

Sustaining clinical competency in compression bandaging for Nurses working in the community.

Maria Schollum

A dissertation submitted to Auckland University of Technology in partial fulfilment of the requirements for the degree of Masters of Health Science (MHSc)

2014

School of Health Care Practice

Primary Supervisor: Shelaine Zambas

## **Table of Contents**

List of Tables.....	iv
List of Figures.....	v
ATTESTATION OF AUTHORSHIP .....	vi
ACKNOWLEDGEMENTS.....	vii
ABSTRACT .....	viii
Chapter 1: Introduction .....	1
Background.....	2
Current educational framework .....	4
Leg Ulcers .....	9
Leg ulcer management.....	11
Conclusion.....	15
Chapter 2: Methodology.....	16
Search Strategy 1.....	17
Search Strategy 2.....	19
Chapter 3: Compression Bandaging/Competency.....	23
Study Participants.....	24
Pressure monitors.....	25
Bandage Types .....	26
Sustainability timeframes.....	28
Education design .....	29
Bandaging skill .....	30
Summary.....	33
Chapter 4: Sustaining Clinical Competency .....	37
Competency Assessments.....	41
Objective structured clinical examinations (OSCEs) .....	43

Electronic Learning (e-learning) .....	46
Blended learning .....	50
Summary .....	53
Chapter 5: Discussion .....	55
Implications of findings for practice/education.....	57
Implications of findings for research .....	60
Conclusion.....	61
References .....	63
Appendix 1 Waikato DHB LUAN Competency Day 2011-2013 Evaluation results.....	69
Appendix 2 CASP example .....	70
Appendix 3 Research exploring compression bandaging technique following initial training.....	75
Appendix 4 Summary of research exploring compression bandaging technique following initial training.....	76
Appendix 5 Research exploring clinical competency .....	77

## **List of Tables**

<b>Table 1</b> - Population figures for territorial regions for Waikato DHB.....	3
<b>Table 2</b> – Leg ulcer requests for Waikato DHB 2010-2013 .....	4
<b>Table 3</b> – PICO framework – Sustained competency in compression bandaging.....	17
<b>Table 4</b> – PICO framework – Sustained clinical competency .....	20
<b>Table 5</b> – Criteria for classification of bandage proficiency scores .....	30

## **List of Figures**

<b>Figure 1</b> - Population figures for territorial regions for Waikato DHB.....	2
---	---

### **ATTESTATION OF AUTHORSHIP**

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which is a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Maria Schollum

Date

## **ACKNOWLEDGEMENTS**

I would firstly like to acknowledge the immense support from my supervisor Shelaine Zambas who without her invaluable guidance, wisdom and direction this dissertation would not have been a reality. I started my Post Graduate journey with you so seems fitting to complete the journey with you. It truly has been a journey and I thank you.

I would like to say a special thank you to Julie Betts for your ongoing encouragement and mentoring, which I truly value and appreciate. Thank you also for your support while I have been studying and for the words of wisdom when needed.

To my family thank you always for your love and support.

This work is dedicated to Anna, a valued friend and colleague whose laugh was contagious, her motto to live in the moment and the colour pink rules.

## **ABSTRACT**

**Objectives:** To determine the best education framework to sustain clinical competency in compression bandaging for District Nurses working in the community.

**Method:** Two literature reviews were undertaken to answer the study question. The first review examined the research directly related to sustainable strategies that supported clinical competency in compression bandaging. Very little research was found and as a consequence a second literature review was undertaken to explore educational frameworks used to sustain competency in specialist skills in general. The databases Google Scholar, CinahlPlus, Medline, Cochrane Library and ProQuest were used, searching the following key words truncated and in combination: compression bandaging, clinical competency, district nurses, leg ulcer, education, frameworks and skill development, from 2000 to the present. The second search used similar key words but included medicine, and skill acquisition. The first review used the CASP framework to identify appropriate studies. The second review used an integrative review to explore the topic more broadly.

**Results:** Research has identified that training programmes are beneficial in the initial stages of skill acquisition in compression bandaging, however competency is not sustained long term. No research was identified which explored specific educational strategies other than using an external pressure monitor when the



compression bandage is applied. While sound educational frameworks are needed to sustain competency, very little is known about the best educational methods for sustaining competency. Each style of learning has its benefits, but also its challenges.

**Conclusion:** From the literature reviewed, no one method of education to date has successfully shown that clinical competency is sustained post initial certification between reassessments. This dissertation found no educational programme or strategy that would ensure that clinical competency in compression bandaging was sustained over a long period of time. There is however evidence suggesting that a blended learning approach using face to face and e-learning tools might lead to sustained clinical competency in compression bandaging.

## **Chapter 1: Introduction**

Compression bandaging is a fundamental part of venous leg ulcer treatment. It is a core clinical skill required of nurses working in community settings. Currently district nurses (DNs) within the Waikato District Health Board (Waikato DHB) provide compression bandaging to patients in the community with venous leg ulcers. In order to ensure competency to do this safely, they complete the Compression Bandaging Clinical Competency Programme, which consists of a theoretical workbook, a 2 hour practical workshop and clinical skill sign-off by either a leg ulcer assessment nurse (LUAN), clinical nurse specialist (CNS) or nurse practitioner (NP). Once initial competency has been obtained DNs are required to recertify 3 yearly. Despite this, maintenance of acceptable levels of clinical competency appears variable.

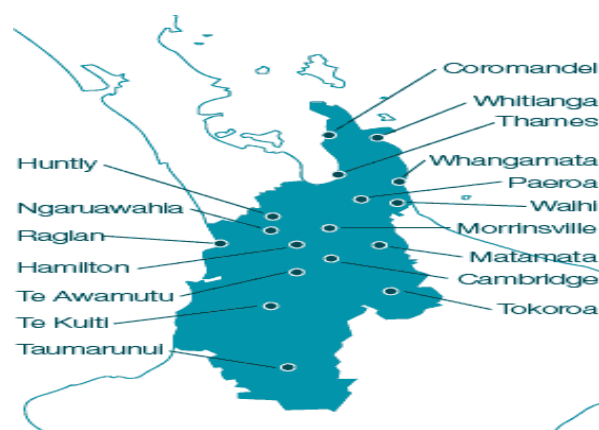
The ability to sustain a competent level of skill in venous ulcer compression bandaging is critical to decreasing venous ulcer healing times and patient morbidity. Venous leg ulcer management is a significant burden on patients, their families and the health care system (Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011). The purpose of this dissertation is to critically review the literature regarding sustaining clinical competency in the application of compression bandaging. The specific research question asked is, "What is the best educational framework for sustaining clinical competency in compression bandaging for nurses working in the community?" This review will be used to develop a theoretical and practice

framework that sustains competency in application of compression bandaging for venous ulcers by District Nurses (DNs).

## Background

District nursing is a provider of personal health services at the interface between primary, secondary and tertiary services, providing episodes of care for assessment and treatment to patients of all ages in their community settings. Predominately, referrals for venous leg ulcer management are received from hospitals (approximately 70%), General Practitioners (GP), Accident Compensation Corporation (ACC), Disability Services, and private specialists. (Rural & Community Services Plan, 2011-2012). Once a referral is made, and based on the LUAN assessment and treatment plan, the DN's initiate compression bandaging within their designated workplaces.

**Figure 1 – Waikato DHB boundaries and Rural and Community team bases**



From: <http://www.waikatodhb.health.nz/directory-of-our-services/rural-and-community/family-health-teams/>

As shown in figure one, the geographical area of Waikato DHB Rural and Community services encompasses the Waikato DHB region, including Hamilton city, and surrounding rural areas and consists of seventeen (17) District Nursing bases. The total population for the region is 393,840 based on New Zealand 2013 census data with Hamilton city consisting of 150,200. Almost two thirds of the population live rurally, with towns ranging in population from 300-15,000. The largest elderly population which has significance in relation to the prevalence of leg ulcer development is in the Thames Coromandel region with 25.6% of the population over age 65, 10% higher than the national average. Within New Zealand the number of people aged 65+ has doubled since the early 1980s, now reaching 635,200 and making up 14% of the population. As detailed in Table 1, it is the fastest growing age group (New Zealand Statistics, National Population Estimates, 2013).

**Table 1 Population figures for territorial regions for Waikato DHB**

<b>Region</b>	<b>Area</b>	<b>Total</b>	<b>%65+</b>
Hamilton City		150200	11.4%
Waikato District		64900	12.2%
Waipa District		46400	16.9%
Matamata Piako District		32200	18.3%
Hauraki District		18750	22.3%
Thames Coromandel District		27100	25.6%
South Waikato District		22500	15.7%
Otorohanga District		9330	13.1%
Waitomo District		9410	14.2%
Ruapehu District		13050	13.8%
<b>Total</b>	<b>Waikato DHB</b>	<b>393840</b>	<b>16.3%</b>

**From:** Statistics New Zealand 2013 National Census Data

Table 2 shows data collected over the past three years regionally on the number of leg ulcer assessments undertaken, with numbers increasing from 419 in 2010 to 781 in 2013. Of the 781 assessments undertaken in 2013, approximately 250 patients were placed in compression bandaging for venous ulceration. The total cost of bandaging annually in 2013 for the entire region was approximately \$200,000. This would be expected to increase over the next 10 years with the rise in the aging population.

**Table 2 – Leg ulcer requests for Waikato DHB 2010-2013**

	<b>Hamilton</b>	<b>Rural</b>	<b>Southern</b>	<b>Hauraki Thames Coromandel</b>	<b>Total</b>
2010	141	156	40	82	419
2011	197	242	82	108	629
2012	233	245	89	143	710
2013	236	302	101	142	781

**From:** Waikato DHB Leg Ulcer database 2010 – 2013

## **Current educational framework**

Nurses within the District Nursing Service (DNS) complete the compression bandaging clinical competency programme within six months of commencing employment within the Waikato DHB and are deemed competent in compression bandaging once the theoretical and practical components of the programme are completed. The programme is designed for the initial education on the application of compression bandaging, which includes both the theoretical and practical aspects of compression bandaging. (Waikato DHB - Compression

Bandaging Clinical Competency Programme, 2007). Once completed the DNs are signed off by the LUAN, CNS or NP as being competent in applying compression. A nurse competent in compression bandaging should possess the following skills; show critical thinking and reasoning, escalate concern related to changes in the patient's clinical picture promptly, and assess if health outcomes are not being met. Once initial certification is obtained they are expected to demonstrate their continued competency in order to sustain their clinical competency by attending a 2 hour refresher and practical sign off by the LUAN, CNS or NP every 3 years.

Prior to 2005 education for DNs in compression bandaging at the Waikato DHB was undertaken by the Doppler nurses (now known as a LUAN) and was very adhoc in its approach. A compression bandaging education working party was established in 2005 consisting of the NP Wound Care and two DNs who held a wound representative role. They undertook an audit to determine the current knowledge base of DNs regarding the use of Profore™ bandaging in the management of venous and mixed aetiology leg ulcers. This information was necessary in order to develop an education program regarding the appropriate application of compression bandaging. Information was gathered from all DNs within the region and generally the knowledge base of the key relevant points regarding the application of Profore™ was 75%. Areas requiring development were the role of the Doppler assessor (LUAN) and the reasons for application of Profore™ Lite. (Waikato District Health Board (2005) District Nurse Compression Bandaging Working Party – used with permission).

Taking the information obtained from the audit in 2007, the working party developed the first compression bandaging clinical competency programme for the Waikato DHB. The workbook incorporated five theoretical sections including anatomy and physiology of the circulation of the lower leg, use of Doppler ultrasound, the role of the LUAN, compression therapy and management of patients in compression bandages. It was the belief of the authors of this workbook and educational framework that three yearly certification would be sufficient to maintain an acceptable standard in compression bandaging.

Prior to undertaking this dissertation the LUAN education pathway was reviewed to see if that could be adapted to DNs and compression bandaging. The way in which the leg ulcer assessment nurses undertook yearly recertification at the Waikato DHB, was reviewed and revamped in 2011 by the previous CNS and current NP. LUANs generally need to do 10 – 15 assessments per month to maintain accuracy in determining an Ankle Brachial Pressure Index (ABPI). It was agreed that 10 per calendar month should be sufficient, due to geography of the region which takes into account the travel that may be required within some of the more remote areas. Statistics obtained from the leg ulcer database allowed the number of requests to be monitored and the ability to match resource to this demand, but not competency. After discussions with senior medical staff, a clinical competency framework was developed, and the way in which recertification occurred was channelled into a new format to measure clinical competency. The desired outcome would be that all LUANs would be competent in taking the medical history and performing examination, completing an ABPI,

develop a differential diagnosis and appropriate treatment plan for leg ulcers, predominately those of venous aetiology.

The first group to attend this new education format completed the following; theoretical questions covering characteristics of the leg, ulcer and pain, practical application of palpating pedal pulses and finally two case studies to review and implement management strategies with rationale. A LUAN was deemed competent when 80% of the required theoretical and practical components were completed. The results were not surprising and reflected what the organisers had suspected anecdotally, that the quality of assessments and decision making had not always been reliable (Refer Appendix 1). Only one participant was competent in all criteria, the remaining participants had varied results and were given feedback and an opportunity to be retested six months later. Six months seemed an appropriate length of time for participants to review the theoretical and practical components of leg ulcer management, however if any LUAN's practice was borderline a performance plan would have been implemented to support them during that period. At the completion of the six month period, all were deemed competent. Thus a LUAN is deemed competent when 80% of the required theoretical and practical components are completed to a satisfactory level.

This programme was repeated again in 2013 and the results showed improvements (Refer Appendix 1). Three of the six participants were competent on the day, and the remaining participants were only marginal in the diagnosis



criteria and needed to resubmit their case scenarios. The overall improvement could be attributed to the nurses now being accustomed to this style of learning, awareness of what is expected in their role, or self-directed revision of principles prior to attending day. The experience of the LUANs ranged from 2 years to 10 years. All had attended the previous year's programme; 4 of those who were marginal had experience greater than 10 years in leg ulcer management.

As previously stated the LUANs are required to undertake 10 leg ulcer assessments per month in order to maintain clinical competency and attend recertification yearly. This method of education and maintenance of clinical skills is more than what is currently in place for the DNs and this is largely attributed to the fact that this is a small group and it is logistically easier to facilitate a day every year to assess their competency. With approximately 100 DNs within the region, this method of education would be resource intensive for ongoing competency assessment in terms of travel, managing workloads and teaching resources.

The exploration and development of a clinical competency framework to sustain clinical competency and knowledge would strengthen DN practice and improve patient outcomes. Therefore the challenge is the identification and integration of an educational and recertification framework that supports and allows for the sustainability of these skills over a period of time and accommodates the geographical diversity within this DHB.

In my role as a clinical nurse specialist (CNS) in wound care I frequently see ineffective bandage application when reviewing patients. Ineffective bandage application includes decreased bandage tension, more or less than 50% bandage overlap, and not re-measuring ankle circumference to ensure the correct bandage system is applied thereby avoiding adverse events such as increasing the sub-bandage pressure or pressure necrosis (Beldon, 2008; Todd, 2011). This suggests that the current recertification process does not enable the DNs to sustain clinical skills to an acceptable level. The application of correct bandaging is vital in the management of patients with venous leg ulcer. While the consequences of ineffective compression bandaging may not be evident to nurses routinely reviewing their own patients as part of their primary workload, the cumulative effect of this is increased costs to the organisation in both monetary and resource terms, increased length of treatment time, reduced healing rates and impacts on patients' quality of life.

## **Leg Ulcers**

Leg ulcers are a common, debilitating, chronic condition which can occur at any age, but are more prevalent in older people. Leg ulceration is a leading cause of morbidity amongst the elderly, particularly females in Western countries. While the exact prevalence is difficult to establish, it is estimated to be between 1-2 % of the population (Templeton, 2005).

A leg ulcer is defined as being any interruption in skin integrity, below the knee, which has not healed within six weeks of onset, or within what would be

considered a reasonable length of time depending on the nature of the injury that preceded the ulcer (Flanagan, 2013; Baranoki & Ayello, 2012). These ulcers fail to heal due to an underlying pathophysiological process, a circulatory insufficiency of the venous system, the arterial system, or both (Callum, Ruckley, Harper, & Dale, 1985; Templeton, 2005; Nelson, Cullum, & Jones, 2006).

Underlying venous aetiology is the most common cause of leg ulceration with approximately 70% of all leg ulcers having a venous component (Flanagan, 2013; Baranoki & Ayello, 2012). It is estimated that 1% of people in an industrialised country will experience a leg ulcer at some time in their life with the risk of ulceration increasing with age (Moffatt & Dorman, 1995; Walker, Rodgers, Birchall, Norton, & MacMachon, 2002). The majority of leg ulcers are as a result of venous hypertension, related to poor calf pump action to effectively empty the veins of the lower leg, this could be due to valvular incompetence, venous obstruction, calf muscle impairment or a combination of all these factors (Moloney & Grace, 2004). Leg ulcers are thought to occur in 0.39/1000 people in the New Zealand population (Walker et al., 2002). The prevalence of leg ulceration increases markedly in relation to advancing age.

A 2002 study undertaken in Auckland found people aged between 60-69 years had a prevalence of 0.76/1000, people aged 70-79 years a prevalence of 2.38/1000 and people aged 80 years or more a prevalence of 5.64/1000 of developing lower leg ulceration (Walker et al., 2002). It is estimated that by 2040 the proportion of people over 65 years will rise from 12% to 24%, and

those over 85 years will have increased fourfold from 1.3% to 5.5% (Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011).

### **Leg ulcer management**

The gold standard treatment for uncomplicated venous leg ulceration is to provide graduated multi-layer high compression of 40 mmHg of pressure at the ankle with the pressure sustained for at least a week (O'Meara, Cullum, Nelson, & Dumville, 2012). Compression therapy aims to promote venous return, reduce venous pressure and prevent venous stasis (O'Meara et al., 2012). It is also important in the management of lower leg wounds that the aetiology of the ulcer is correctly diagnosed as this can result in inappropriate therapy being applied with the potential for further trauma and possible limb loss. An uncomplicated venous ulcer is an ulcer that occurs in the presence of venous disease in a limb with an ABPI >0.8 or with no other medical conditions that would contraindicate the use of high compression (Schuren & Mohr, 2008; European Wound Management Association (EWMA) Position Document, 2003).

A number of different compression bandaging types and systems exist that are used in the treatment of venous leg ulcers including multi-layer systems, inelastic and elastic bandaging (O'Meara et al., 2012; Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011). Each type of bandage or system is applied differently and has a different recommended wear time ranging from daily to weekly. Multi-layer bandaging

systems, where one of the layers is elastic, appears to achieve better outcomes of the healing of venous leg ulcers compared to a single layer component system (Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011).

Profore™ is a four layer bandaging system made up of four essential layers: natural padding bandage, light conformable bandage, light compression bandage and flexible cohesive bandage. It is the latter two layers that apply the necessary compression, and uses a 50% extension with 50% overlap technique to apply this bandage. Coban 2™ is a two layer system which consists of only two layers: a padded layer and a flexible cohesive bandage, this outer layer is applied at full extension. This DHB currently uses the Profore™ bandaging system as its main bandaging system. For patients that have altered limb shapes, Coban 2™ is used if there are problems with slippage, or lifestyle. The two component systems have been shown to be just as effective as the multi-layer system in clinical practice (O'Meara et al., 2012; Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011).

Within the Waikato DHB any wound on the lower leg that has not healed after 4 weeks is referred to a LUAN for assessment. It is then managed by the primary DN in concordance with the community wound care pathway, based on the results of the ABPI and subsequent prescription for compression therapy. This compression therapy should be applied by a health professional trained in the application of compression therapy and according to the manufacturer's

guidelines (Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011). Within this DHB any DN who has completed the compression bandaging clinical competency programme is able to undertake compression bandaging.

The application of bandaging is complex and prior to the application of any compression bandage, a comprehensive patient assessment including a full history, physical examination and ABPI should be undertaken to diagnose the correct aetiology of the ulcer and assess arterial inflow. This ensures that any co-morbidities are identified that may influence treatment of the ulcers and to ensure that any compression bandage applied is done so safely (Flanagan, 2013; Babanoki & Ayeolla, 2012; Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011). An ABPI of 0.5 – 0.8 would indicate a mixed arterial ulcer and moderate arterial insufficiency and reduced compression may be indicated taking into account the medical history and clinical presentation (EWMA Position Document, 2003). At the Waikato DHB the LUAN undertakes the initial comprehensive assessment and based on the results prescribes appropriate treatment. The DNs carry out this treatment, however should be aware of the underlying aetiology in order to manage adverse events and escalate concerns to the LUAN or CNS.

Applying correct tension and overlap, while accommodating differences in limb circumference and shape, is critical in achieving optimal compression. Research indicates that up to 70% of venous leg ulcers heal within 12 weeks of

commencing compression bandaging (Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers, 2011). While the intention of applying compression is to facilitate healing of venous leg ulcers, adverse events may occur. These are usually evidenced by a failure of the ulcer to heal or deterioration in the ulcer or peri-wound area. Clinical signs indicating adverse events include an increase in the size of the ulcer, pain, exudate, malodour, increasing oedema in the lower leg or pressure necrosis over vulnerable areas such as the Achilles' tendon, dorsum of the foot and the malleolar region (Beldon, 2008).

As noted previously, there are several types of compression bandages on the market and each system requires a different application so nurses need to be familiar with each system and apply them correctly, with the right amount of tension and overlap. Tension and overlap are based on Laplace's Law, with the applied pressure being directly proportional to the tension in the bandage but inversely proportional to the radius of the curvature of the limb to which it is applied (EWMA, Position Document, 2003). Nurses need to take into account not only limb shape, but also bony prominences which need to be padded out in order to avoid excessive pressure (Beldon, 2008).

Healing rates are the most important outcome measure in relation to leg ulcer management for both patients and health care organisations. For the patient a healed ulcer means a return to normal skin integrity and functional status. For the health care organisation it is a reduction of associated costs with wound

management such as dressings, nursing time, antibiotic use and hospital admissions (Betts, 2005).

## **Conclusion**

To provide effective and safe patient care, it is imperative for all health practitioners to possess a core set of skills and to maintain them at a certain recognized standard (Anderson, 2003). To ensure this occurs, the best methods of teaching and supporting ongoing clinical competency need to be identified. The purpose of this dissertation is to review current literature on methods of sustaining clinical competencies in the specialized skill of compression bandaging and to identify those methods best suited to a large geographical area. Recommendations will be made to inform the development of a framework which will support DNs to sustain their clinical competency level following initial training in compression bandaging.



## **Chapter 2: Methodology**

The focus of evidence based practice (EBP) questions is practical real world problems and issues (Davies, 2011), and in today's changing and challenging environment without these questions EBP would not exist. This chapter outlines two reviews that were undertaken to answer the study question. The first literature review undertaken looked directly at the research available to answer the research question, "What is the best educational framework for maintaining clinical competency in compression bandaging for nurses working in the community?"

The initial search and review of the literature revealed that there was very little literature related to strategies that support clinical competency in the application of compression bandaging post completion of a required educational programme. As a consequence of this, a second literature review was undertaken to explore educational frameworks used to sustain competency in specialist skills in general. The outcome of both reviews will be discussed within subsequent chapters.

The research question was formulated using the PICO framework. Miller and Forrest (2001) suggest that a well-constructed question should include the following four parts: patient problem or population (P), intervention (I), comparison (C), and outcome (O). An alternative search strategy for qualitative research, SPIDER (sample, phenomenon of interest, design, evaluation and

research type), has been developed however in order to be a viable alternative to PICO needs to be refined and tested (Cooke, Smith, & Booth, 2012). PICO was chosen as it provided a systematic process for converting information on a clinical problem into a clinical question so that it can be answered (Miller & Forrest, 2001; Schardt, Adams, Owens, Keitz, & Fontelo, 2007).

**Table 3 – PICO framework – Sustained competency in compression bandaging**

<b>POPULATION</b>	Nurses and Doctors
<b>INTERVENTION</b>	Education for Compression Bandaging
<b>COMPARISON</b>	Different educational frameworks
<b>OUTCOME</b>	Sustained competency in compression bandaging

## Search Strategy 1

A search in English of Google Scholar, CinahlPlus, Medline, Cochrane Library and ProQuest was conducted using the following key words truncated and in combination: compression bandaging, clinical competency, district nurse, leg ulcer, education, frameworks, and/or skill development.

The criteria was limited to research articles from 2000 to present that related to the study question using any methodology, in English, which included health professionals, and excluded opinion articles and existing clinical guidelines and frameworks. The purpose was to identify evidence based practice research which supported sustained competency. Limiting only to English may have excluded relevant studies. Whilst searching for articles related to the initial

question, during the hand search three research studies were cited in current articles and although pre date 2000 were important to include in the literature review.

During the literature review the type of bandaging system used did not impact on the search criteria. However the search was expanded to include studies using the individual generic names of bandaging systems such as Profore™ and Coban 2™. Unfortunately this produced articles only relative to the application of the specific bandage, or comparison of use with other bandages and shed no further light on educational frameworks which supported skill levels. Articles related to chronic oedema and lymphoedema were excluded as they were not relevant to the initial research question as the application of compression bandaging for this group of patients differs compared to the application of compression bandaging for uncomplicated venous leg ulcers.

Potential articles were selected by their title and abstract, followed by an in-depth review of the contents in relation to education strategies and frameworks for sustaining clinical competency. In the initial search only five research articles were identified as being relevant to the research question. A manual search of the research articles was undertaken including the reference lists to extract any further research related to the research question which had not previously been found during the database searching. No New Zealand studies were found in this first literature review.

Once the relevant articles were selected, they were analysed using the Critical Appraisal Skills Programme (CASP, 2013; Miller & Forrest, 2009; Jones, Crookes, & Johnson, 2011). (Refer to Appendix 2). The CASP programme provides specific tools for the critical appraisal of scientific evidence about health care. Each tool consists of about ten questions about each specific type of research, which prompts the researcher to evaluate each question topic and determine if it is worth continuing based on the critical appraisal of EBP research, internal validity, the results and relevance to practice and patients (CASP, 2013; Bartkowiak, 2005). Emergent themes were identified from the first literature review and are explored and discussed in Chapter 3. This formed the initial literature review for this dissertation.

## **Search Strategy 2**

As the results from the first review did not completely answer the question a second literature search was conducted to identify clinical competency approaches for similar skill acquisition and recertification areas. It was determined as well that the initial search had been too restrictive, as only a limited number of research studies were identified. An integrative review was utilized for the second literature search to explore the question in its broader context.

Broome suggests that an integrative review “is a specific review method that summarises past empirical or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem” (as cited in Whittmore & Knafl, 2005, p.546). The inclusion of an

integrative review is important as it has the potential to build nursing science and inform research, practice and policy initiatives. Whittmore and Knafl (2005) further argue that “well done integrative reviews present the state of science, contribute to theory development, and have direct applicability to practice and policy” (p.546). Thus an integrative review seemed most suitable to the development of an educational framework in the narrow field of compression bandaging.

The clinical skills areas that were included in the second review included plaster of paris bandaging, intravenous (IV) certification, and cardiac resuscitation. In addition other relevant advanced nursing and medical training programmes using different methods of learning styles such as blended learning, electronic learning (e-learning), objective structured clinical examination (OSCEs) and/or frameworks to sustain competency were explored. The PICO framework was again used to identify the patient problem or population, intervention, comparison, and outcome (Miller & Forrest, 2001).

**Table 4 – PICO framework – Sustained clinical competency**

<b>POPULATION</b>	Nursing and Medicine
<b>INTERVENTION</b>	Clinical skill acquisition
<b>COMPARISON</b>	Different educational frameworks
<b>OUTCOME</b>	Sustained clinical competency

A search in English of Google Scholar, CinahlPlus, Medline, Cochrane Library and ProQuest was conducted using the following key words truncated and in combination: clinical competency, nurse, medicine, education, frameworks, and/or skill development and acquisition. The search criteria was unable to differentiate between undergraduate and post graduate educational frameworks for the second search. The search was limited to articles from 2000 to present that related to the study question using any research methodology, in English, and related to health professionals. In contrast to the initial review, opinion articles and existing clinical guidelines and frameworks were included as it was determined they might shed light on current best practice which has not been published as 'research'.

For the second literature search potential articles were selected by their title and abstract, followed by an in-depth review of the contents to identify clinical competency approaches from other relevant advanced nursing and medical training programmes that used different methods of learning styles, to assess and/or sustain clinical competencies. A manual search of the research articles' reference lists were also undertaken to extract any further articles related to the research question which had not previously been found during the database searching. There were challenges in defining the methodology used or they did not describe the education programme used to sustain clinical competency in a number of articles identified in the second review. Two New Zealand articles were found in the second literature search.

The following two data chapters present the initial review of the research addressing compression bandaging specifically (Chapter 3) and the ability to sustain clinical competency more broadly (Chapter 4). The final chapter summaries the findings and presents a suggested framework for practice within the Waikato DHB (Chapter 5).

### **Chapter 3: Compression Bandaging/Competency**

This chapter will present a review of the research addressing compression bandaging specifically. Five studies were identified in the search of available research specific to the research question. They consisted of two prospective cohort studies and three quasi-experimental pre and post-test designs. (Refer to Appendix 3). The dearth of research into this issue necessitated the inclusion of three research studies which predated 2000. These studies were included as it was determined that similar bandages are still used and the technique itself of application has not changed since the early 1990s.

The use of quasi-experimental designs facilitates the search for knowledge and examination of causality in situations in which complete control is not possible (Burns & Grove, 2011). Cohort prospective studies are the best design for establishing relationships between the outcome of interest and the exposure variable (Burns & Grove, 2011). The gold standard of the randomised control trial (RCT) is not always possible when testing live human subjects (Akobeng, 2005). It would be difficult to do RCTs in this environment as the researcher would not be able to blind the type of bandage used. There are also variations in limb shape and patient demographics which further compound blinding. No RCTs were found during this literature search. Four main themes presented themselves and these are: pressure monitors, bandage type, sustainability and education design. They will be discussed within the chapter.



The issue of demonstrating and sustaining clinical competency in bandaging appears to have existed since at least the early 1990s. The types of bandaging available have also not changed radically over the past 20 years. Studies by Nelson, Ruckley and Barbenel (1995), Taylor, Taylor and Said (1998), Reynolds (1999) and Hafner, Luthi, Hanssle, Kammerlander and Burg (2000) sought to establish if using a pressure monitor and training programmes improved the bandaging skills of nurses caring for patients with leg ulcers and to what extent these improvements in bandaging technique sustained clinical skill following training over time. More recently, Keller, Muller, Calow, Kern and Schumann (2009) evaluated the pressures under compression bandages in order to improve bandaging techniques using pressure monitors. All studies were concerned with sustainability and had a follow-up testing period ranging from 2 to 14 weeks. A summary of the results of the five studies reviewed in the first literature search is detailed in Appendix 4.

### **Study Participants**

The study participants were from a variety of health settings, including specialist dermatology clinics, hospital and community, and included both nursing and medical students. The study groups were small with numbers ranging from 10-23. The study participants in four of the studies had experience in compression bandaging from either their current work practice, attendance at a leg ulcer training day or previous education in wound healing/management. Keller et al. (2009) incorporated a purpose built pressure monitor in the initial compression therapy training with 156 participants taught during a wound healing course.

Independent to this education, 10 nurses with many years of experience in compression bandaging and 10 medical students with no experience in compression bandaging participated in an in-house compression bandaging training session and were followed up at 2 weeks. It was unclear from the article if any of these participants attended the wound healing course prior to being tested. This was a small group with a short interval period.

### **Pressure monitors**

A pneumatic pressure measurement system (pressure monitor) was used in all 5 studies. It is a common type of pressure transducer that measures interface pressure under compression products. It uses air as its medium to transfer the force applied by the compression garment through the attached probe to an air pressure that converts into an electrical signal (Al Khaburi, 2010). Nelson et al. (1995), Taylor et al. (1998) and Reynolds (1999) used the monitor in their studies at three points along the lateral aspect of the volunteer's leg on a line between the tibial tuberosity and lateral malleolus to record bandage pressures.

Hafner et al. (2000) and Keller et al. (2009) also utilised a pressure monitor with a sensor under the bandaging however this sensor was only placed on the medial gaiter (12cms above inner ankle medial aspect). They also used volunteers. No data was recorded above the medial gaiter region thus graduation in therapy was unable to be assessed. This is important as it is a variable in the study which was possibly not accounted for. This could affect the primary outcome measure if that was measuring graduated compression. By not allowing for measurements

further up the leg the reader cannot determine if the bandaging was applied appropriately to increase healing potential. Hafner et al. (2000) used a handmade pressure monitor unlike the other four studies that used a commercially available unit. Little is known about the accuracy, sensitivity and specificity of the pressure monitors used in any of these studies.

On a normal shaped leg the circumference of the ankle is substantially smaller than that of the calf. Following Laplace's Law, if a bandage is applied with constant tension and overlap, the pressures achieved at the gaiter and calf will be lower than that of the ankle, resulting in applied graduated compression. To reverse the effects of venous hypertension, the level of compression should be between 40mmHg-50mmHg at the ankle to produce a haemodynamic benefit. It is consistent formation of this ideal pressure gradient that can be difficult to achieve practically (EWMA, Position Document, 2003).

### **Bandage Types**

A variety of bandage types were used in an attempt to improve competency in maintaining appropriate pressures within the studies. One of the bandaging types used by Nelson et al. (1995) was a single layer system (Granuflex™ adhesive) marked by hand so that an oval pattern became a circle when the recommended extension was achieved. The Granuflex™ adhesive type of bandage produced slight improvement in bandaging application, in conjunction with the pressure monitor, however the improvement was not statistically

significant suggesting that using tension guides are not sufficient enough to produce acceptable bandage pressures.

Taylor et al. (1998) used a four layer bandaging system on three separate occasions: at baseline with participants using their current technique and no pressure monitor, at the end of the training session with input and correction using the pressure monitor, and two to four weeks later for a recall measurement. At the start of the study bandaging proficiency was less than 50%. These results improved to 81% with feedback and 86% on recall. Using a four layer bandaging system appears not to be an influencing factor on technique in this study.

Reynolds (1999) used two types of bandages within his study. Bandage A (Tensopress™) was used widely by the nurses and bandage B (Surepress™) contained a geometrical design similar to that used in the Nelson et al. (1995) study. To maintain consistency the same volunteer was used throughout the study and results were taken with the limb dependent and elevated. Using one bandage type compared to the other achieved better proficiency scores but this was not statistically significant (Reynolds, 1999).

In the studies by Hafner et al. (2000) and Keller et al. (2009) the nurses chose the types of bandages so as to be reflective of their current practice ie short stretch bandages. This meant familiarity with the bandaging system, which should lead to improved techniques. The results in the Keller et al. (2009) study

using an inelastic bandage type were comparable to the results in Nelson et al. (1995) and Reynolds (1999) using elastic type bandages.

In all of the studies familiarity with the bandaging type did not appear to be an influencing factor on bandaging techniques and competency. Using only one type of bandage also appears not to be an influencing factor on bandaging proficiency.

### **Sustainability timeframes**

The issue of sustainability is a challenging one. The Oxford English dictionary definition of sustainability is “the quality of being sustainable at a certain rate or level” (“Sustainability,” 2014) and to sustain is “to cause to continue in a certain state for an extended period or without interruption, to keep or maintain at the proper level, standard or rate” (“Sustain,” 2014). All studies had a follow-up testing period ranging from 2 – 14 weeks. Nelson et al. (1995) and Taylor et al. (1998) showed improvement in clinical skills when using pressure monitors in conjunction with training programmes at 2-4 weeks post testing. Hafner et al. (2000) and Keller et al. (2009) also showed that training effectively improved the accuracy of compression therapy being applied, using a pressure monitor at 2 weeks and 10-14 weeks at time of retesting. Hafner et al. (2000) suggested that health professionals can improve their accuracy by means of using a pressure monitor measurement device and that it is a skill that requires daily practice.

Across all studies competence levels increased significantly with standardized training programmes and bandaging techniques were improved immediately after training. It was not clear from the studies however, if this was a result from the training itself or from the use of the pressure monitor. Neither study had a control group so again it is difficult to attribute change in practice to a specific aspect of the training programme.

## **Education design**

In three of the studies (Nelson et al., 1995; Taylor et al., 1998; Hafner et al., 2000) training was conducted prior to selection into the study, by attending a leg ulcer study day or completing a specialist course in wound healing. It was unclear from the research reports what the content of each of these study programmes contained. Keller et al. (2009) only incorporated training in use of the pressure monitor during the actual study.

The study by Reynolds (1999) was the only one in which the education programme was described. It consisted of a four hour workshop revising the aetiology of venous leg ulcers and criteria for compression therapy, pressure profiles, followed by a practical session. Nurses self-reported their current level of knowledge and skill pre training as between good and adequate.

From the Reynolds (1999) study there is benefit in having an education framework as the base of an initial training programme however in Hafner et al's (2000) study the medical students produced adequate to good results from just having training with the pressure monitor. This suggests that initial skill

acquisition is easy to learn. The benefits of an education programme long term would still require further investigation.

## **Bandaging skill**

Criteria for the evaluation of bandaging skill levels within the three older studies, (Nelson et al., 1995; Taylor et al., 1998; Reynolds, 1999) relied upon the British Standard (refer to Table 5) of the level of compression required to reduce oedema related to venous insufficiency (EWMA Position Document, 2003). The ability to produce graduated compression was assessed by calculating the calf/ankle ratio, as there should be a gradual reduction in pressure from the ankle to the calf by at least 70% (EWMA Position Document, 2003).

**Table 5 – Criteria for classification of bandage proficiency scores**

<b>Rating</b>	<b>Ankle pressure mmHg</b>	<b>Calf:Ankle pressure ratio</b>	<b>Proficiency</b>
Good	25-50	<0.7	3
Adequate	18-24 or 51-60	0.7-1.0	2
Poor	<18 or > 60	>1.0	1

**From:** Nelson et al. (1995), Taylor et al. (1998) and Reynolds (1999) adapted in their studies from the British Standards Institute

The pressures achieved in the Nelson et al. (1995) study increased over the study period from 26.7mmHg to 36.5mmHg. The results of this small study showed a statistically significant difference ( $p<0.01$ ) in the bandage proficiency score between baseline results and post training results and that this difference was maintained 2 weeks following training ( $p<0.01$ ). Only 11 of the 18 nurses returned for retesting which may have influenced the results however.

Bandaging maintained at 2 weeks was acknowledged by Nelson et al as a short follow up period.

Taylor et al. (1998) found significant improvement between the baseline and feedback sessions ( $p=0.016$ ) and between the baseline and recall sessions ( $p=0.008$ ). There was no significant difference ( $p=0.5$ ) between the feedback and recall results showing that there was improvement in techniques at recall. Less than 50% of the participants showed good bandaging techniques on initial assessment. The most notable common mistake was the application of insufficient pressure at the ankle due to over-caution in order to prevent skin necrosis. Taylor et al. concluded that the pressure monitor was a useful adjunct for teaching bandaging skills.

Reynolds (1999) showed a reduction in good and adequate pressures when using two types of bandages immediately post training. The result of Bandage A at post training was 87%, falling to 44% at follow-up. Bandage B post training was 91% and this fell to 56% at follow-up (6-10weeks). This showed the proficiency of bandage application falling back to the levels that were assessed before educational intervention. Nurses had been instructed to practice as often as possible and this may not have occurred for a number of reasons such as workload, or a decrease in the number of patients requiring bandaging at that time. The decreased number of participants at recall (18/23) may have also altered results.



Whilst Nelson et al. (1995) and Taylor et al. (1998) showed an increase in sustained skills it is noted that the follow-up period was short. Only one pressure monitor was available for the Reynolds (1999) study so participants were watched by others and the researcher. Reynolds suggests that the psychological response of being watched may have altered the participants' behaviour (the Hawthorne effect) thereby demonstrating disappointing results.

The concept of the Hawthorne effect was first studied at the Western Electric Telephone Manufacturing factory at Hawthorne near Chicago between 1924 and 1933 (Mayo, Roethlisberger & Gillespie, as cited in McCambridge, Witton, & Elbourne, 2014). A literature review by McCambridge et al. (2014) sought to explore whether the Hawthorne effect actually exists, under what conditions it exists and to predict the impact such an effect actually has. The Hawthorne effect has been used widely and has taken on the meaning of an alteration in behaviour as a consequence of being watched or examined and appears to be a term used to interpret unexpected results, both better than and disappointing. Interestingly, productivity increases when workers are being supervised intensively by managers under the pretence of research (French, as cited in McCambridge et al., 2014). They concluded that the consequences for behaviours being investigated do exist, but little is known about how they operate, the effect or the size of that effect (McCambridge et al., 2014). As in the Reynolds study (1999), Keller et al. (2009) also suggest the results may have been as a result of the Hawthorne effect as the participants were under observation and the centre of attention.

Hafner et al. (2000) found that 10 nurses attained pressures of 35.3 mmHg pre intervention and 40.5 mmHg post intervention while 10 medical students attained pressures of 41.3 mmHg pre intervention and 33.8 mmHg post intervention. These results demonstrated sustained competency at 2 weeks post intervention by the nurses using only a pressure monitor as a training method. The medical students failed on post intervention to produce pressures within the acceptable range (35- 45mmHg), this may be attributed to the fact this is not part of their current practice. However, their study had the variable of no pressure monitor above the medial gaiter. Hafner et al. (2000) also suggested that in order for measurement of graduated compression the training should include two interface points, the medial gaiter and calf region.

Keller et al. (2009) concluded that utilisation of a pressure monitor reduced the risk of insufficient or excessive pressures (<20mmHg - >60mmHg) from 34% pre intervention to 17.5% post. At recall 82.6% of the nurses who had used a pressure monitor in current practice since intervention achieved pressures between 20mmHg – 60 mmHg. This study supports the view that pressures can be variable and the importance of establishing education that assists in the maintenance of skill over a longer period.

## **Summary**

Health practitioners are required to meet certain standards for which specific skills are required. Leg ulcer management is one of those skills. Compression bandaging is expensive and if over half of nurses that perform this skill are

applying bandaging poorly or inadequately, the implications both in financial cost and the cost to the patients' quality of life are significant (Feben, 2003). Ineffective bandaging can lead to increased risks for the patient that can increase the length of treatment and impact on their quality of life. It is important that compression bandaging skill is taught, practiced and sustained to ensure optimal patient outcomes and effective patient management.

The research studies identified and reviewed in this chapter all explored the impact of using a pressure monitor to educate and sustain clinical competency in compression bandaging. Competency increased in all of the studies using a pressure monitor in conjunction with other training methods. Thus it appears that pressure monitors are an acceptable tool for teaching clinical competency in applying compression bandaging, at least initially.

In the Waikato DHB there are approximately 100 DNs applying compression bandaging throughout the region. At approximately \$10, 000 per unit, the use of pressure monitors is cost prohibitive. As a result, the DHB does not utilise pressure monitoring either in practice or as part of an education programme. Although use of a pressure monitor is considered helpful, it is not the method that the author would consider as a tool to sustain clinical competency due to cost restrictions and the lack of research demonstrating its ability to sustain competency over time.

Arguably the best indicator of effectiveness of compression bandaging is whether the wound is healing (Rippon, Davies, White, & Bosanquet, 2007). There was no attempt in the studies reviewed to measure wound healing.

There was also little attempt to explore specific teaching strategies other than using an external measure to determine competency. The outcome of all the studies was that formalised training is a key to improving bandaging techniques, however it was not clear whether the improvements in practice were a result of the training itself or from the use of the pressure monitor. What was clear was the justification for identifying a sound educational framework to sustain competency.

The initial literature review demonstrated that no training programme has been identified or is known to be effective in ensuring adequate competency in compression bandaging in the long term. While it is evident that training programmes are of benefit in the initial stages of learning and immediately post training, for whatever reason skill in compression bandaging is not sustained over time.

In addition, the review raised issues for further research including the current standard of compression bandaging by individuals who consider themselves competent in this skill. In all five studies nurses in general did not achieve sustained graduated compression before training, despite having defined themselves as experienced bandagers. The study authors found that nurses'

perception and length of work experience were not guaranteed indicators of sustained competency in compression bandaging.

In summary, the studies reviewed suggest that competency can be achieved in the short term, but that it returns to near baseline levels in the long term. Despite the initial improvement in skill, there was no evidence that the training programmes utilised in the studies led to long term improvements. This is a concerning finding which supports my own observations that competency is not sustained over time. There is a need to assess the skill level of current practitioners or provide a way in which they can assess their own skill, improve training to those with inadequate skills and assess the effects of future training in the long term in order to ensure adequate and safe bandaging technique. The initial literature review reinforced the significance of this research project and directed the focus of the second literature review on educational frameworks.

## **Chapter 4: Sustaining Clinical Competency**

The initial literature review demonstrated the challenges inherent in sustaining skill in compression bandaging but shed very little light on the best educational methods to assist health professionals in sustaining competency. From the initial literature search and review it became evident that while educational programmes are effective in teaching compression bandaging, their ability to ensure sustained competency is poor. The results of the review have demonstrated a need for a reliable method of assisting DNs to sustain their clinical competency in compression bandage application.

The research question was not answered from the initial literature review so a more extensive literature review was undertaken to identify clinical competency approaches from other areas such as casting, intravenous (IV) certification, cardiac resuscitation, advanced nursing training programmes and senior medical training programmes, using different methods of learning styles such as certification, competencies, blended learning, OSCEs and frameworks. (Refer to Appendix 5). From the literature reviewed it was envisaged that this would assist in the development of a framework that more adequately supports DNs to sustain their clinical competency level following initial training in compression bandaging.

Nursing education has changed over time. Even the past ten years has seen a change in the delivery method of education as the computer age revolutionises

aspects of our everyday life and nursing is no exception. Any education strategies implemented to provide sustainability need to be adjustable to learning styles, adaptable to stakeholders and meet geographical remoteness. Valiga (2012) suggests that nurse educators must challenge themselves to be proactive and to anticipate the future. While this is true of educators, the governing body of nurses in New Zealand as part of their professional scope of practice has defined that ... "Registered nurses are accountable for ensuring all health services they provide are consistent with their education and assessed competence, meet legislative requirements and are supported by appropriate standards" (New Zealand Nursing Council, 2007, p.3). Therefore nurses have a requirement to maintain a level of competency in the skills they perform.

Nursing is a profession that expects and supports the development of a competent workforce. There appear to be many definitions of the word competence; competent, competencies and competency are often used interchangeably. Benner (as cited in Cowan, Norman & Coopamah, 2005) defined nursing competency as "the ability to perform a task with desirable outcomes under the varied circumstances of the real world" (p.358). Watson, Stimpson, Topping and Pollock (2002) suggest that competence may be achieved simply by undergoing education or training in a particular aspect of nursing without performance being assessed. On the other hand, competence could be achieved by a level of performance being assessed or achieved by completing component parts of competence called competencies. McMullan et al. (2003) suggest that competence and competencies are job related, while conversely

Nolan and McConnell (as cited in Cowan et al., 2005) defined competence as a capacity or potential to perform a skill and competency as the actual performance. The current methods for assessing clinical competency identified in the literature include: competency assessments, OSCEs, blended learning, and e-learning.

While there appears to be a lack of consensus on whether competence equates to potential or actual ability, how to measure this potential remains challenging.

The issue is what level of performance would indicate that a practitioner is competent (Watson et al., 2002). Competencies focus on the summative behaviours required and expected in clinical practice and are very specific endpoints that can be assessed. This suggests that to measure competency you need evaluations that have the effective implementation of specified skills, and that these critical elements are demonstrated (Rubenfeld & Scheffer, 2006). If someone performs 80% of the completed tasks are they less competent than someone who achieved 100% or is 100% the only measure of competence?

Does a certification process ensure clinical competency and maintenance of skills in a given specialty? McConnell (as cited in Redd & Alexander, 1997) would suggest that credentials are only indicators of what a person should be able to do and not what that person can or will do. This poses real questions as to the validity of the current way in which DNs demonstrate clinical skills in compression bandaging, at least in the long term. As the previous chapter has shown there is no research which clearly defined a method of learning or skill



development that leads to the sustained application of clinical skill in compression bandaging over time.

Two examples of education programmes that measure competency are cardiopulmonary resuscitation (CPR) and plaster casting. CPR is a compulsory generic skill at the Waikato DHB requiring demonstration of this clinical competence through theoretical and practical elements. This skill is assessed on a 2 yearly basis by attending a 4 hour workshop with clinical scenarios and final examination. The Australian Resuscitation Council (2013) and the New Zealand Resuscitation Council (2013) recommend that learning objectives for training must include the following: recognition of an emergency, ability to call an emergency response number, competence in chest compressions and rescue breathing, and be emotionally prepared for the capability to act in an emergency. The guideline also concludes that no optimal interval for retraining has been established but that a repeated refresher is of benefit to those individuals who are not performing this skill on a regular basis.

The application of compression bandaging is similar to that of plaster casting in terms of similar adverse events if applied incorrectly. Pressure injuries are the most common complication of casting when an improper technique is used, and these occur over bony prominences and at the edge of the cast. The population most at risk would be those with a sensory loss, head injury, or peripheral neuropathy (Pifer, 2000). The current education programme for basic plastering skills at Waikato DHB is by attending a workshop, and to then demonstrate three

examples of each plaster type. Consolidation of learning is through repeated clinical practice. It is unclear what the recertification process is for this skill however it could be that the frequency of application increases the ability to remain competent in this skill. It is not known how many nurses undertake plaster casting at Waikato DHB but it is assumed that it is nurses working in the Orthopaedic and Emergency departments throughout the region.

### **Competency Assessments**

Nurses are required to have the practical skills to perform within their clinical environment. Anderson (2003) described the development of a framework for the education of and the skill acquisition of performing a Doppler assessment and undertaking compression bandaging that is particularly relevant to the research question. As part of a leg ulcer module practice portfolio at the University of Hertfordshire, for practitioners pursuing post registration study, Anderson developed what would be the required competency elements for performing a Doppler assessment and applying compression bandaging in order for nurses to be clinical competent in these skills. Anderson suggests that it is important to assess the practitioner in actual clinical practice rather than in an artificial environment. As a result Anderson did not include an OSCE type assessment, instead working beside the practitioner in actual clinical practice. This logical recommendation mimics the real world for DNs; that is, patients with large weeping oedematous legs, immobile patients and the constraints of the home and rural environment.

As this was a framework for compression bandaging this could be adapted to meet the DNs clinical needs in the first instance to gain clinical skill acquisition. Individual practice portfolios, in addition to the competency elements, were developed in order for the practitioners to reflect on their current practice and to actively plan for the development of skills based on their individual needs. Feedback received from the assessors and practitioners was favourable towards this type of assessment and has promoted a closer working relationship with the assessors and practitioner (Anderson, 2003). This cohesive relationship could lead to better bandaging techniques, supportive learning and working environment and improved health outcomes for patients.

In contrast with individual programmes, Tomlinson (2004) described the development of a national framework of competency across a range of paediatric nursing specialties. Prior to the development, information on the needs and expectations of the key stakeholders was obtained through a postal questionnaire and focus groups. From the nurses focus group the main theme was that education provision should be available and accessible. The development of a national framework for nurse education and continuing professional development can decrease the travel of those who live remotely, but allowing them the same educational opportunities. This would be of value within all DHBs given the increase reported in the aging population within New Zealand. Generally an ideal framework was seen to include a format that would enable nurses to build on their previous education (Tomlinson, 2004).

## **Objective structured clinical examinations (OSCEs)**

The OSCE was born out of medicine by Ronald Harden in Scotland and was first reported in 1975 and is a method used to assess clinical competence. OSCEs are thought to be objective in nature, fulfil the criteria of validity, reliability and practicality, and have the potential to test a wide range of knowledge and skills and can be used to examine multiple practitioners at one time (Ross et al., 1988). In order for the OSCE to accurately assess and be a true reflection of actual competence it depends on measures used, examination content and the complexity of the skill being examined (Hodges, 2003).

Hodges (2003) suggests that an OSCE will only be valid in relation to clinical situations in which subjects reproduce specified behaviours. By describing what clinical competencies are required, precise questions, scenarios and clinical skills can be formulated, in order for participants to be examined and assessed at a competent level. OSCE is a method of determining competency and has been critiqued via a variety of methods including pre and post evaluation research, utilisation focused evaluation, literature review and audit.

The issues that have been identified with OSCEs include adequacy of actors to mimic actual patient and leg characteristics as well as the impact of stress on performance. A limitation of the OSCE is the ability to assess clinical competency in the real world. Using real patients maximises the validity of the OSCE however the recruitment of real patients does come with ethical considerations.

Rushforth (2006) and McWilliam and Botwinski (2005) suggest that the use of adult volunteers or health professionals may weaken the validity and reliability of the OSCE assessment and that real patients trained to present their condition maximise validity. The use of trained actors as simulated patients is optimal if not expensive, providing an environment resembling that of actual practice.

Stress is a normal emotion that may lead to the impairment in the ability to perform the required tasks within an OSCE environment. Brosnan, Evans, Brosnan and Brown (2006) found the OSCE examination style meaningful and a fair form of assessment, but also concluded that it was perceived as a stressful experience by the students.

Clarke, McDonald and Rainey (2012) conducted an audit to explore the views of registered nurses undertaking an OSCE for the first time. This was a change from their current education programme which included an integrated preparatory skills workshop. A questionnaire was designed to evaluate not only stress and anxiety levels but also that of perceived confidence levels at designated points, before, during and after the assessment to provide insight into the students' experience. Clarke et al. (2012) found that 81% of participants (22/27) felt the time leading up to the examination was stressful, and 82% felt stressed or anxious during the examination. The stress associated with this type of examination can be counterproductive if the stress is such that it leads to an impairment of the students' performance or ability to perform at their actual level of performance. Although many can also excel in this environment (Clarke

et al., 2012) does excelling in the OSCE guarantee that the skill is sustained, or have they just learned what was taught?

Seeley and Harding (2008) explored the effects of two different types of educational programmes on community nurses undertaking leg ulcer management in their clinical practice by basing the education design on the learning needs of the participants. This article explored the impact of learning styles rather than the OSCE as a method of education. The experimental group had training needs and preferred learning styles identified using Kolbs learning styles and were exposed to a 4 hour intensive educational programme on the subject matter. The control group was exposed to education that was designed to discount training needs and learning styles. Despite the experimental group being given an educational gain, as the educational programme was designed to improve knowledge retention of the subject matter, the results showed no statistical difference between the knowledge and skill acquisition in each group and concluded that no statistically consistent knowledge and skills gap existed between the two groups over the study period (Seeley & Hardy, 2008).

Stolarek (2007) and Patel, Oosthuizen, Child and Windsor (2008) both evaluated the impact on first-year postgraduate house surgeons (PGY1s) undertaking a procedural skills course and of the ongoing experience on their confidence levels and skill retention within two New Zealand hospitals. Stolarek (2007) suggested that in order to maintain clinical skill acquisition the desired skill needed to be done regularly and that often there was competition amongst the PGY1s to

undertake the task. Each PGY1 was also required to complete a log diary during the week to record their exposure and completion of required clinical skills. Patel et al. (2008) in their study showed a significant increase in skill acquisition in the short term, but this decreased to only 50% of skills and confidence maintained at five months follow-up unless there was ongoing clinical experience with the procedure. While these evaluations were small (n=10 and n=33 respectively) both suggest that ongoing experience is required to reinforce learning and that participants should be given every opportunity to undertake the desired task.

No study exploring the use of OSCEs showed the sustainability of clinical skills post initial examination. Clarke et al. (2012) found that 94% (25/27) of participants said that this method would enhance their clinical practice. They concluded that further research was being developed to examine if skills are retained following completion of an OSCE (Clarke et al., 2012).

### **Electronic Learning (e-learning)**

The use of information technology (IT) is continually expanding within health care and is challenging educators to provide flexible education programmes to support professional development for practitioners (Moule, Albarran, Bessant, Brownfield, & Pollock, 2008). E-learning, the use of IT in teaching and learning is a platform to educate, assess competencies and provide lifelong learning (Petit dit Dariel, Wharrad, & Windle, 2012). Increasing pressure on time and resources warrants the use of this style of learning and educational delivery.

Two pilot studies which addressed e-learning as a means of education were reviewed. They compared e-learning with traditional classroom methods of teaching. The focus of both studies was CPR training, one for undergraduate nurses, and the second for mental health nurses. Moule et al. (2008) conducted a pilot study to investigate whether a computer based learning package together with practical instruction were comparable with traditional methods in the development of skills and knowledge in basic life support with an automated external defibrillator. Eighty three mental health professionals were allocated into 2 groups, 28 completed an e-learning package and the remaining 55 received the content in a classroom environment. The study was non randomised and conducted over a 9 month period and over a large geographical area.

In the study both groups gained cardiopulmonary resuscitation knowledge following either the classroom or e-learning delivery with no significance noted between the two groups in the results ( $p=0.28$ ). They concluded that self-study using interactive media can be as effective in changing the performance of the participants when compared to that of traditional methods taught at other times (Moule et al., 2008).

Cook, McAloon, O'Neill and Beggs (2012) evaluated the impact of an interactive web based simulation game on final year student nurses, with the objective to motivate online and engagement, enhance student experiences, and improve psychomotor skills associated with CPR training. Significant statistical difference



was found in the competence of the group who utilised this programme prior to undertaking CPR training ( $p=0.05$ ). Access to e-learning seems to enable sustained key knowledge and skills for practice but again it is unknown if it is sustained long term.

The learning world for nursing students today is imbedded in a computer environment and with that comes the experience of utilising this element to engage in the clinical and theoretical aspects of nursing inquiry. The results of the studies by Moule et al. (2008) and Cook et al. (2012) support the use of e-learning, however when computer use to access learning is not part of routine practice, getting familiar with this system and learning tools could be challenging. While this technology is not new it can still be a foreign concept to many, particularly those nurses who trained prior to the widespread use of computers in undergraduate education and whose work does not include a requirement for computer literacy.

The use of e-learning platforms is gaining momentum in the professional development in health care environments and MOODLE is one example. MOODLE is a free, open source virtual learning environment that can be created by educators for educators using the pedagogical principles to guide the design of the website (Kaminski, 2005). The philosophy behind MOODLE includes both a constructivist and social constructionist approach to education, highlighting that learners and teachers contribute to the education process (MOODLE, 2014).

Only two studies were found that looked at MOODLE as a platform for delivering education despite its abundant use in skill/competency maintenance in pre and post-registration qualifications. MOODLE has been in use for several years in the undergraduate environment and within DHBs. Despite this very little research has been published exploring its use at a post registration level. This may be due to the fact that this is still a new technology in the clinical environment or that there are limited opportunities for research within DHBs.

A project conducted by Seif, Brown and Annan-Coultas (2013) used the MOODLE learning system to foster the clinical reasoning skills of physiotherapy students to better prepare them for practice. Sixty three students were assessed on their perception of their clinical reasoning skills both before and after educational intervention. Pre and post assessment showed statistical significance for 17 of the 26 questions showing that students perceived improvement in their clinical reasoning skills. Video recorded patient encounters and interactive lessons, were seen as a method of developing clinical reasoning skills.

Beavis, Morgan and Pickering (2012) reported on their experiences of using MOODLE as a means to delivering online in medication and calculations to nurses working in a dialysis unit in Australia compared to previous written modules. In previous years it has been challenging to get participation and completion of the required medication education, achieving only 75% over a 10 month period. In comparison it took only 3 months to achieve the same level of participation using Moodle. The authors found that staff in general preferred to

complete the assessments online, and described the site as easy to navigate (Beavis et al., 2012). They report the benefits of online skill assessment include flexible delivery, access to multiple sessions and multiple sites, collaborative, cost effective (once set up) and reduced travel cost and time. Barriers to online learning include slow internet access, interruptions within the workplace, and limited access to computers within the workplace.

### **Blended learning**

Blended learning is a relatively new educational concept which describes the blend of classroom face-to-face learning experiences with e-learning experiences. Garrison and Kanuka (2004) suggest that it is not clear how much or how little e-learning is inherent to blended learning and that the real test of blended learning is how effective the integration of the two components is. Any e-learning should have students and tutors confident and competent with the technology. The articles found for blended learning used research methods such as quasi-experimental, mixed method, case study and evaluation methodology.

The mixed method study by Woltering, Herrler, Spitzer and Spreckleen (2009) of 185 nursing students and 14 tutors was aimed at determining whether bPBL (blended problem based learning) increased students motivation and supported the learning process with respect to the students cooperation, orientation and more reliable tutoring compared to problem based learning (PBL). Problem based learning (PBL) is an established approach in medical education. Its impact is thought to largely depend on the quality of the tutors teaching and the

students' motivation. Woltering et al. (2008) concluded that bPBL (blended problem based learning) increased a student's motivation and supported the learning process with respect to the students' cooperation, orientation and was more reliable compared to problem based learning (PBL).

Howatson-Jones (2012) and Tsai, Shen and Tsai (2011) argued that students can be distracted when not in a classroom setting as e-learning is designed for those who are self-motivated. For those students not self-motivated, or due to the lack of structure, online learning challenges the students responsibility if no face to face with tutors is required or feedback from tutors took time. Howatson-Jones also suggested that the learning on the part of the participants can appear focused on completion rather than exploration of knowledge throughout the online course. Students accessing this type of learning for the first time can find it overwhelming and unsure of the expectations.

Howatson-Jones (2012) concluded that e-learning can be one solution to address the problems of health professionals' having to leave clinical environments to attend in-services education. Integrating e-learning approaches with more traditional approaches makes it possible to reach a wider audience, overcoming some of the geographical challenges while still having face to face interactions (Tsai et al., 2011).

A quasi-experimental study by Sung, Kwon and Kyu (2008) analysed the effects of a blended learning programme on medication administration by new nurses

using a non-equivalent group design. Twenty six nurses received a medication education programme using blended learning (experimental group) and 24 nurses received face to face instruction in a classroom setting (control group). The results showed improved knowledge of medication administration after e-learning education. This was significantly higher in the e-learning group compared to those that had face to face learning in a classroom setting. Six months later retesting of the nurses' perception of their knowledge occurred, and was similar in both groups, however neither group was tested on actual knowledge levels so it is impossible to determine if knowledge was actually sustained over that period of time (Sung et al., 2008). The initial cost of changing current learning packages to e-learning or utilizing a blended learning approach maybe high in terms of both financial and staff resources, but over time this would reduce (Sung et al., 2008).

In Moore (2012) the participants' undertook presentations that assessed their learning as part of blended learning. It was noted that the time taken to observe these presentations could be equaled to the time of the original classroom lecture or longer depending on group sizes. This method of education style and marking could be peer reviewed which may reduce the time requirements (Moore, 2012). However there would still be the need for face to face and practical sessions for certain skill acquisitions and development.

## Summary

The second literature review has explored the use of different methods of education such as, blended learning, e-learning, OSCEs and/or frameworks in other relevant advanced nursing and medical training programmes. All the studies in the second review supported the use of educational frameworks in the initial stages of learning however again shed very little light on the best educational method for sustaining competency. While each style of learning has its benefits there were also challenges.

From the literature reviewed it is suggested that assessing the DNs by working beside them in actual clinical practice is more beneficial than in an artificial environment. Although working more closely with them in clinical practice may cause them to behave differently or add to their stress levels, it could also enable a cohesive partnership which leads to better bandaging techniques and provides a supportive learning and working environment. This type of training also portrays the realities for DNs; that is it occurs with patients with challenging limb shapes who are immobile and geographically dispersed.

E-learning has shown that it is an effective platform to educate and assess competencies. To develop e-learning modules can be costly to set up initially not only in financial terms but also staff resources. Access to e-learning can be limited if there is slow internet access, interruptions within the workplace, and limited access to computers within the workplace especially in the rural settings. The increasing pressure on time and resources warrants the use of this platform

and given the large geographical region would be a tool that would support education delivery to all DNs while reducing travel cost and time. This platform does not support the practical components required to competently bandage however.

The literature supports the use of a blended learning approach as the most suitable model to educate the DNs in compression bandaging, using face to face, practical workshops and e-learning. The development of a pathway for compression bandaging utilising e-learning to examine theoretical knowledge and working alongside in practice could support this skill development and start to sustain these skills long term.

## **Chapter 5: Discussion**

From the literature reviewed in this dissertation, no one method of education has to date successfully shown that clinical competency is sustained post initial certification between reassessments. Several strategies have emerged from both literature reviews that will be explored in this discussion. The initial literature review revealed that clinical competency in compression bandaging was sustained post education from between 2 weeks to 14 weeks but after that, nurses returned to previous bandaging skill and techniques. The studies examining compression bandaging specifically utilised a pressure monitor in conjunction with education but it was not clear if initial improvement was a result of the training itself or from using the pressure monitor as an adjunctive training tool. None of the reviewed studies had a control group so it is difficult to attribute any improved results or change in practice to a specific aspect of the training programme. Additionally, the type of bandage used in clinical practice from the literature review appears not to be an influencing factor on bandage techniques.

It was clear from both reviews however that an educational programme that underpins a clinical competency has shown to increase that clinical knowledge after attending or completing an initial educational programme (Reynolds, 1999). Ongoing educational strategies that meet both professional and personal objectives for the DNs are likely to build on this foundation to enable sustained clinical competency in compression bandaging.



Ongoing, preferably daily, exposure to a clinical experience or skill is needed to reinforce learning and sustain competence. Patients in compression bandaging have their bandages changed twice weekly initially and then weekly which lessens the numbers of bandages a DN could be exposed to. One consideration could be that of having a designated compression bandaging nurse at each base, however due to the large geographical region and that most DNs are part time this is unlikely to meet the needs of the patient population group. Having DNs undertaking compression bandaging for that team or area would be challenging in the more rural regions due to travel and workloads. Alternatively, having DNs attending NP/CNS clinics to increase practice and exposure to bandaging could be a suitable option however with clinics only monthly, this may not be a feasible option either.

The literature suggests the importance of assessing the DNs by working beside them in clinical practice rather than in an artificial environment. Working alongside DNs in the clinical environment aligns with the realities for the DNs and allows for education to take place in the patient's home accommodating some of the challenges and constraints of the home and rural environment. Due to the numbers of DNs and the challenges of the geographical region working alongside DNs in practice this could be undertaken by the NP, CNS and LUANs. Each of the six LUANs work from a regional base so could be utilised to work alongside DNs in practice, thereby reduce the amount of travel that may be required to some of the more remote areas.

## **Implications of findings for practice/education**

The findings of this literature review have implications for District Nurses and nursing practice. The literature showed that a blended learning approach would be the most suitable model to educate the DNs in compression bandaging using face to face, workshops and e-learning. MOODLE has been used by Waikato DHB for a number of years as the learning management system and has started to gain momentum with several specialties already using this for nursing education such as the theoretical components of IV medicine management.

The current workbooks for compression bandaging and wound care could be developed into modules using the MOODLE platform. The introduction of the MOODLE platform would be an effective method when the access to or release from clinical areas to study days is difficult or when compared to that of traditional methods taught at other times such as after work or on weekends. E-learning would overcome some of the challenges of distance learning and allow equal opportunities for DNs within the region.

The literature exploring the use of e-learning with undergraduate students who are not self-motivated suggests that it can be challenging when there is a lack of structure and no face to face opportunity with tutors, or feedback is not given in a timely manner. Practicing nurses however require professional hours or completion of learning requirements as part of their professional development and annual practicing certificate and therefore have different motivation to participate in learning.

The current Compression Bandaging Clinical Competency Programme consists of a theoretical workbook, a two hour practical workshop and clinical skill sign-off. Completion of the programme counts as 8 hours of professional development initially, with an additional 2 to 4 hours required every 3 years. The transfer of this programme to e-learning could come with similar hours attached and also be available as refresher applications yearly, allowing nurses to keep up to date with current research practice and theoretical components of venous leg management. Participation and completion of modules could be linked to the DNs annual performance reviews.

In order for a clinical skill to be sustained, the skill needs to be done daily. Thus while regular application of compression bandaging is beneficial, it is only beneficial if actually applied correctly, with the appropriate tension, bandage type and size. A pressure monitor during training and subsequent assessment may be a more reliable measure of individual clinical competence and may be worth exploring. A practice portfolio could also assist in maintaining a record of development and achievement (Anderson, 2003). A template could be developed to support this process with DNs recording the number of compression bandages they apply per week and include a peer review. The LUANs have to complete 10 leg ulcer assessments per month to maintain clinical competency. A similar format could be explored for the DNs.

The use of electronic devices as an adjunct to practice is increasing. Rural and Community services recently trialled iPads in the community. The goals of this

trial included improved time management, access to resources, improved referral pathways, and use of global position system (GPS). Whilst tools such as iPads give the DNs access to DHB systems, this technology could facilitate educational applications so that DNs could access these when out in clinical practice. Mini tutorials could include different bandaging techniques and refreshers on anatomy and physiology of the circulation of the lower leg for example. While the iPad may not become a reality in practice in the short term, having the resources available on standard computers would still have an important role to play so that all DNs have access to online learning tools including initial assessment and examinations.

In leg ulcer management, nurses are required to have not only hands on skills but also the cognitive skills to make clinical decisions. The framework developed for the recertification of the LUAN s continues to produce favourable results and sustain clinical skill and acquisition between yearly recertification. It had been the original thought of the author that this could be adapted for compression bandaging however this would not be a feasible option given the size of the region, workloads, DN numbers and CNS resources. However using a blended learning framework and developing a pathway to work beside the DNs in practice in conjunction with the LUANs may provide a supportive environment for the DNs.

## **Implications of findings for research**

There are implications of the findings for future research. Changes to the current education strategies for applying compression bandaging and skill development for DNs would require evaluation to ascertain if implementing and utilising a blended learning approach actually improves clinical competency long term. Previous studies showed sustainability in clinical skill up to 14 weeks post training. Any further research would need to assess if competency was sustained over a longer period.

A method of assessing if competency is sustained once the blended learning approach is implemented would be to monitor healing rates of patients in compression bandaging. Patients in bandaging at 12 weeks with a wound that has reduced by 50% would suggest that compression bandaging is being applied effectively. This however is related to a patient's episode of care and comorbidities and not directly to the individual DNs applying the bandaging. Future research is needed which explores the impact of patient co-morbidities such as hypertension, obesity and age related factors on wound healing and venous leg ulcer management.

Two bandaging systems are currently in use at Waikato DHB for the management of uncomplicated venous leg ulcers. While the literature indicated that the type of bandage used in clinical practice was not an influencing factor there is cause to consider having just one type of bandage. Undertaking a cost benefit analysis would give base line figures on spend and usage. If there were

cost savings to be made then further evaluation would need to be undertaken to establish if a single bandage system reduced treatment time for patients with better compression application, produced better health outcomes and reduced health costs.

## **Conclusion**

Compression bandaging is a fundamental part of venous leg ulcer treatment. It is a core clinical skill required of district nurses working in community settings.

From the literature reviewed, no one method of education to date has successfully shown that clinical competency is sustained post initial certification between reassessments. There was not one educational programme or strategy that could be put in place that would ensure that clinical competency in compression bandaging was sustained over a long period of time. There is however evidence suggesting that a blended learning approach might lead to sustained clinical competency in compression bandaging.

Anderson (2003) suggests that the true outcome of any education is the extent to which the learner builds on learnt skills and applies this into practice. In wound care however, one could also argue that a true outcome would be improved healing rates and a decreased length of treatment within a clinical service. The programme which is developed needs to not only address the educational input, but also monitor and evaluate for successful health outcomes. Healing rates are the most important outcome measure in relation to leg ulcer management for both patients and health care organisations.

The results of this literature review can be developed into practice using a blended learning approach including face to face, practical workshops and e-learning. This new knowledge provides a way forward in the education framework for compression bandaging for DNs working in the community to sustain their clinical competency following initial training and will address some of the challenges faced with providing education within a large geographical region.

Looking forward to the future, the development of a Midland CNS group could be beneficial once the e-learning platform is developed. This group, instead of each DHB working in isolation, could jointly implement and develop a regional e-learning framework for all DNs within the Midland region in leg ulcer management. The management of venous leg ulcers is similar within New Zealand therefore if this framework is successful the potential for other DHBs is significant.

## **References**

- Akobeng, A.K. (2005). Principles of evidence based medicine. *Arch Dis Child* 90 837-840  
Retrieved May 11 2014 from  
<http://adc.bmj.com/content/90/8/837.full.html#ref-list-1>
- Al Khaburi, J.A.J. (2010) Pressure Mapping of Medical Compression Bandages Used for Venous Leg Ulcer Treatment PhD thesis University of Leeds Retrieved June 16 from <http://etheses.whiterose.ac.uk/id/eprint/3386>
- Anderson, I. (2003). Developing a framework to assess competence in leg ulcer care. *Professional Nurse*, 18(9), 518-522.
- Australian and New Zealand Resuscitation Guidelines 2013 Retrieved 26 May from [www.nzrc.org.nz](http://www.nzrc.org.nz)
- Australian and New Zealand Clinical Practice Guideline for Prevention and Management of Venous Leg Ulcers (2011) Cambridge Publishing.
- Baranoki, S. & Ayello, E. A. (2012). *Wound care essentials: Practice principles* (3rd ed.). Philadelphia PA: Lippincott Williams & Williams.
- Bartkowiak, B.A., (2005). Searching for Evidence-Based Medicine in the Literature Part 3: Assessment. *Clinical Medicine & Research*, 3(2), 113-115.  
<http://www.clinmedres.org>
- Beavis, J., Morgan, J., & Pickering J. (2012). Testing nursing staff competencies using an online education module. *Renal Society of Australasia Journal*, 8 (1), 31-36.
- Beldon, P. (2008). Compression bandaging: avoiding pressure damage. *British Journal of Community Nursing*, S6-S14.
- Betts, J. A. (2005). Establishing and evaluating a Nurse Practitioner Leg ulcer Clinic: The Journey. Portfolio University of Auckland.
- Brosnan, M., Evans, W., Brosnan, E., & Brown, G. (2006). Implementing objective structured clinical skills evaluation (OSCE) in nurse registration programmes in a centre in Ireland: A utilization focused evaluation. *Nurse Education Today*, 26, 115-122.
- Burns, N & Grove, S.K. (2011). *Understanding Nursing Research* (5<sup>th</sup> ed.). United States of America: Saunders, an imprint of Elsevier Inc.
- Callam, M., Ruckley, C., Harper, D., & Dale, J. (1985). Chronic ulceration of the leg: extent of the problem and provision of care. *British Medical Journal (Clinical Research Edition)*, 290, (6485), 1855-1856.
- Clark, S., McDonald, S., & Rainey, D. (2012). Assessing registered nurses' clinical skills in orthopaedics. *Nursing Standard*, 26(43), 35-42.



- Cook, N. F., McAloon, T., O'Neill, P., & Beggs, R. (2012). Impact of a web based interactive simulation game (PULSE) on nursing students' experience and performance in life support training - A pilot study. *Nurse Education Today*, (32), 714-720. doi: 10.1016/j.nedt.2011.09.013
- Cooke, A., Smith, D., & Booth, A. (2012). Beyond PICO. The SPIDER tool for Qualitative Evidence Synthesis *Qualitative Health Research*, 20(10), 1435-1443. Retrieved July 1, 2014 from <http://qhr.sagepub.com/content/22/10/1435>
- Cowan, D.T., Norman, I., & Coopamah, V.P. (2005). Competence in nursing practice:a controversial concept – A focused review of literature. *Nurse Education Today*, 25, 355-362. doi: 10.1016/j.nedt.2005.03.002
- Critical Appraisal Skills Programme (CASP). (2013). *10 questions to help you make sense of reviews*. Creative Commons Attribution. Retrieved July 29, 2013 from <http://www.casp-uk.net>.
- Davies, K.S. (2011). Formulating the Evidence Based Practice Question: A Review of the Frameworks. *Evidence Based Library and Informaiton Practice*, 6.2 <http://creativecommons.org/licences/by-nc-sa/2.5/ca/>
- European Wound Management Association (EWMA). Understanding compression therapy. Position document. London, MEP Ltd, 2003.
- Feben, K. (2003). How effective is training in compression bandaging technique? *British Journal of Community Nursing*, 8(2), 80-84.
- Flanagan, M. (2013). *Wound Healing and skin intergrity: priniciples and practice*. Chichester UK: John Wiley & Sons Ltd.
- Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Educaton*, 7, 95-105. doi: 10.1016/j.iheduc.2004.02.001
- Hafner, J., Luthi, W., Hanssle, H., Kammerlander, G., & Burg, G. (2000). Instruction of Compression Therapy by Means of Interface Pressure Measurement. *Dermatol Surg*, (26), 481-487.
- Hodges, B. (2003). Validity and the OSCE. *Medical Teacher*, 25(3), 250-254. doi:10.1080/1421590310001002836
- Howatson-Jones, I.L. (2012). Translating an academic module into an online resource. *Nursing Standard*, 26(31), 44-48
- Jones, S. C., Crookes, P. A., & Johnson, K. M. (2011). Teaching critical appraisal skills for Nursing research. *Nurse Education in Practice*, 327-332.
- Kaminski, (2005). Moodle: a user friendly, open source course management system. *Online Journal of Nursing Informatics* 9 (1) (online) Retrieved June 6 2014 from [http://ojni.org/9\\_1/talktech.htm](http://ojni.org/9_1/talktech.htm) Teaching critical appraisal skills for Nursing research.

- Keller, A., Muller, M. L., Calow, T., Kern, I. K., & Schumann, H. (2009). Bandage pressure measurement and training: simple interventions to improve efficacy in compression bandaging. *International Wound Journal*, 6(5), 324-330.
- McCambridge, J., Witton, J., & Elbourne, D. R. (2014). Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. *Journal of Clinical Epidemiology*, 67, 267-277. doi:10.1016/j.jclinepi.2013.08.015
- McMullan, M., Endacott, R., Gray, M. A., Jasper, M., Miller, C. M. L., Scholes, J., & Webb, C. (2003). Portfolios and assessment of competence: a review of the literature. *Journal of Advanced Nursing*, 41(3), 283-294.
- McWilliam, P. L., Botwinski, C. A. (2005). Identifying Strengths and Weaknesses in the Utilization of Objective Structured Clinical Examination (OSCE). *Nursing Education Perspectives*, 33(1), 35-39.
- Miller, S., & Forrest, J. (2001). Enhancing your practice through evidence-based decision making: PICO, learning how to ask good questions. *Journal of Evidence Base Dental Practice*, 1(2), 136-141. doi: 10.1016/s1532-3382(01)70024-3
- Miller, S., & Forrest, J. (2009). Translating Evidence-Based Decision Making into Practice: Appraising and Applying the Evidence. *Journal of Evidence Base Dental Practice*, 9, 164-182. doi: 10.1016/j.jebdp.2009.05.001
- Moffatt, C & Dorman, M. (1995). Recurrence of leg ulcers within a community leg ulcer service. *Journal of Wound Care*, 4(2), 57-61.
- Moloney, M. C., & Grace, P. (2004). Understanding the underlying causes of chronic leg ulceration. *Journal of Wound Care*, 13(6), 215-218.
- MOODLE, (2014) Moodle 2014 (Online) <http://moodle.org>
- Moore, S. (2012). Is it time for blended learning? *British Journal of Midwifery*, 20(11), 812-816
- Moule, P., Albarran, J. W., Bessant, E., Brownfield, C., & Pollock, J. (2008). A non-randomized comparison of e-learning and classroom delivery of basic life support with automated external defibrillator use: A pilot study. *International Journal of Nursing Practice*, (14), 427-434. doi: 10.1111/j.1440-172X.2008.00716.x
- Nelson, E. A., Ruckley, C. V., & Barbenel, J. C. (1995). Improvements in bandaging technique following training. *Journal of Wound Care*, 4(4), 4.
- Nelson, E., Cullum, N., & Jones, J. (2006). Venous leg ulcers. *British Medical Journal (Clinical Research Edition)*, 332(11), 1447-1452.
- New Zealand Nursing Council Competencies for registered nurses (2007) Retrieved June 25 2014 from <http://www.nursingcouncil.org.nz>

- O'Meara, S., Cullum, N., Nelson, E.A. & Dumville, J.C. (2012). Compression for venous leg ulcers. Cochrane Database of Systematic Reviews. CD000265. DOI: 10.1002/14651858.
- Patel, M., Oosthuizen, G., Child, S., & Windsor, J.A. (2008). Training effect of skills courses on confidence of junior doctors performing clinical procedures. *The New Zealand Medical Journal*, 121 (1275). ISSN. 1175 8716.  
[http://www.nzma.org.nz/journal/121\\_1275/3085/](http://www.nzma.org.nz/journal/121_1275/3085/)
- Petit dit Dariel, O., Wharrad, H., & Windle, R. (2012). Exploring the underlying factors influencing e-learning adoption in nurse education. *Journal of Advanced Nursing*, 69(6), 1289-1300. doi: 10.1111/j.1365-2648.2012.06120.x
- Pifer, G.(2000). Casting and Splinting: Prevention of Complications. *Topics in Emergency Medicine*, 22(3), 48-54
- Redd, M. L., & Alexander, J. W. (1997). Does Certification Mean Better Performance? *Nursing Management*, 28(2), 45-50.
- Reynolds, S. (1999). The impact of a bandage training programme. *Journal of Wound Care*, 8(2), 55-60.
- Rippon, M., Davies, P., White, R., & Bosanquet, N. (2007). The economic impact of hard-to-heal leg ulcers. *Wounds UK*, 3(2), 58-69
- Ross, M., Carroll, G., Knight, J., Chamberlain, M., Fothergill-Bourbonnais, F., & Linton, J. (1988). Using the OSCE to measure clinical skills performance in nursing. *Journal of Advanced Nursing*, (13), 45-56.
- Rubinfeld, M. G., & Scheffer, B. K. (2006). *Critical Thinking Tactics for Nurses Tracking, Assessing, and cultivating thinking to improve competency-based strategies*. Massachusetts, Jones and Bartlett Publishers.
- Rushforth, H.E. (2006). Objective structure clinical examination (OSCE): Review of literature and implications for nursing education. *Nurse Education Today*, 27, 481-490.
- Schuren, J., & Mohr, K. (2008). The efficacy of Laplace's equation in calculating bandage pressure in venous leg ulcers. *Wounds UK*, 4(2), 38-47.
- Schardt, C., Adams, M.B., Owens, T., Keitz, S., & Fontelo, P. (2007). Utilization of the PICO framework to improve searching PubMed for clinical questions. *BMC Medical Informatics and Decision Making*, 7(6), 1-6. doi: 10.1186/1472-6947-7-16
- Seeley, M. A., & Harding, K.G. (2008). The effects of education and training on clinical practice in wound healing. *International Wound Journal*, 5(5), 660-664.
- Seif, G.A., Brown, D., & Annan-Coultas, D. (2013). Fostering Clinical-Reasoning Skills in Physical Therapist Students Through an Interactive Learning Module Designed in the Moodle Learning Management System. *Journal of Physical Therapy Education*, 27(3), 32-40

- Statistics New Zealand (2013) *National Population Estimates* Retrieved March 31 2014 from <http://www.stats.govt.nz>
- Stolarek,P. (2007). Procedural and examination skills of first-year postgraduate doctors do not improve with clinical experience alone. *The New Zealand Journal* 120(1253) ISSN 1175 8716 <http://www.nzma.org.nz/journal /120-1253/2515/>
- Sung Y.H., Kwon, I. G., & Ryu, E (2008). Blended learning on medication administration for new nurses: Integration of e-learning and face-to-face instruction in the classroom. *Nurse Education Today*, 28(8), 943-952. Doi: 10.1016/j.nedt.2008.05.007
- Sustain. (2014). In *Oxford English online dictionary* (3<sup>rd</sup> ed.). Retrieved June 6 from <http://dictionary.oed.com>
- Sustainability. (2014). In *Oxford English online dictionary* (3<sup>rd</sup> ed.). Retrieved June 6 from <http://dictionary.oed.com>
- Taylor, A. D., Taylor, R. J., & Said, S. S. S. (1998). Using a bandage pressure monitor as an aid in improving bandaging skills. *Journal of Wound Care*, 7(3), 131-133.
- Templeton, S. (2005). Leg Ulcers. In S.Templeton (Ed.), *Wound Care Nursing A Guide to Practice* (pp. 147-170). China: Ginross Publishing.
- Tomlinson,D. (2004). Paediatric oncology nurse education: the development of a national framework. *Journal of Clinical Nursing*, 13(5), 646-654 doi: 10.1111/j.1365-2702.2004.00917.x
- Todd, M. (2011). Compression bandaging types and skills used in proactical application. *British Journal of Nursing*, 20(11), 681-687.
- Tsai, C-W., Shen, P-D., & Tsai, M-C. (2011). Developing an appropriate design of blended learning with web-enabled self-regulated learning to enhance students' learning and thoughts regarding online-learning. *Behaviour & Information Technology*, 30(2), 261-271. DOI: 10.1080/0144929X.2010.514359
- Valiga, T.M. (2012). Nursing Education Trends Future Implications and Predictions. In M.E.S Glasgow (Eds.) *Clinic review articles nursing clinics of North America New Directions in Nursing Education* (pp423-434). Elsevier, United States of America
- Walker, N., Rodgers, A., Birchall, N., Norton, R., & MacMachon, S. (2002). The occurrence of leg ulcers in Auckland. *The New Zealand Medical Journal*, 159-162.
- Waikato District Health Board - Compression Bandaging Clinical Competency Programme Workbook 2007.
- Waikato District Health Board – Rural & Community Services (Hamilton & Rural Family Health Team) – Service Plan 2011/2012.
- Watson, R., Stimpson, A., Topping, A., & Porock, D. (2002). Clinical competence assessment in nursing: a systematic review of the literature. *Journal of Advanced Nursing*, 39(5), 421-431

Whittmore, R., Knafl, K, (2005). The integrative review: updated methodology. *Journal of Advanced Nursing*, 52(5) 546-553.

Woltering, V., Herrier, A., & Spitzer, K (2009). Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: results of a mixed method evaluation. *Advances in Health Science Education*, 14, 725-738. Doi 10.1007/s10459-009-9154-6

## **Appendix 1 Waikato DHB LUAN Competency Day 2011-2013**

### **Evaluation results**

#### **Results of LUAN study day 2011**

<b>Competency</b>	<b>Incompetent</b>	<b>Marginal</b>	<b>Competent</b>	<b>Mixed</b>	<b>Total</b>
Medical Conditions	0	7	2	0	9
Characteristics of leg	0	2	7	0	9
Characteristics of ulcer	0	4	5	0	9
Pain	0	5	4	0	9
Pedal pulses (palpation)	0	0	9	0	9
ABPI	0	6	3	0	9
<b>Diagnosis</b>					
Scenario One	0	0	7	2	9
Scenario Two	0	3	5	1	9

#### **Results of LUAN study day 2013**

<b>Competency</b>	<b>Incompetent</b>	<b>Marginal</b>	<b>Competent</b>	<b>Mixed</b>	<b>Total</b>
Medical Conditions	0	0	7	0	7
Characteristics of leg	0	0	7	0	7
Characteristics of ulcer	0	0	7	0	7
Pain	0	1	6	0	7
Pedal pulses (palpation)	0	0	7	0	7
ABPI	0	0	7	0	7
<b>Diagnosis</b>					
Scenario One	0	1	5	1	7
Scenario Two	0	4	3	0	7

## Appendix 2 CASP example

Keller, Müller, Cabow, Kern and Schumann (2)  
Bandage Pressure measurement and training ✓  
CRITICAL APPRAISAL SKILLS PROGRAMME  
making sense of evidence

### 12 questions to help you make sense of a cohort study

#### *General comments*

- Three broad issues need to be considered when appraising a cohort study.

*Are the results of the study valid?*

*What are the results?*

*Will the results help locally?*

The 12 questions on the following pages are designed to help you think about these issues systematically.

- The first two questions are screening questions and can be answered quickly. If the answer to those two is "yes", it is worth proceeding with the remaining questions.
- There is a fair degree of overlap between several of the questions.
- You are asked to record a "yes", "no" or "can't tell" to most of the questions.
- A number of italicised hints are given after each question. These are designed to remind you why the question is important. There will not be time in the small groups to answer them all in detail!

CVI = chronic  
venous  
insufficiency

CB = compression  
bandaging

PM = pressure  
monitor  
VLU = venous leg ulcer

A/ Are the results of the study valid?

35-45 mmHg  
optimal

### Screening Questions

<p><b>1 Did the study address a clearly focused issue?</b></p> <p><i>HINT: A question can be focused in terms of:</i></p> <ul style="list-style-type: none"> <li>- the population studied</li> <li>- the risk factors studied</li> <li>- the outcomes considered</li> <li>- is it clear whether the study tried to detect a beneficial or harmful effect?</li> </ul>	<p>Yes <input checked="" type="checkbox"/> Can't tell <input type="checkbox"/> No <input type="checkbox"/></p> <p>subbandage pressure before and after introduction of PM and training was measured 21 nurses</p>
<p><b>2 Did the authors use an appropriate method to answer their question?</b></p> <p><i>HINT: Consider</i></p> <p>pre post 10-14 weeks</p> <ul style="list-style-type: none"> <li>- Is a cohort study a good way of answering the question under the circumstances?</li> <li>- Did it address the study question?</li> </ul>	<p>Yes <input checked="" type="checkbox"/> Can't tell <input type="checkbox"/> No <input type="checkbox"/></p> <p>prospective study subjects measured at variable intervals self report questionnaire - confidence and self perceived competence on applying CB 1-10 scale</p>

✓ Is it worth continuing? 1 = being very confident

### Detailed Questions

<p><b>3 Was the cohort recruited in an acceptable way?</b></p> <p><i>HINT: We are looking for selection bias which might compromise the generalisability of the findings:</i></p> <ul style="list-style-type: none"> <li>- Was the cohort representative of a defined population?</li> <li>- Was there something special about the cohort?</li> <li>- Was everybody included who should have been included?</li> </ul>	<p>Yes <input checked="" type="checkbox"/> Can't tell <input type="checkbox"/> No <input type="checkbox"/></p> <p>21 qualified nurses, from specialist Dermatology clinic, frequently applying high CB for lymphoedema and CVI *small group? reflective of other nurses applying CB in rural setting, isolated practice, access to guidelines, education etc.</p>
--	---



\*multilayer gauze standard vlv

short stretch  
long stretch  
single layer  
multilayer

<p><b>4. Was the exposure accurately measured to minimize bias?</b></p> <p>HINT: We are looking for measurement or classification bias:</p> <ul style="list-style-type: none"> <li>- Did they use subjective or objective measurements?</li> <li>- Do the measures truly reflect what you want them to (have they been validated)?</li> <li>- Were all the subjects classified into exposure groups using the same procedure?</li> </ul>	<p>Yes <input type="checkbox"/> Can't tell <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>Qualified nurses with short 0-2 yrs } professional medium 3-10 yrs } service long 10+ yrs }</p> <p>CB with pressure &lt;70 &gt;60 rated as insufficient between 35-45 mmHg (see CB classification)</p>
<p><b>5. Was the outcome accurately measured to minimize bias?</b></p> <p>HINT: We are looking for measurement or classification bias:</p> <ul style="list-style-type: none"> <li>- Did they use subjective or objective measurements?</li> <li>- Do the measures truly reflect what you want them to (have they been validated)?</li> <li>- Has a reliable <u>system</u> been established for detecting all the cases (for measuring disease occurrence)?</li> <li>- Were the measurement methods similar in the different groups?</li> <li>- Were the subjects and/or the outcome assessor blinded to exposure (does this matter)?</li> </ul>	<p>Yes <input type="checkbox"/> Can't tell <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>*Nurse chose bandaging system not researchers <u>multiple types used</u></p> <p>*Limb shape of patients can influence results - used same participant throughout.</p> <p>Pressure sensor under short stretch bandage only (reflective of practice) 3 consecutive bandages</p>
<p><b>6. A. Have the authors identified all important confounding factors?</b></p> <p>List the ones you think might be important, that the authors missed.</p> <p><b>B. Have they taken account of the confounding factors in the design and/or analysis?</b></p> <p>PM only at B1 (2cms above inner ankle medial aspect lower leg)</p> <p>HINT:</p> <ul style="list-style-type: none"> <li>- Look for restriction in design, and techniques eg modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors</li> </ul>	<p>Yes <input type="checkbox"/> Can't tell <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>General district nursing population</p> <p>Yes <input type="checkbox"/> Can't tell <input type="checkbox"/> No <input type="checkbox"/></p> <p>List: as above</p> <p>efficiency of CB highly depends on skills of those applying it. Use of objective devices to prove that bandage is sufficiently applied are not standard in training</p>

study design  
definition of adequate/insufficient  
compression

7. A. Was the follow up of subjects complete enough?	Yes <input type="checkbox"/>	Can't tell <input checked="" type="checkbox"/>	No <input type="checkbox"/>
B. Was the follow up of subjects long enough?	Yes <input type="checkbox"/>	Can't tell <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<p>HINT:</p> <ul style="list-style-type: none"> <li>- The good or bad effects should have had long enough to reveal themselves</li> <li>- The persons that are lost to follow-up may have different outcomes than those available for assessment</li> <li>- In an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort?</li> </ul>			

9.5% optimal pre  
31.7% optimal post  
**B/ What are the results?**

Followup 10-14 weeks  
17/22 > 10 yrs experience  
less than optimal pressure post training

8. What are the results of this study?	9. How precise are the results?		
<p>HINT:</p> <ul style="list-style-type: none"> <li>- What are the bottom line results?</li> <li>- Have they reported the rate or the proportion between the exposed/unexposed, the ratio/the rate difference?</li> <li>- How strong is the association between exposure and outcome (RR)?</li> <li>- What is the absolute risk reduction (ARR)?</li> </ul>	<p>How precise is the estimate of the risk?</p> <p>HINT:</p> <ul style="list-style-type: none"> <li>- Size of the confidence intervals</li> </ul> <p>Results not what were expected given nurses using pm in practice over 10-14 weeks.</p> <p>They suggest further training to improve the %.</p> <p>? nurses responsibility</p>		
10. Do you believe the results?	Yes <input checked="" type="checkbox"/>	Can't tell <input type="checkbox"/>	No <input type="checkbox"/>
<p>HINT:</p> <ul style="list-style-type: none"> <li>- Big effect is hard to ignore!</li> <li>- Can it be due to bias, chance or confounding?</li> <li>- Are the design and methods of this study sufficiently flawed to make the results unreliable?</li> <li>- Consider Bradford Hills criteria (eg time sequence, dose-response gradient, biological plausibility, consistency).</li> </ul>			

Nurses returning to old practice.

---

*Is it worth continuing?*

---

### C/ Will the results help me locally?

<p><b>11. Can the results be applied to the local population?</b></p> <p><i>HINT: Consider whether</i></p> <ul style="list-style-type: none"> <li>- The subjects covered in the study could be sufficiently different from your population to cause concern.</li> <li>- Your local setting is likely to differ much from that of the study</li> <li>- Can you quantify the local benefits and harms?</li> </ul>	<table border="0"> <tr> <td>Yes</td> <td>Can't tell</td> <td>No</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> <p>What frameworks/tool are best to sustain clinical competency every day</p>	Yes	Can't tell	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes	Can't tell	No					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
<p><b>12. Do the results of this study fit with other available evidence?</b></p>	<table border="0"> <tr> <td>Yes</td> <td>Can't tell</td> <td>No</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> <p>Similar to previous studies using PM</p>	Yes	Can't tell	No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes	Can't tell	No					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

**One observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making.**

**However, for certain questions observational studies provide the only evidence.**

**Recommendations from observational studies are always stronger when supported by other evidence.**

Note: difficult to ascertain but ? only x1 point on kg  
Hafer et al also ? significance

### **Appendix 3 Research exploring compression bandaging technique following initial training**

	<b>Patient Population</b>	<b>Intervention</b>	<b>Comparison</b>	<b>Outcome</b>
Nelson E A 1995	18 Nurses selected from study day	Compression Bandaging	Marked bandages Pressure monitor	Sustained competency at 2 weeks 10/11 91% (11/18)
Taylor et al 1998	16 Nurses Grade D-I	Compression Bandaging	Pressure monitor Education and feedback	Sustained competency at 2-4 weeks 12/14 86% (12/14)
Reynolds S 1999	25 Community nurses	Compression Bandaging	Compression bandaging programme, 4 hour workshop and pressure monitor	Sustained competency bandage A = 44% (8/18) and bandage B = 55% (10/18) at 6 – 10 weeks (18/23)
Hafner et al 2000	156 participants 10 nurses and 10 medical students	Compression Bandaging	Courses on wound healing and individual training Education on interface pressure measurement	10 nurses at 2 weeks – 40.5mmHg 10 Med at 2 weeks – 33.8mmHg Sustained competency at 2 weeks 156 participants – not shown
Keller et al 2009	21 nurses	Compression bandaging	Pressure monitor, training including theoretical and practical	Sustained competency at 10-14 weeks 21/21 82.6%

#### **Appendix 4 Summary of research exploring compression bandaging technique following initial training**

Study	Nelson 1995	Taylor et al 1998	Reynolds 1999		Hafner et al (2000)	Keller et al (2009)
	n/N % with adequate or better bandaging technique				mean range 35-45mmHg	<20 - >60mmHg
			Bandage A	Bandage B		
Pre training/intervention	6/18 (33%)	8/16 (50%)	7/23 (30%)	12/23 (52%)		34.9%
Post training	14/18 (78%)	13/16 (81%)	20/23 (87%)	21/23 (91%)	Nurses = 35.3 mmHg Medical students = 41.3mmHg	17.5%
2-4 weeks	10/11 (91%)	12/14 (86%)			Nurses = 40.5 mmHg Medical students = 33.8mmHg	
6-10 weeks			8/18 (44%)	10/18 (56%)		
10-14 weeks						82.6%

## **Appendix 5 Research exploring clinical competency**

	<b>Reference</b>	<b>Study Design</b>	<b>Sample size</b>	<b>Comments/Key findings</b>
1.	Tomlinson, D. (2004) Paediatric oncology nurse education: the development of a national framework. <i>Journal of Clinical Nursing</i> , 13(5), 646-654 doi: 10.1111/j.1365-2702.2004.00917.x	Project	104 75% return Nurses Postal survey questionnaire	Development of a framework provided ongoing opportunities for continuing professional development within the specialty and was accessible to a wide geographical area
2.	Cook, N.F., McAloon, T., O'Neill, P. & Beggs. R. (2011). Impact of a web based interactive simulation game (PULSE) on nursing students' experience and performance in life support training – A pilot study. <i>Nurse Education Today</i> .32 (2012), 714-720. Doi 10.1016/j.nedt.2011.09.013	Pilot study	34 undergraduate nursing students	A statistically significant difference was found between the competence the groups displayed in the three skill sets of checking equipment, airway assessment and the safe effective use of defib and PULSE was positively evaluated as an educational tool
3.	Moule, P., Albarran, J.W., Bessant, E., Brownfield, C., & Pollock, J. (2008). A non-randomized comparison of e-learning and classroom delivery of basic life support with automated external defibrillator use: A pilot study. <i>International Journal of Nursing Practice</i> 14, 427-434. DOI 10.1111/j.1440-172X.2008.00716.x	Pilot study	83 mental health nurses	No differences were found with basis resus skills or in the time to first shock. E learners performed slightly better in 21 of the 30 observed skills. Overall e learning has potential to prepare learners
4.	Howatson-Jones, I.L. (2012). Translating an academic module into an online resource.	Evaluation	14 Opticians	Translating modules into an online mode requires technical literacy.

	<i>Nursing Standard</i> 26(31) 44-48			Blended learning – face to face and distance learning
5.	Stolarek, P. (2007) Procedural and examination skills of first-year postgraduate doctors do not improve with clinical experience alone. <i>The New Zealand Medical Journal</i> 120 (1253) ISSN 1175 8716 <a href="http://www.nzma.org.nz/journal/120-1253/2515/">http://www.nzma.org.nz/journal/120-1253/2515/</a>	Evaluation Self reporting questionnaires	10 PGY1	Small numbers limit generalization. Improvements were seen and gaps still present at 6 months
6.	Sung Y.H., Kwon, I. G., & Ryu, E (2008). Blended learning on medication administration for new nurses: Integration of e-learning and face-to-face instruction in the classroom. <i>Nurse Education Today</i> 28(8), 943-952. Doi: 10.1016/j.nedt.2008.05.007	Non-equivalent group design	50 nurses	Results suggested that blended learning integrating e-learning and face-to-face instructions in the classroom and is useful for enhancing medication knowledge.
7.	Moore, S. (2012). Is it time for blended learning? <i>British Journal of Midwifery</i> 20(11). 812-816	Case study on blended learning	Midwives	A blended learning approach suggests that group work and presentations promote active learning
8.	Tsai, C-W., Shen, P-D., & Tsai, M-C. (2011). Developing an appropriate design of blended learning with web-enabled self-regulated learning to enhance students' learning and thoughts regarding online learning. <i>Behaviour &amp; Information Technology</i> 30(2), 261-271. DOI: 10.1080/0144929X.2010.514359	Study	Undergraduates	Results indicated that students in the SRL and BL in the online class had the highest scores
9.	Woltering, V., Herrler, A., & Spitzer, K. (2009). Blended learning positively affects students' satisfaction and the role of the	Mixed method evaluation	185 3 <sup>rd</sup> year nursing students 14 tutors	Motivation, subjective learning gains and satisfaction achieved significantly higher ratings by the

	tutor in the problem-based learning process: results of a mixed method evaluation. <i>Advances in Health Sciences Education</i> 14 725-738. DOI 10.1007/s10459-009-9154-6			bPBL compared with the students learning by traditional PBL
10.	Anderson, I. (2003). Developing a framework to assess competence in leg ulcer care. <i>Professional Nurse</i> , 18(9), 518-522.	Article		Development of competency framework for Doppler assessments and compression bandaging.
11.	Watson, R., Stimpson, A., Topping, A., Porock, D. (2002). Clinical competence assessment in nursing: a systematic review of the literature. <i>Journal of Advanced Nursing</i> 39(5), 421-431.	Integrative literature reviews and meta-analyses	107 articles	The assessment of clinical competence remains almost universally accepted in the nurse education literature as a laudable pursuit yet there are aspects of it that remain at odds with the higher education of nurses.
12.	McMullan, M., Endacott, R., Gray, M.A., Jasper, M., Miller, C.M.L., Scholes, J., & Webb, C. (2003). Portfolios and assessment of competence: a review of the literature. <i>Journal of Advanced Nursing</i> 41(3), 83-294.	Literature review	72 articles	The use of portfolios is still evolving, has advantages and disadvantages.
13.	Patel, M., Oosthuizen, G., Child, S., & Windsor, J.A. (2008). Training effect of skills courses on confidence of junior doctors performing clinical procedures. <i>The New Zealand Medical Journal</i> 121(1275). ISSN. 1175 8716 <a href="http://www.nzma.org.nz/journal/121-1275/3085/">http://www.nzma.org.nz/journal/121-1275/3085/</a>	Evaluation	33 junior doctors	Procedural skills course produced a significant increase in confidence in the short term, but this decreased unless there was ongoing clinical experience with the procedure.



14.	Brosnan, M., Evans, W., Brosnan, E., & Brown G. (2006). Implementing objective structured clinical skills evaluation (OSCE) in nurse registration programmes in a centre in Ireland: A utilization focused evaluation. <i>Nurse Education Today</i> 26, 115-122. Doi: 10.1016/j.nedt.2005.08.003	A utilization focused evaluation		OSCE process was found to have a positive impact on stakeholders, seen as fair and meaningful however can be stressful.
15.	Rushforth, H.E. (2007). Objective structure clinical examination (OSCE): Review of literature and implications for nursing education. <i>Nurse Education Today</i> 27, 481-490. Doi: 10.1016/j.nedt.2006.08.009	Narrative review		Offers an attractive option for assessment of practitioner competency
16.	Ross, M., Carroll, G., Knight, J., Chamberlain, M., Fothergill-Bourbonnais, F., & Linton, J (1998). Using the OSCE to measure clinical skills performance in nursing. <i>Journal of Advanced Nursing</i> 13 45-55.	Article		History of the OSCE Overview of OSCE
17.	McWilliam, P.L., Botwinski, C.A. (2005). Identifying Strengths and Weaknesses in the Utilization of Objective Structured Clinical Examination (OSCE). <i>Nursing Education Perspectives</i> 33(1). 35-39.	Evaluation methodology	Undergraduates	Use and evaluation of OSCE in undergraduate degree
18.	Clarke, S., McDonald, S., Rainey, D. (2012). Assessing registered nurses' clinical skills in orthopaedics. <i>Nursing Standard</i> . 26 (43) 35-42	Audit process	Registered nurses	OSCE Limits – need to examine skill retention
19.	Seeley, M.A., Harding, K.G. (2008). The effects of education and training on clinical	Cohort study	Registered nurses	Learning styles OSCE

	practice in wound healing. <i>International Wound Journal</i> 5(5) 660-664		Educational programmes
20.	Hodges, B. (2003). Validity and the OSCE. <i>Medical Teacher</i> 25 (3) 250-254. ISSN 0142-159X print/ISSN1466-187X DOI: 1080/01421590310001002836	Article	OSCE
21.	Petit dit Dariel, O., Wharrad, H., & Windle, R. (2012). Exploring the underlying factors influencing e-learning adoption in nurse education. <i>Journal of Advanced Nursing</i> , 69(6), 1289-1300. doi: 10.1111/j.1365-2648.2012.06120.x	Q-methodology	
22.	Seif, G.A., Brown, D., & Annan-Coultas, D. (2013). Fostering Clinical-Reasoning in Physical Therapist Students Through an Interactive Learning Module Designed in the Moodle Learning Management System. <i>Journal of Physical Therapy Education</i> , 27(3) 32-40		
23.	McCambridge, J., Witton, J., & Elbourne, D.R. (2014). Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. <i>Journal of Clinical Epidemiology</i> , 67, 267-277. doi:10.1016/j.jclinepi.2013.08.015	Systematic review	There appear to be consequences for behaviours being observed however little is known as to their mechanisms of effect or the size of that effect

24.	Kaminski, (2005). Moodle: a user friendly, open source course management system. <i>Online Journal of Nursing Informatics</i> 9 (1) (online) Retrieved June 6 2014 from <a href="http://ojni.org/9_1/talktech.htm">http://ojni.org/9_1/talktech.htm</a> Teaching critical appraisal skills for Nursing research.	Article	Overview of MOODLE
25.	Beavis, J.,Morgan, J., & Pickering J. (2012). Testing nursing staff competencies using an online education module. <i>Renal Society of Australasia Journal</i> , 8 (1), 31-36.	Article	Use of e-learning to update current learning modules
26.	Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. <i>Internet and Higher Education</i> , 7, 95-105. doi: 10.1016/j.iheduc.2004.02.001	Article	E-learning
27.	Cowan, D.T., Norman, I., & Coopamah, V.P. (2005). Competence in nursing practice:a controversial concept – A focused review of literature. <i>Nurse Education Today</i> , 25, 355-362. doi: 10.1016/j.nedt.2005.03.002	Article	
28.	Redd, M. L., & Alexander, J. W. (1997). Does Certification Mean Better Performance? <i>Nursing Management</i> , 28(2), 45-50.	Article	

---