimal (Beeckman et al., 2008).

DISCUSSION

This review produced information about graduating student nurses' wound care competence. The findings suggest that graduating student nurses' wound care competence is limited. Most studies in this review assessed undergraduate nurses' pressure ulcer prevention and/or treatment knowledge to be deficient. Some earlier studies have also been conducted about graduated registered nurses' pressure ulcer knowledge with similar results (e.g. Zulkowski et al., 2007; Chianca et al., 2010; Ilesanmi et al., 2012; Miyazaki et al., 2010) which also used Pieper's (1995) PUKT to evaluate nurses' pressure ulcer knowledge. The mean percentage of correct answers varied between 61% and 79%, which means that graduated registered nurses' pressure ulcer competence is also limited.

Graduating student nurses instead showed a positive attitude towards pressure ulcer prevention. Nurses' attitudes play an important role because pressure ulcer prevention is an essential part in basic patient care (EPUAP, 2014). pressure ulcers also causes huge costs to health care systems and decrease patients' quality of life (Bennet et al., 2004; Hopkins et al., 2006; Brem et al., 2011). Earlier studies conducted with graduated registered nurses support these findings. Registered nurses working at intensive care units (ICUs) felt that pressure ulcer prevention was an important part of care, a priority in daily care and felt that most pressure ulcers could be avoided (Strand and Lindgren, 2010). Also, almost all nurses working in other fields considered that most pressure ulcers could be avoided and felt that they should concern themselves with pressure ulcer prevention in their work (Källman and Suserud, 2009). The explanation for students' more positive attitude towards wound care, versus objective wound care competence,

may be that students are aware of the importance of wound care and wound prevention but that practice is seen to be more complex.

Graduating student nurses evaluated their pressure ulcer competence with controversial results. In some studies, student nurses evaluated their overall pressure ulcer competence to be inadequate (Snarska et al., 2005; Carvalho Moura and Larcher Caliri, 2013), and while in other studies most of the student nurses believed that they could undertake pressure ulcer risk assessment (Ousey et al., 2013; Stephen-Haynes, 2013), some students still felt they lacked confidence in the classification of pressure ulcers (Ousey et al., 2013). pressure ulcer competence self-evaluation has also been studied with graduated registered nurses (Oseni and Adejumo, 2014) which showed that almost a third of nurses evaluated their pressure ulcer assessment and documentation skills as *low* and a fifth as *very low*. These findings suggest that graduated registered nurses' perceived pressure ulcer competence is also low. The controversial results may be explained by the structure of the various questionnaires but also by the difficulty of evaluating one's competence. Students' perceived wound care competence should probably be studied with a qualitative design in order to get a more specific description of their perceived wound care competence.

Disputed results were also found in pre-registration student nurses' overall preparedness for wound care. Students felt confident about undertaking the majority of wound care procedures (Ousey et al., 2013) but most of the students did not felt well prepared regarding tissue viability (Stephen-Haynes, 2013). There are also some previous studies about graduated registered nurses' and podiatrists' overall wound care competence (McIntosh and Ousey, 2008) which indicated that most of the respondents claimed that their wound care knowledge was either satisfactory (44%), fair (23%) or poor (3%). About a quarter (26%) felt that they possessed good knowledge and only 4% (all nurses) claimed to have excellent knowledge of wound care. By contrast, in another study (all nurses), registered nurses stated that 35% of the nurses working on acute care reported that their wound care knowledge is either good or excellent (Gillespie et al., 2014). Disputed results in self-evaluation may be explained by the difficulty of evaluating one's skills and actions. Some may see their competence level as too optimal and some as too low. More practical wound care training could give both students and nurses more confidence, which could also help in their competence evaluation.

According to this review, student nurses did not receive much wound care or skin integrity education during their studies. However, students reported that the teaching they received had developed their knowledge and skills at maintaining skin integrity for all patients (Ousey et al., 2013). This review also suggests that pressure ulcer education had a positive relation to students' pressure ulcer competence. Education seems to also have a positive effect on graduated registered nurses' wound care competence. Nurses who had accomplished post-basic courses or specific wound care courses had better wound care knowledge (Pancorbo-Hidalgo et al., 2007; Källman and Suserud, 2009; Karadag Aydin and Karadag, 2010; McCluskey and McCarthy, 2012). Also, wound care certification and education significantly affected on the nurses' knowledge of pressure ulcers (Zulkowski et al., 2007). These results highlight the importance of wound care education and the need for enough teaching hours. New teaching methods should also be considered. For example, student nurses and podiatrist could study wound management together in multidisciplinary courses. Nurses' wound care competence requirements could be also added to the European Union (2013/55/EU) directive on the recognition of professional qualifications.

Strengths and limitations

This review has some strengths and limitations which need to be taken into account. The strengths are related to the literature search and retrieval process. The literature search was conducted systematically from five international databases which are comprehensive in the field of health sciences (Subirana et al., 2005). In addition, a national database was included to widen the coverage of the search. The search was updated to ensure all recent publications in this field. The limitations are related to the study selection process. The studies were selected by only one researcher but the results along the data search were discussed with other researchers. Due to language restrictions, some potential studies might have been undiscovered however, the majority of research papers are published in English.

The quality of the original studies varied from poor to fair, which means that the results of this review cannot be generalised. More information and robust studies are needed addressing graduating nurses' wound care competence. Especially ethics and bias, and data-analysis were poorly reported in most studies which decreased the validity of the studies. However, most studies had a clear and informative title and abstract, and the methodology was informatively reported in most studies.

CONCLUSION

The findings of this literature review indicate that final-stage student nurses' wound care competence is limited. However, students showed a positive attitude towards pressure ulcer prevention. Some studies assessed students' perceived preparedness and knowledge of wound care with some controversial results. These findings indicate that more education is needed during nurse education. Also, more research about graduating student nurses' wound care competence is needed. Wound care competence should be studied using objective tools, such as knowledge tests, or by observing students' wound care skills and performance. Also, studies about undergraduate student podiatrists' wound care competence are needed because no previous studies were found though the literature search. Podiatrists play a significant role in wound care and in wound care education.

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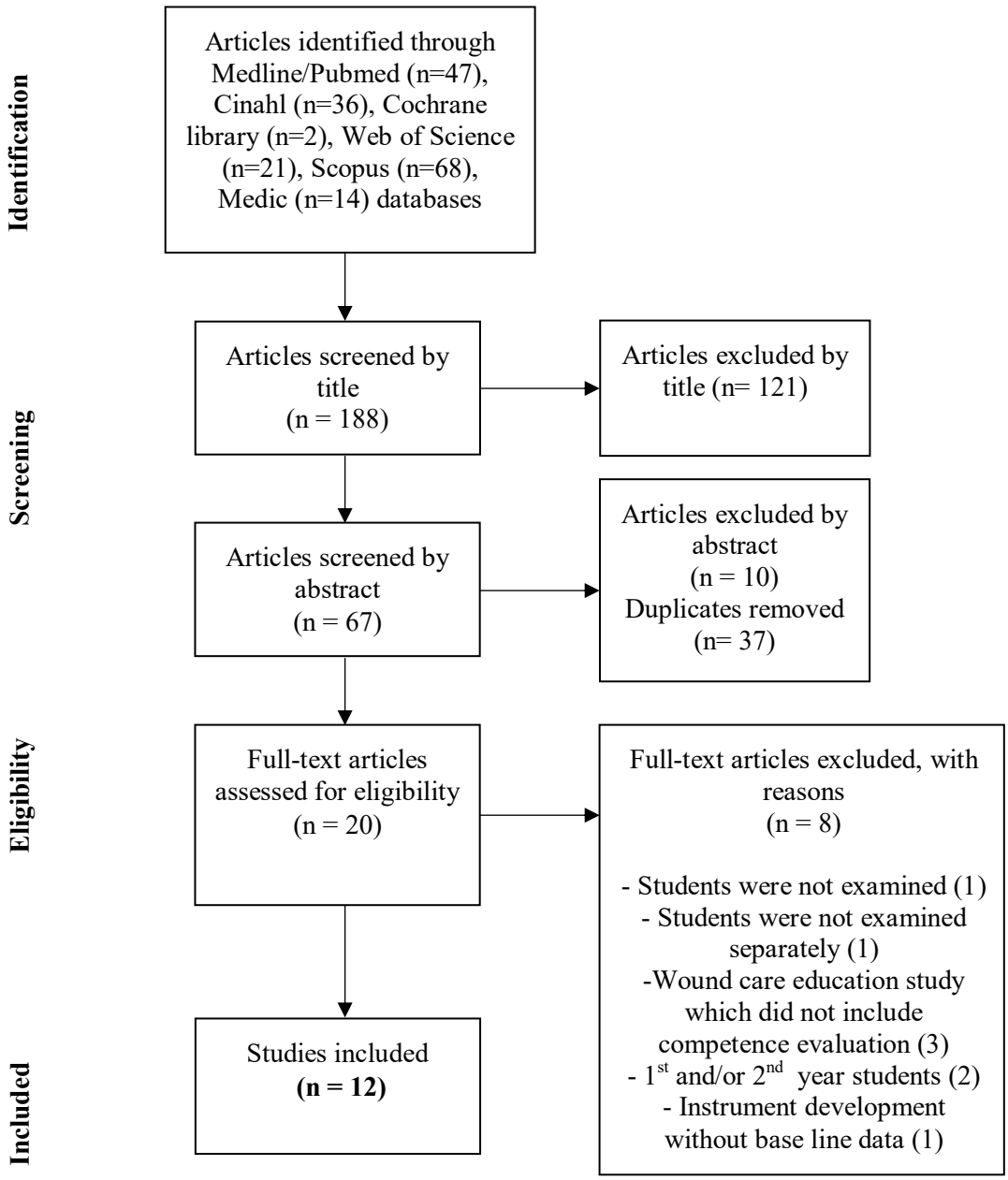

Figure 1: Flow chart of selection process

Table 1: Critical appraisal: Total scores of the original studies by Hawker et al (2002)

Study	1 Abstract and title	2 Introduction and aims	3 Method and data	4 Sampling	5 Data analysis	6 Ethics and bias	7 Results	8 Transferability or generalizability	9 Implications and usefulness	Total (36)
Beeckman et al. 2007	4	3	4	3	3	1	3	3	3	**27**
Beeckman et al. 2010a	4	3	3	2	2	3	4	2	4	**27**
Carvalho Moura & Larcher Caliri 2013	3	2	2	2	3	1	2	2	1	**18**
Cullen Gill & Moore 2013	4	3	4	1	2	2	4	3	3	**26**
Florin et al. 2016	3	4	4	3	4	3	4	3	4	**32**
Gunningberg et al. 2013	4	3	3	2	3	2	3	3	4	**27**
Larcher Caliri et al. 2003	3	3	3	4	2	2	3	3	3	**26**
Ousey et al. 2013	3	3	2	3	2	2	3	3	2	**23**
Rafiei et al. 2015	4	2	3	2	2	2	3	2	3	**23**
Simonetti et al. 2015	4	3	4	3	3	2	4	3	3	**29**
Snarska et al. 2005	2	2	2	2	1	1	2	2	2	**16**
Stephen-Haynes 2013	2	4	4	3	2	2	3	4	3	**27**

Average scores	**3.5**	**3.3**	**3.5**	**2.8**	**2.6**	**2.1**	**3.4**	**3.1**	**3.2**	**25**

Table 2: Original studies in the literature review

Authors, Country and Year	**Objective**	**Design, methods and instrument**	**Main findings**
Beeckman et al. Belgium 2008	To detect problems when classifying a pressure ulcer and to examine whether an e-learning programme can increase the classification skills of qualified nurses and student nurses.	**An intervention study with a repeated measure design** (pre-test and 3 post-tests) Questionnaire: the *PUCLAS2 (pressure ulcer classification) e-learning programme* **N** = 212 nurses and **214** final-year nursing students	The classification skills were low in both groups in the pre-test. Student nurses achieved better results when using the e-learning programme. However, their skills did not become optimal.
Beeckman et al. Belgium 2010a	To develop a valid and reliable instrument to assess knowledge of pressure ulcer prevention.	**A prospective psychometric instrument validation study** Questionnaire: A 26-item instrument with 6 themes **N** = 608 of which 296 were nursing students and of which **99** were third-year nursing students	The third-year student nurses' mean score of the pressure ulcer knowledge test was 12.3/26.
Carvalho Moura & Larcher Caliri Brazil 2013	To analyse the perception of undergraduate student nurses of simulation strategies in the teaching–learning process in order to develop competence in risk	**A descriptive study with qualitative analysis** Focus group discussions with semi-structured questions **N = 29** final-year student nurses	Students evaluated that they did not apply the presupposed policy or practices of risk assessment for pressure ulcers.

	assessment for pressure ulcers.		
Cullen Gill & Moore Ireland 2013	To determine fourth-year undergraduate nurses' knowledge of and attitudes towards pressure ulcer prevention.	**A quantitative cross-sectional survey** Questionnaire: The *Pressure Ulcer Attitude and Knowledge Tool* **N = 46** fourth-year undergraduate nurses	Student nurses (SNs) showed a positive attitude towards pressure ulcer prevention. The mean score was 40/47 and 59% achieved a score greater than 40. However, students displayed poor knowledge of pressure ulcer prevention. The mean score was 15/26 and 92% scored less than 18. Attitude and knowledge scores had an inverse relationship.
Florin et al. Sweden 2016	To conduct a psychometric evaluation of the Attitude towards Pressure ulcer Prevention (APuP) instrument in a Swedish context and to describe and compare attitudes towards pressure ulcer prevention between registered nurses (RNs), assistant nurses (ANs) and SNs.	**An instrument validation study** Questionnaire: *APuP* **N** = 196 RNs, 97 ANs and **122** last-semester SNs	SNs mean pressure ulcer attitude score was 46/52. SNs had lower confidence in their ability to prevent pressure ulcers than RNs and ANs. Compared with RNs and ANs, SNs also rated their own training to be less rigorous and they found pressure ulcer prevention to be too difficult. SNs also thought that they had a more important task in pressure ulcer prevention than RNs and ANs.
Gunningberg et al. Sweden 2013	To describe and compare the knowledge of RNs, ANs and SNs about preventing pressure ulcers.	**A descriptive, comparative multicentre study** Questionnaire: *PUKAT (The Pressure Ulcer Knowledge Assessment Tool)*	SNs' mean knowledge score was 61%. The highest scores were in the themes *nutrition* (92%) and *risk assessment* (80%). The lowest scores were in the themes *reduction in the amount of pressure and*

		N = 195 RNs, 97 ANs and **122** last-semester SNs	*shear* (49%) and *classification and observation* (54%).
Larcher Caliri et al. Brazil 2003	To examine Brazilian student nurses' knowledge of pressure ulcers.	**A quantitative study design** Questionnaire: *The Pressure Ulcer Knowledge Test (PUKT)* **N = 83** third- or fourth-year student nurses	SNs correctly answered 68% of the knowledge test. Students who participated in extracurricular activities and used the Internet had a significantly higher knowledge level.
Ousey et al. UK 2013	To explore if pre-registration student nurses felt prepared to manage patients' skin integrity effectively on registration.	**A quantitative study design with qualitative comments** Questionnaire: Demographic data and 10 questions relating to their experience of learning about managing patient's skin integrity needs and room for qualitative comments. **N = 217** pre-registration student nurses	70% reported that the teaching they received had developed their knowledge and skills to maintain skin integrity for all patients. Most respondents were confident in undertaking the majority of wound care procedures.
Rafiei et al. Iran 2015	To determine the level of student nurses' knowledge of pressure ulcer prevention, classification and management.	A cross-sectional descriptive study Questionnaire: *PUKT* **N = 133** final-year student nurses	Students correctly answered 67% of the knowledge test. Students correctly answered 50% of questions in the classification/onset section, 78% in pressure ulcer evaluation and 70% in pressure ulcer prevention.
Simonetti et al. Italy	To assess both knowledge and attitudes among student nurses on pressure ulcer	**A multi-centre cross-sectional survey** Questionnaire:	Third-year student nurses' mean pressure ulcer knowledge and pressure ulcer attitudes: 14.7/26 (56.5%) and 41.1/52 (79%) respectively.

2015	Prevention Evidence-Based Guidelines.	General information, the *Knowledge Assessment Instrument* and the *APuP Tool* **N** = 742 student nurses of whom **191** were third-year students	Third-year students' pressure ulcer knowledge and attitudes towards pressure ulcers were significantly higher than first- and second-year students'.
Snarska et al. Poland 2005	To assess bedsore (pressure ulcer) prevention knowledge among student nurses and to determine the factors on which their level of knowledge depend.	**A quantitative study design** Questionnaire: 37 open questions **N = 50** third-year part-time SNs	SNs' pressure ulcer prevention knowledge was insufficient. Students knew the main causes of pressure ulcer better, but they knew less about the factors related to the patient's state that could cause pressure ulcers. 54% of the students evaluated their pressure ulcer prevention knowledge to be insufficient.
Stephen-Haynes UK 2013	To generate a clearer insight into pre-registration student nurses (SNs) knowledge of the key aspects within tissue viability and capture their views on pre-registration tissue viability education.	**A quantitative study design** Questionnaire: Interactive voting pads at a conference. **N = 170** pre-registration student nurses	84% of SNs felt that they were not well prepared in tissue viability and 83% indicated that they did not receive sufficient education in skin anatomy and physiology. However, 83% of the students believed that they could undertake PU risk assessment.

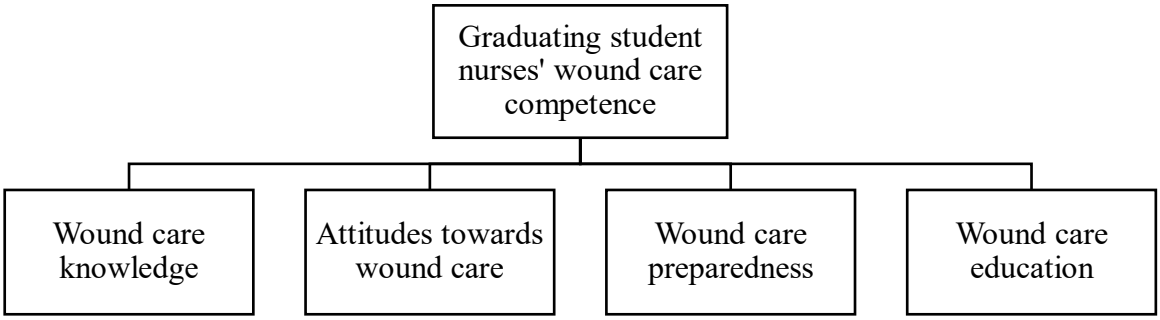

Figure 2: The main theme and subthemes of the literature review