Pressure Injury Prevention and Management

An Exploration of Knowledge and Practice

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Abstract

Objective. The purpose of this study was to explore nursing team members' knowledge and practices related to pressure injury prevention and management.

Sample and Setting: Registered Nurses (n=18), Licensed Practice Nurses (n=66), and Personal Care Attendants (n=36) who work in urban and rural Long Term Care facilities.

Methods. This was a descriptive-exploratory study. Two versions of a Pressure Ulcer Knowledge Questionnaire were used to assess knowledge about pressure injury prevention, management and related policies; one for RNs and LPNs with wound care education (LPNwcs), another for PCAs and LPNs without wound care education (LPNnowcs). Retrospective chart review was used to assess practices related to risk and skin assessments, and implementation of pressure injury prevention interventions.

Results. Knowledge for all nursing team participants was lower than expected. Median scores and ranges were: 1) RNs: 74.5 (59.6 to 83.0) and 2) LPNwcs: 72.0 (53.2 to 80.9). Mean scores and ranges were: 1) LPNnowcs: 78.4 (62.5 to 91.7) and 2) PCAs 75.9 (54.2 to 91.7). Policy knowledge was poor. There was insufficient completion of the Braden Risk Assessments (38.5%), with the most done on admission (76.6%). Fewer than 25% of high risk residents had sufficient interventions and consults documented.

Conclusion. Each nursing group has different learning needs. Recommendations include improving education, auditing with feedback, and tailoring education for individual needs. Organizational support is required. *Key Words. Pressure Ulcer, Pressure Injury, Long Term Care, Braden Scale Risk Assessment, Nursing, Knowledge, Education, and Policy*

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Chapter 1: Introduction

Chapter 1 provides a description of the research problem, as well as the study rationale, framework, and the research questions that guided this study. A brief overview of the study methodology is included with more detail provided in chapter 3.

Background to the Problem

A pressure injury is defined as a localized damage to the skin and/or underlying tissue which is usually over a bony prominence such as elbows, heels, hips, shoulders, sacrum, or the back of the head. A pressure injury is caused by unrelieved and/or intense pressure and may also be the result of unrelieved pressure along with shear. The damage may also be caused by a medical or other device. Microclimate, nutrition, perfusion, comorbidities and soft tissue condition may also affect susceptibility of soft tissue to pressure damage. A pressure injury may present as either intact skin or an open injury and may be painful (National Pressure Ulcer Advisory Panel, 2016).

Since completion of this research study, on April 8 and 9, 2016, the National Pressure Ulcer Advisory Panel replaced the term “pressure ulcer” with “pressure injury” (National Pressure Ulcer Advisory Panel, 2016). Throughout this thesis, the terminology has been changed to reflect the recent changes by the National Pressure Ulcer Advisory Panel (NPUAP) with the exception of its use in the titles on the questionnaires and their content developed for this study, including Pieper’s Pressure Ulcer Knowledge Test.

Studies published from 2004 to 2015, reported prevalence of pressure injuries was variable globally, ranging from 6.7% to 48% in long term care (LTC) settings (Alejezawi, Qadire, & Tubaishat, 2014; Canadian Institute for Health Information, 2016; Frietas et al., 2011; Johansen, Bakken, & Moore, 2015; Moore & Cowman, 2011; Thein, Gomes, Krahn, & Wodchis, 2010; VanGilder, MacFarlane, & Meyer, 2008; Woodbury & Houghton, 2004). In a review of 34 published prevalence studies between 2000 and 2011 examining nursing homes from different countries including 20 from the US, Pieper (2012) found rates to range from 8% to 12%. Prior to the start of this study, the rate of Stage 2 or higher pressure injuries from 2009 to 2010 in St. John's based LTC facilities was 3.87 per 1000 resident care days. This rate did not include Stage 1 pressure injuries (K. Coffey, personal communication, August 12, 2011). Unfortunately, comparison with published rates was not possible because of differences in how rates were reported. Since then however, 13 of Eastern Health's LTC facilities have been reporting Stage 2 to 4 pressure injury prevalence and incidence rates to the Canadian Institute for Health Information (CIHI, 2016). CIHI has national benchmarks set for reporting facilities. In the second and third quarters of 2015-2016, the national prevalence benchmark was 5.5% while the rates for Eastern Health LTC (EHLTC) were 5.5% in the second quarter and 5.7% in the third. The national incidence benchmark for the second and third quarters was 1.7%, while the EHLTC rate was slightly higher at 1.9% for both quarters. Even though the pressure injury prevalence rates for Eastern Health LTC were similar to the national benchmarks, lower rates are desirable given that most are considered preventable (Johansen, Bakken, & Moore, 2015; Sullivan & Schoelles, 2013). The goals should be to keep prevalence and incidence as low as possible and to continuously strive for no occurrences of pressure injuries.

As of 2009, Accreditation Canada identified pressure injury prevention as a required organizational practice (ROP) in the long term care sector (Accreditation Canada, 2010). This ROP was added because the consequences of pressure injuries are numerous and serious. For example, they can lead to hospitalization due to sepsis or the need for surgical repair (Pieper, 2007) or even death (Leijon, Bergh, & Terstappen 2013; Lyder et al., 2012). Because pressure injuries are chronic wounds requiring extensive labor intensive treatment, they impact quality of life for the affected residents and their families (Gist, Tio-Matos, Falzgraf, Cameron, & Beebe, 2009; Jaul, 2010; Registered Nurses Association of Ontario, 2007; White-Chu, Flock, Struck, & Aronson, 2011). Compounding the problem of pressure injuries are the high financial costs associated with treatment. Cano et al. (2015) found that treatment expenses can range from $500 and $70,000 depending on the stage of the pressure injury. Brem et al. (2010) reported that a stage 4 pressure injury can cost $129,000. Costs to treat pressure injuries are estimated to be two to three times higher than the amount for prevention (Schweinberger & Roukis, 2010).

The risk for pressure injury development is determined by both clinical judgment and the use of a risk assessment tool that is valid and reliable such as the *Braden Scale for Predicting Pressure Sore Risk* (European Pressure Injury Advisory Panel-National Pressure Injury Advisory Panel, 2009; Registered Nursing Association of Ontario, 2011). The Braden Scale can be seen in Appendix A. Commonly identified risk factors for pressure injuries include advanced age, immobility related to physical or cognitive impairments, poor nutrition, incontinence, and multiple comorbidities (Garcia & Thomas, 2006; Jaul, 2010; Keast, Parslow, Houghton, Norton, & Fraser, 2006; White-Chu et al., 2011). Such risk factors frequently characterize residents in LTC facilities, making this population particularly vulnerable for the development of pressure injuries (Sprakes & Tyrer, 2010).

Healthcare workers require comprehensive knowledge and skills in the prevention of pressure injuries. Nursing team members such as Registered Nurses (RNs), Licensed Practical Nurses (LPNs), and Personal Care Attendants (PCAs) working daily with residents of LTC settings, should know about risk assessments, skin assessments, appropriate interventions and protocols and the relevant policies and procedures (Jankowski & Nadzam, 2011; White-Chu et al., 2011). This can be achieved with ongoing education about pressure injury prevention and management.

Education has been shown to improve pressure injury knowledge and to contribute to a decrease in pressure injury prevalence and incidence. Research, however, has demonstrated that knowledge and practice gaps exist regarding pressure injury prevention and management in all healthcare settings (Gallant, Morin, St. Germain, & Dallaire, 2010). Identification of knowledge and practice gaps regarding pressure injuries can result in a more tailored and effective educational program that addresses learning needs (Demarré et al., 2011; Kwong, Lau, Lee, & Kwan, 2011; Registered Nursing Association of Ontario, 2011).

The Problem and Rationale for the Study

Prior to this study, in EHLTC, healthcare workers' knowledge regarding pressure injuries had not been formally evaluated. To support Accreditation Canada's Required Organizational Practice of Pressure Injury Prevention as well as relevant Eastern Health (EH) pressure injury policies, pressure injury education was being planned for RNs, LPNs, and PCAs. It was difficult, however, to plan education without a good understanding of levels of knowledge and practices of LTC nursing staff related to pressure injuries.

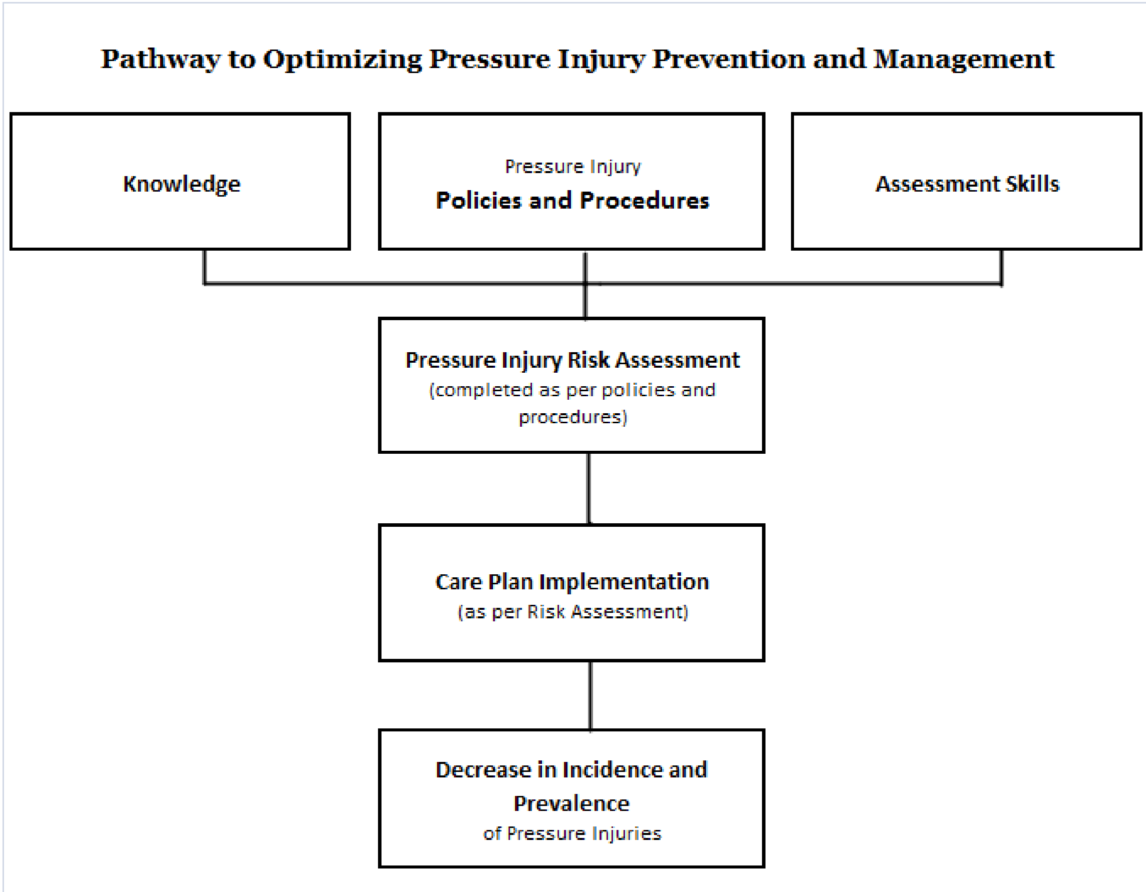
At the time of the study, a skill mix model of care was being phased in across all EHLTC sites. As part of this skill mix model of care there was scope of practice changes for the RNs, LPNs, and the PCAs. This skills mix had major implications for the LPNs' scope of practice. The expansion in the scope of practice involved upskilling LPNs in wound care. Prior to the implementation of the skills mix model of care, some LPNs either had very limited education in wound care or had not been doing wound care in practice even if they received the relevant education in their formal training. LPNs who were identified to need wound care education were expected to complete a wound care learning module through the Centre for Nursing Studies. Consequently, some LPNs at the time of this study were competent in wound care, while other still were not. Daily skin assessments were completed by PCAs and LPNs, while RNs and qualified LPNs (LPNs who completed wound care education) were responsible for Braden Scale risk assessments and care planning. More specific details regarding the levels of responsibility and the skill mix structure can be found in Appendix B.

In light of numerous nursing staff of varying levels and role expectations in EHLTC, it was expected that their knowledge base was diverse and broad. Each team member must possess the appropriate level of knowledge. For this reason, a strategic comprehensive educational approach must ensure that a wide range of learning needs related to pressure injuries are addressed. Therefore, the aim of this study was to explore their knowledge and practice. Results from this study can enhance understanding of knowledge and practice gaps.

Study Framework

Figure 1 shows the logic model used to guide this study. It illustrates a pathway to optimizing pressure injury prevention and management. As the model shows, nursing team members need knowledge about pressure injuries and skills related to assessment. The nursing team must be aware of and guided by organizational policies and procedures related to pressure injuries. They must conduct risk assessments at the appropriate times using a valid and reliable tool. Interventions should be incorporated into the plan of care and implemented. When the pathway as outlined in Figure 1 is followed, pressure injury risks can be minimized, averting the development of a pressure injury.

Figure 1. Pathway to Optimizing Pressure Injury Prevention and Management



The pathway outlined in Figure 1 requires a collaborative approach that is strengthened by ongoing communication and documentation among all involved healthcare workers. Documentation supports and validates any communication concerning the risk assessment and pressure injury prevention interventions put in place for a resident. It provides a record so that staff can be aware of a resident's status and pressure injury risk while ensuring consistency in the provision of the needed care. Documentation is part of the foundation upon which a care plan is developed, readjusted, and evaluated (Association of Registered Nurses of Newfoundland and Labrador, 2010; Navuluri, 2000; Taylor, 2003).

This logic model was used as the framework for this study. The model not only shows what needs to occur to optimize pressure injury prevention and management, but it can also be used to identify gaps. Even though assessment of knowledge is needed, this model is an important tool that illustrates other areas for evaluation and possible action.

Study Purpose and Questions

When gaps at any point in the pathway model occur, barriers are created that prevent optimal pressure injury prevention and management. This study was intended to explore the existing knowledge and practices of nursing staff in LTC related to pressure injuries which in turn can expose any gaps in these areas that may hinder optimal care. By identifying where in the pathway there are gaps, we can be better positioned to address those gaps. For example, if the practices indicated that risk assessments and reassessments were not conducted at the recommended intervals, then a strategy can be developed to build reminders into the care planning system. Such a strategy can strengthen practices related to pressure injuries and eliminate a gap in the pathway to optimal care.

At the time of this study, organizational policies were in place for EHLTC that required completion of pressure injury risk assessment using the Braden Scale, daily skin inspections, along with recommended care plan interventions. Even though appropriate policies were in place and occurrences of pressure injuries were obtained as quality indicators, little was known regarding nursing knowledge and application of these policies or their content. Effective implementation of such policies would depend on nursing team members knowing about the policies and how to apply them. Policies and awareness of them are not enough to ensure good pressure injury prevention and management. Nursing team members also need sufficient knowledge and skills so that they can practice to their scope of practice as expected in each of their respective roles. This study addressed the following seven research questions:

1. What is the level of knowledge of EHLTC RNs and LPNs who have completed education in wound care with respect to pressure injury prevention, assessment, and management?
2. What is the level of knowledge of EHLTC PCAs and LPNs who have not completed education in wound care with respect to pressure injury prevention and assessment?
3. What learning needs do staff members perceive they have related to pressure injury prevention, assessment, and management?
4. Do RNs and LPNs who have completed education in wound care know when the Braden Risk Assessment is to be used as per EH policies?
5. What are the practices of EHLTC PCAs and LPNs who have not completed education in wound care with respect to skin assessments?
6. Were initial Braden Skin Risk Assessments and reassessments documented at the right times as per policy for residents in EHLTC sites?

7. Were interventions incorporated into the plan of care that reflected the Braden Scale score for the residents of EHLTC?

Study Methodology

This was a descriptive-exploratory study that assessed knowledge and practices related to pressure injuries by: 1) assessing the knowledge of the four groups of nursing staff based on education related to wound care, and 2) reviewing practices related to appropriate completion and implementation of the Braden Scale risk assessment for residents in EHLTC.

To fully assess the knowledge of nursing staff related to pressure injuries, a multi-part Pressure Ulcer Knowledge Questionnaire was administered to nursing staff. The questionnaires included the Pieper's Pressure Ulcer Knowledge Test for RNs and LPNs with wound care education (LPNwcs) or a condensed version for PCAs and LPNs without wound care education (LPNnowcs). Additional questions were included related to assessment, prevention and policy knowledge as well as items related to perceived learning needs and preferences. To evaluate practices related to pressure injury prevention, a retrospective chart review was completed using a Pressure Ulcer Risk Assessment Audit Tool, developed by the researcher. The methods are described in detail in Chapter 3 and the results are described in Chapters 4 and 5.

Chapter 2: Literature Review

This chapter provides an overview of the literature relevant to this study. It begins with a brief summary of search methods used, the definition of a pressure injury and an introduction to the problem. To elucidate the extent of pressure injuries in healthcare facilities, available prevalence and incidence data and the consequences of pressure injuries are presented. Next, to help understand the implications for the assessment, management, and prevention of pressure injuries, the pathophysiology and risk factors are discussed. A summary of the literature findings regarding recommendations for assessment, management, and prevention of pressure injuries are then provided. As the focus of this study was to explore knowledge and practices of LTC nursing staff related to pressure injuries, in order to address any gaps, this review will conclude with a summary of research studies demonstrating knowledge deficits and the effectiveness of pressure injury prevention education.

Literature Review Methods

Sources of literature were online journal databases, the Google search engine, and websites and textbooks relating to wound care. The references of journal articles and book chapters were also searched.

For this literature review, an online search of both the PubMed and CINAHL databases, as well as the internet using the Google search engine, was conducted for the years from 2005 to July, 2011. A subsequent search was repeated after the data analysis, using the same methods to extend the search timeline to April, 2016. Some key search terms included “nursing homes”; “long term care”; “older adult”; “elderly”; “pressure ulcer education”; “pressure ulcer prevention”; “pressure ulcer intervention”; “Braden scale”; “pressure ulcer needs assessment”; “pressure ulcer stage 1”; “prevalence and incidence of pressure ulcers in nursing homes”; “pressure ulcer treatment”; “pressure ulcer knowledge”; and “pressure ulcer risk factors”. Searches were limited to English language publications and research involving humans only. After a review of the abstracts, pertinent articles were selected. Reference lists were searched in the selected articles for any additional relevant literature that did not show up in the original searches. All selected articles were then obtained from the e-journals or requested via interlibrary loan.

Websites related to wound care, pressure injury prevention and best practices were searched for guidelines, definitions, and recommendations pertaining to management of pressure injuries in long term care settings. The websites reviewed included the Canadian Association of Wound Care (CAWC), the National Pressure Injury Advisory Panel (NPUAP), the Registered Nurses’ Association of Ontario (RNAO), Accreditation Canada, and the National Guideline Clearinghouse.

Introduction to the Problem

Pressure injuries are chronic wounds requiring extensive labor intensive treatment that is costly while impacting quality of life for the affected residents and their families (Gist et al., 2009; Jaul, 2010; RNAO, 2011; White-Chu et al., 2011). According to the substantial amount of literature located pertaining to prevention, management, and treatment of pressure injuries, it is clear that pressure injuries have been recognized as a serious complex problem requiring attention. Pressure injury prevention requires interventions from multiple disciplines. Prevention is best achieved within an organizational culture that promotes coordinated teamwork and communication, as well as individual expertise (RNAO, 2011; White-Chu et al., 2011).While a system focus can optimize pressure injury prevention, the appropriate knowledge and skill of frontline nursing staff are crucial (Alejezawi, Qadire, & Tubaishat, 2014; Lyder & Ayello, 2008; McIntyre, May, & Marks-Maran, 2012).

Most pressure injuries are considered preventable, however some may be unavoidable. A pressure injury that develops even though all appropriate preventative interventions have been implemented is considered unavoidable. Also the development of a pressure injury under certain circumstances may be considered unavoidable, such as when movement is restricted due to hemodynamic instability, or when appropriate nutrition and fluid intake is not possible, or at the end of life, or when factors hinder preventative measures (RNAO, 2016).

Despite the unavoidability of some pressure injuries, the majority are preventable and if frontline nursing team members do not have sufficient knowledge about the causes, risk factors, and preventative measures, preventable pressure injuries will occur (Altun & Zencirci, 2011; Fife et al., 2010). Frontline nursing team members in LTC are an important group involved in pressure injury prevention. With adequate knowledge and skills, along with clear team communication, the nursing team can implement strategies so that development of pressure injuries can be averted or if a pressure injury develops, it can be correctly staged and treated (Doughty, 2004; Gunningberg & Ehrenberg, 2013; White-Chu et al., 2011). Because frontline nursing staff members provide direct day to day care for residents in LTC, they are in a very strategic position to complete risk assessments, recognize those who are at risk, and initiate interventions as needed (Demarré et al., 2011). Consequently, frontline nursing staff members require adequate ongoing education regarding pressure injury prevention and management so that optimal care is provided. Education should be tailored to meet the learning needs of those on the nursing team, thus, it is beneficial to understand their level of knowledge (Miyazaki, Caliri, dos Santos, 2010). Best practice guidelines for prevention, treatment and management have been developed by various healthcare professional organizations such as the European Pressure Injury Advisory Panel and National Pressure Injury Advisory Panel (EPUAP & NPUAP, 2009) and the RNAO. However, such guidelines must be translated into practice to be effective (Rapp et al., 2010).

This literature review revealed that among studies completed to determine pressure injury knowledge of nursing staff, from the past to the present, a deficit persists globally (Altun & Zencirci, 2011; Briggs, 2006; Gunningberg et al., 2013; Jones, Young, & Liptrot, 2003; Miyazaki et al., 2010; Pancorbo-Hidalgo, García-Fernández, López-Medina, & López-Ortega, 2007; Qaddumi & Khawaldeh, 2014; Sinclair et al. 2004). Other studies have shown that educational interventions have been effective at improving pressure injury knowledge while decreasing incidence (Bergquist-Beringer et al., 2009; RNAO, 2011; Sprakes & Tyrer, 2010; Young, Ernsting, Kehoe, & Holmes, 2010).

Additionally, there have been studies examining multicomponent quality initiatives that have had some success in improving pressure injury related outcomes (Cano et al., 2015; Hanna-Bull, 2016; Howe, 2008; Sinclair et al., 2004; Sprakes & Tyrer, 2010; Young, Ernsting, Kehoe & Holmes, 2010). Before discussing these studies, the definition of a pressure injury and additional background information will be reviewed.

Pressure injury definition. A pressure injury is defined as a localized damage to the skin and/or underlying tissue which is usually over a bony prominence. It is caused by intense or unrelieved pressure and may also be the result of unrelieved pressure along with shear. Damage may also be the related to a medical or other device. A pressure injury appear on intact skin or be an open ulcer and may be painful. Soft tissue susceptibility to pressure may be affected by factors such as microclimate, nutrition, perfusion, co-morbidities, and skin condition (NPUAP, 2016; RNAO, 2016).

The NPUAP developed a staging system to identify the level of tissue destruction or involvement. Staging ranges from stage 1 to 4, from least severe to most severe as well as two other classifications labeled “deep tissue injury” and “unstageable”. The pressure injury is identified by the highest stage at which it developed (NPUAP, 2016; RNAO, 2016). With early recognition and timely interventions, Stage 1 pressure injuries are more amenable to healing than other stages (Aydin & Karadağ, 2010; Vanderwee, Grypdonck, De Bacquer, & Defloor, 2009). As of April 8-9, 2016, the NPUAP changed staging labels from Roman numerals to Arabic numbers and omitted the word “suspected” from the stage labeled “suspected deep tissue injury”. Staging terminology has been adjusted in this thesis report to reflect the NPUAP's changes with the exception of wording in the questionnaires developed and used for this study. More detailed definitions of each pressure injury stage can be seen in Appendix C.

Staging of pressure injuries is a tool to help healthcare team members identify the extent of tissue injury. Staging is also a method that, when used appropriately by health care providers, can ensure use of standard terminology when identifying pressure injuries. Staging can enhance and guide appropriate management while evaluating for improvement or deterioration. Nursing team members require knowledge of the differing stages of pressure injuries in order to accurately identify, describe and document using standard terminology (RNAO, 2007).

Prevalence and incidence of pressure injuries. There are multiple prevalence and incidence rates cited in the literature. Prevalence captures the picture of the number of pressure injuries that exist at a particular point in time or period of time (RNAO, 2011). Prevalence does not reveal how or why pressure injuries develop (Moore & Cowman, 2011). However, prevalence surveys may be a useful method in establishing benchmarks, either for a single unit or facility or against national rates (VanGilder, Amlung, Harrison, & Meyer, 2009). In comparison, incidence data indicate the number of persons who acquired a new pressure injury in a specified time period; it can help determine the number of health care associated pressure injuries. Incidence rates are useful, especially when used in conjunction with prevalence rates. Use of both prevalence and incidence results can lend insight into the breadth of the problem (RNAO, 2011).

Results from prevalence and incidence surveys can guide quality improvement initiatives and resource utilization strategies (VanGilder et al., 2009).

Even though prevalence and incidence surveys are useful, comparability of results between healthcare settings can be difficult due differing methodologies (RNAO, 2011). The Canadian Institute for Health Information (2013) has identified issues related to evaluating prevalence and incidence results. One issue is that inconsistencies may be found in collection of data as well as with identification and classification of pressure injuries. For example stage 1 pressure injuries may or may not be included in many prevalence studies due to the difficulty in identifying and staging them, and therefore, the actual problem may be underestimated. Furthermore, Stage 1 pressure injuries if not recognized may progress to higher-staged pressure injuries (CIHI, 2013; RNAO, 2016). Other inconsistencies may include varying prevalence time periods and differing settings and populations. Another issue is that data collection and documentation are also dependent on the skill of those completing assessments. Baharestani et al. (2009) suggested that there is a need for awareness of shortcomings in evaluating, interpreting and comparing prevalence and incidence of pressure injuries. Improvements are needed in standardizing pressure injury prevalence and incidence study methodologies. The results of such studies along with rates of facility acquired pressure injuries are widely used as quality indicators in health care settings (Baharestani et al., 2009; Berlowitz, 2014; Simon, Bergquist-Beringer, Gajewski, & Dunton, 2010).

For this literature review, prevalence and incidence studies were limited to Canadian LTC settings. However, a summary of prevalence and incidence from the

United States (US) and overseas was included to provide context as to the breadth of the problem of pressure injuries on a global level.

Prevalence. Even though, not recent, the most commonly cited Canadian pressure injury prevalence rates were published in a review of 45 studies that surveyed over 14,000 patients across the country (Woodbury & Houghton, 2004). The data were obtained from various healthcare settings which were identified as 18 acute care facilities, 23 non-acute care facilities (sub-acute care, chronic care, complex continuing care, long-term care, and nursing home), 19 mixed health settings (settings that consisted of a mixture of acute, non-acute, and/or community care delivery models), and five community care agencies. Overall, the review showed that the prevalence of pressure injuries across all healthcare facilities was 26% (95% CI, 25.2% to 26.8%). It was estimated that 25% (95% CI, 23.8% to 26.3%) of acute care patients had a pressure injury while the rate was higher in non-acute care at approximately 30% (95% CI, 29.3% to 31.4%). In mixed healthcare areas, the rate was roughly 22% (95% CI, 20.9% to 23.4%), while it was 15% (95% CI, 13.4% to 16.8%) in community care. In summary, the highest rate was 30% in non-acute care settings which included LTC settings, revealing a concerning estimate.

Woodbury and Houghton (2005) identified that estimates of pressure injuries for acute and non-acute care facilities were not available for the Prairie Provinces, creating a regional gap in available data for their review. They identified several other limitations in the review. The term for healthcare facilities with non-acute patients had evolved over the study period and differed among regions across Canada. Various terminologies identified as non-acute settings included long-term care, nursing homes, complex continuing care, skilled nursing facilities, rehabilitation, and geriatrics. Information regarding the research methods in some of the studies reviewed was insufficient while not all results were reported. Even though there was a wide variation in prevalence estimates within individual studies, when critically appraised, it was found that the studies with poor methodological scores tended to underestimate pressure injury prevalence. Despite limitations and variability, the authors were confident in the pressure injury prevalence estimates obtained, given the narrow confidence interval (95% CI, 25.2-26.8%) and the large combined samples from across the country. Their prevalence estimates were based on sample sizes that were three to 10 times above those necessary to be within a 95 per cent confidence interval of the true estimation of pressure injury prevalence (Woodbury & Houghton, 2004).

Other studies that were conducted have also shown pressure injury prevalence in Canada continues to remain a concern. In 2005, prevalence was found to be 14.4% in a study by Hill-Rom conducted in 52 long term care facilities participating from the US and Canada (VanGilder, MacFarlane, & Meyer, 2008). For LTC sites in Ontario, between May 2004 and November 2007, pressure injury prevalence was 9% (Thein et al., 2010). More recently, for 2011 to 2012, the Canadian Institute for Health Information (2013) obtained a lower rate of 6.7% from LTC facilities across Canada. The results from the studies do show a decrease in prevalence over time in Canada, however, even low rates of pressure injuries are a concern and must be kept to a minimum. Outside of Canada, prevalence of pressure injuries also remain an issue worldwide with recent rates ranging from 9% to as high as 48% (Alejezawi et al., 2014; Frietas et al., 2011; Johansen et al., 2015; Moore & Cowman, 2011). It is also important to consider that published rates my be underestimated given that Stage 1 pressure injuries are often not included in studies.

Incidence. Incidence data were also collected by Woodbury and Houghton (2005) on pressure injuries in differing Canadian healthcare settings. Incidence was calculated as the number of people with new pressure injuries in a specified period of time divided by the number of individuals at risk in the population during that period multiplied by 100. The approximate incidence rates for pressure injuries were 14% in acute care, 11% in LTC, and 5% in mixed health care, while no data were obtained for community care. The overall incidence rate across all health care settings was 8.4%. Incidence studies were not plentiful and mainly came from Ontario and as such this was acknowledged as a regional gap in the review.

Recent incidence studies for Canadian LTC settings were not found, so to provide context, less recent incidence studies from US LTC and hospital settings are included here. In an incidence study for 95 US LTC facilities, the incidence was as high as 29% over a 12 week period (Horn et al., 2004). In the US, hospital incidence ranged from 0% to as high as 28% (Jenkins & O'Neal, 2010; Lyder et al., 2012; Young et al., 2010). According to CIHI (2016), in a recent report for Eastern Health on quality indicators in LTC, the Canadian benchmark incidence rate in the second and third quarters of 2015-2016 was 1.7%, which was much lower than the aforementioned published rates.

Prevalence and incidence summary. Despite the variability in rates and differing methodologies and even though some of the figures show a decline in prevalence, the numbers still suggest a problem. Even if prevalence and incidence rates of pressure injuries decrease, the problem of pressure injuries cannot be ignored. Ongoing efforts would be required to maintain and keep pressure injury rates to a minimum, attention to the problem must be sustained with ongoing re-evaluation of current strategies (Delmore, Leboits, Baldock, Suggs, Ayello, 2011).

Consequences of pressure injuries. The consequences that result from the development of a pressure injury can be devastating both in terms of financial burden and quality of life. Pressure injuries are also associated with increased morbidity and mortality. Pressure injuries develop quickly but heal slowly requiring long term treatment or even surgical intervention to obtain the goal of healing. Pressure injuries do not always heal, requiring ongoing care and creating immeasurable burden (Canadian Agency for Drugs and Technologies in Health, 2013; White-Chu et al., 2011).

Costs associated with treating a pressure injury can be exorbitant. Costs to treat a pressure injury are attributable to numerous factors such as utilization of health care resources for the purposes of dressing changes, nursing care, physical therapy, medications, dietary support, and other clinician services (Pieper, 2007). Based on data from England, US and Canada, Spetz, Brown, Aydin, & Donaldson (2013) summarized that incremental costs of treating a Stage I pressure injury was just over $2000, Stage II costs ranged from $3000 to $10,000, and Stage III costs could range from $5900 to $14,840. Costs could be as high as $18,730 to $21, 410 to treat a Stage IV pressure injury. While product use contributes to the cost of treatment, nursing time is a big expense. In one study, nursing time increased by 50% due to pressure injury related treatment compared to providing care for a patient without a pressure injury (Clarke et al., 2005). When considering even low prevalence or incidence rates, the cited figures would suggest that costs would still be substantial, providing even more reason to prevent pressure injuries.

Financial burden is only one aspect of the consequences associated with pressure injuries. For those affected, pressure injuries have a tremendous negative impact on quality of life. For example, because those who typically reside in LTC tend to be elderly with multiple comorbidities, they can be vulnerable to complications from pressure injuries. Complications can include infection and sepsis which may result in hospitalization or even death, particularly in vulnerable elderly frail persons (Sprakes & Tyrer, 2010).

The risk of death can increase with the presence of a pressure injury. For example, in a retrospective secondary analysis of the Medicare Patient Safety Monitoring System in the US, from January 1, 2006 to December 31, 2007, Lyder et al. (2012) found that the mortality risk adjusted odds ratios were 2.81 (95% CI=2.44, 3.23) for in-hospital mortality and 1.69 (95% CI = 1.61, 1.77) for mortality within 30 days after discharge or an increased risk by 11.2% and 15.3%, respectively. According to Leijon, Bergh, and Terstappen (2013), for patients with a pressure injury in a Swedish hospital, a logistic regression analysis showed a 3.6-fold increased risk of dying within 21 months, compared to patients without a pressure injury ($p < .001$). The increased risk of death from pressure injury complications reinforces the importance of prevention.

Even without complications or death, those with a pressure injury may experience pain and suffer from negative body image, social isolation, functional and financial status effects (Pieper, 2007; Thein et al., 2010). Treatment of pressure injuries may be painful and create limitations in day to day living (Sprakes & Tyrer, 2010).

In summary, the effects of pressure injury development can be numerous and severe and consequences are not limited to the individual. Healthcare systems are also negatively impacted. In the US, development of a pressure injury in healthcare facilities may be perceived as negligent and is increasingly associated with litigation (White-Chu et al., 2011). Accreditation Canada addressed the problem of the persistent occurrences of pressure injuries in LTC by identifying pressure injury prevention as a required organizational practice in the long term care sector (Accreditation Canada, 2010). Within Eastern Health in the province of Newfoundland and Labrador, development of a stage II or higher pressure injury is a reportable occurrence. The increasing recognition that the development of pressure injuries may negatively characterize the quality of care provided in healthcare settings underscores the importance that frontline nursing team members possess the appropriate level of knowledge and skill to ensure pressure injuries are prevented.

Development, Prevention, and Management of Pressure Injuries

The pathophysiology involved in the development and healing process of pressure injuries is described here so that the rationale for appropriate treatment protocols is better understood. Risk factors and best practice recommendations for their prevention, treatment and management are also discussed in the next sections.

Pathophysiology of pressure injuries. When prolonged unrelieved pressure occurs, typically over a bony prominence, a cascade of events may ensue, leading to the development of a pressure injury in vulnerable persons (Anders et al., 2010). Exposure to prolonged pressure can result from lying, sitting, or leaning on a surface in a position that places a bony prominence in direct contact with that surface. For example, lying on a bed can result in external pressure of 50 to 94 millimetres of mercury (mmHg) over areas such as the heels or sacrum or sitting on a hard surface can exert up to 500 mmHg over areas such as the ischial tuberosities. The development of a pressure injury depends on the duration and intensity of the pressure (Jaul, 2010).

Essentially, a pressure injury is the consequence of tissue ischemia caused by impaired blood supply to the affected area. When external pressure greater than 70 mmHg exceeds capillary filling pressure (approximately 12 to 32 mmHg) for longer than 2 hours, the potential for tissue breakdown occurs. If the external source of pressure continues over an extended period of time, the capillaries collapse and thrombose, causing a buildup of toxic by-products from metabolic waste resulting in cell death in the adjacent muscle and subcutaneous tissues. Underlying tissue damage may not be immediately evident at the skin surface (Jaul, 2010). With repeated exposure to pressure and inadequate recovery time, damage continues to occur at the now compromised area of trauma. Excessive external pressure furthers the process leading to tissue ischemia, resulting in a pressure injury. Tissue remains ischemic even after pressure is removed (Garcia & Thomas, 2006; Jaul, 2010; Pieper, 2007).

While pressure is frequently the source of pressure injuries, other external factors have been implicated as well. Damage caused by pressure can be exacerbated in the presence of shearing, friction, and excessive moisture (Jaul, 2010). Shearing is described as a mechanical force that causes the bone and subcutaneous layer to move in opposition to the skin. Shearing can be caused by sliding down in a chair or in a bed if the head is elevated greater that 30°. Dermal vessels become stretched, obstructed or torn, disrupting blood supply to the area, thereby starting the cycle of tissue breakdown. Shearing can exacerbate damage to an area already exposed to prolonged pressure (Garcia & Thomas, 2006; Jaul, 2010). Friction results when the skin surface moves across an external surface such as bed linens or from improper repositioning of a person in a bed, for example by dragging without the use of a transfer sheet. Damage caused by friction alone is confined to the epidermal and upper dermal layers. However, friction and shearing forces work synergistically increasing the potential for tissue damage to the affected area (Garcia & Thomas, 2006; Jaul, 2010; Pieper, 2007).

Excessive moisture contributes to the formation of pressure injuries by causing the skin to macerate (Garcia & Thomas, 2006; Jaul, 2010). Sources of excessive moisture may include perspiration, wound drainage, urinary or fecal incontinence, or inadequately dried skin. When skin is macerated, it is more vulnerable to degeneration and injury even in the presence of only slight pressure. Furthermore, macerated skin adheres more easily to surfaces such as bed linens, intensifying the effects of friction. It is also five times more likely to become injured when exposed to friction.

Overall, external factors can contribute to the development of pressure injuries. If these factors are modified, it may be possible to prevent pressure injuries. Frontline nursing team members require the ability to recognize the first signs of skin damage that are attributable to pressure. Equally important is that they understand and recognize how external factors can contribute to the development of a pressure injury in order to alter such factors appropriately. Other risk factors that are considered intrinsic may increase an individual's vulnerability to the consequences of external factors; these are explained in more detail in the next section.

Risk factors. Risk factors are discussed abundantly in the literature. Overall, certain risk factors play a major role in contributing to the development of pressure injuries. The main risks identified in the literature that increase the potential for developing pressure injuries include but may not be limited to immobility, advancing age, poor nutrition, comorbidities with impaired circulation, impaired perception or sensation, neuropathy or incontinence,. These are intrinsic risk factors that may or may not be modifiable (CIHI, 2013; Coleman et al., 2013; Coleman et al., 2014). Due to the nature of the risk factors, a large portion of residents in LTC may be at an increased risk for pressure injury development.

Immobility or limited mobility can be related to spinal cord injury, progressive neurological diseases such as Parkinson's or Alzheimer's disease, or cerebrovascular accident. Patients undergoing surgical procedures may also be affected. Immobility or limited mobility interferes with the ability to make positional changes without assistance thereby exposing the body to excessive pressure. Mobility may also be hampered by a temporary illness such as pneumonia or recovery from surgery (CIHI, 2013; Coleman et al., 2013; Coleman et al., 2014; Jaul, 2010).

Advancing age causes changes in the skin such as decreased elasticity, decreased cutaneous blood perfusion, decreased dermal-epidermal turnover, changes in skin pH, and loss of subcutaneous fat. Aging skin may also have incurred cumulative damage from sun exposure which erodes the dermal connective tissue. Tobacco use may erode skin integrity and interfere with optimal circulation. With advancing age, the skin's capacity to serve as protective organ may deteriorate creating suboptimal conditions for regulation of water loss, thermoregulation, and as a barrier against invading microorganisms. Impaired skin integrity can promote conditions conducive to pressure injury development when exposed to external sources of excessive pressure (CIHI, 2013; Coleman et al., 2013; Coleman et al., 2014; Jaul, 2010).

Poor nutrition can have a profound impact on optimal skin integrity, particularly deficits in protein. Poor nutrition compromises the tissue regeneration process, the inflammatory response, and immune function, thereby eroding wound healing. Poor dentition, cognitive impairment, decline in functional status, and decreased sense of smell may all contribute to poor nutrition (CIHI, 2013; Coleman et al., 2013; Coleman et al., 2014; Garcia & Thomas, 2006; Jaul, 2010; Keast et al., 2006).

Many comorbid illnesses are associated with factors that create conditions amenable to pressure injury development. Congestive heart failure can lead to tissue hypoxia hastening cell death. Diabetes mellitus can impair skin integrity in terms of vascular (impaired circulation), neuropathic (loss of protective sensation), and immune function (impaired wound healing). Progression of dementia negatively impacts bowel and bladder continence, mobility, sensory perception, and nutritional intake. Malignancies place great demands on energy requirements. Arthritic deformities interfere with optimal feeding and mobility independence. Furthermore, certain medications may disturb sensory perception, for example, narcotics for pain (Garcia & Thomas, 2006).

It is critical for nurses to complete a risk assessment for pressure injury development which involves understanding and interpreting the risk factors. A history of a pressure injury also places a person at increased risk for development of a pressure injury and would also be key information for a nurse to know. A risk assessment should be comprehensive and include the individual's overall health status. Factors to consider are severity of any primary illness, comorbidities, ability to participate in activities of daily living, nutritional status, and social and emotional support (Jaul, 2010).

Prevention, treatment and management of pressure injuries. Best practice guidelines have been published regarding the prevention, treatment and management of pressure injuries. The guidelines in effect at the time of this study included the EPUAP-NPUAP (2009) and the RNAO (2011). There are now more updated guidelines available, however, changes to recommendations have been minor. The guidelines are evidence based and have been developed for use by health care professionals globally. For the purposes of this paper the guidelines developed by the EPUAP-NPUAP (2009) about prevention and the RNAO (2011) about treatment will be discussed. Because treatment recommendations are very similar to those for prevention, both sets of guidelines have been collated for this paper.

Assessment. For prevention purposes, residents should receive a comprehensive head-to-toe skin assessment on admission and then daily for those at risk. Bony prominences require particular attention. Health care providers should be educated to inspect skin for areas of early warning signs of pressure development such as redness, localized heat, edema, induration, and blanching response.

The risk for pressure injury development is determined by both clinical judgment and the use of a risk assessment tool that has been tested for validity and reliability such as the *Braden Scale for Predicting Pressure Sore Risk.* In a review of studies assessing the reliability and validity of the Braden Scale, Kring (2007) found reliability among RNs ranged from 0.83 and 0.99, with percent agreement from 88% to 100%. Kring suggested more studies are needed to determine the reliability among LPNs or unregulated healthcare workers. The Braden Scale has demonstrated good sensitivity and specificity in a variety of settings, including nursing homes but not in surgery settings, if the cutoff score range is from 16 to 18 on the scale. Risk factors identified by the scoring tool should determine appropriate interventions. The Braden scale categorizes risk factor scores under sensory perception, mobility, activity, moisture, nutrition, friction and shear. Any clients who are restricted to bed and/or chair should receive an assessment during lifting, turning, and positioning so the risk for pressure, friction and shear is determined. Even though the Braden Scale is a tool that can quickly help clinicians systematically and routinely determine risk, appropriate training is needed to ensure correct use.

Furthermore, it does not take into account other factors that may increase risk, such as comorbid and pre-existing conditions, severity of illness, age and low body mass, therefore, it should be used in conjunction with clinical judgment (Beeson, Prickel, & Mink, 2010).

In LTC, a risk assessment is recommended within 48 hours of admission, then weekly for four weeks, then quarterly, and whenever there is a change in health status. Health professionals should be educated to accurately complete a risk assessment. For injuries to the lower extremities, a vascular assessment should be completed to rule out vascular compromise (EPUAP-NPUAP, 2009; RNAO, 2011). EHLTC policy is to use the Braden Scale to assess for risk of pressure injury.

The management of pressure injuries should begin with a history and focused physical assessment, followed by a psychosocial assessment. Quality of life should also be evaluated from the client's point of view. Nutritional intake should be assessed and optimized within the client's desires. A dietary consult should be completed to determine deficiencies and to implement a plan to enhance wound healing based upon laboratory data and evaluation of nutritional intake. It is recommended that pain related to the pressure injury and its treatment also be assessed (EPUAP-NPUAP, 2009; RNAO, 2011).

Management of causative/contributing factors. For those at risk and those with a pressure injury, an appropriate support surface is recommended. Support surfaces alone do not prevent or heal pressure injuries, but are a component of the treatment plan. Ongoing monitoring and evaluation of the effectiveness of the selected support surface is recommended. For the pressure management of heels, elevation off the surface with the use of pillows placed under the calf is recommended. A seating assessment is advised for those who spend time in a chair and who have limited mobility. Appropriate interdisciplinary team members such as occupational therapists and physiotherapists should be consulted for their expertise in support surfaces, seating, positioning, and mobility (EPUAP-NPUAP, 2009; RNAO, 2011).

Appropriate positioning is an integral part of the treatment plan. A client should not be positioned directly on a pressure injury. The client should be turned and repositioned regardless of the support surface. Turning frequency should be customized according to the client's support surface and tolerability. Each time a client is turned, the skin should be inspected for additional damage. Head of the bed elevation should be limited to 30 degrees for a client on bed rest, unless contraindicated for a medical reason. Clients should sleep in a 30 to 40 degree side-lying position or flat in the bed if not contraindicated. Friction and shear should be avoided by using transfer aids such as trapeze devices. Clients should be lifted, not dragged, for repositioning. A client should not spend any more time than is necessary on a bedpan. Ring or donut-shaped devices should not be used. Heating devices such as heating pads or hot water bottles should not be placed on a pressure injury. Activity should increase as quickly as can be tolerated (EPUAP-NPUAP, 2009; RNAO, 2011).

Skin and wound care. Skin integrity and protection should be promoted by various interventions. Adequate fluid intake promotes skin hydration which in turn contributes to protection against mechanical injury to skin. Using moisturizers over dry areas of skin and avoiding massage over bony prominences aids in protecting the skin against environmental conditions that contribute to impaired skin integrity. Friction injuries should be avoided by using a protective padding or a protective barrier such as liquid barrier films, transparent films, or hydrocolloids. The skin should also be kept clean by implementing an individualized bathing routine to help reduce soiling from body fluids such as urine, feces, wound drainage and perspiration; all of which can irritate the skin increasing susceptibility to injury. Hot water should be avoided and the use of a pH balanced non-irritating skin cleanser should be used for bathing (EPUAP-NPUAP, 2009; RNAO, 2011).

For those with a pressure injury, the treatment plan for local wound care should be based upon assessment of the wound for stage, depth, location, surface area, odour, sinus tracts, undermining, tunneling, exudate, wound bed appearance, and the condition of surrounding skin and wound edges. Weekly comprehensive assessments are recommended to track wound progress and treatment plan efficacy. Additionally, wound changes should be monitored at each dressing change, while a 2-week period is recommended for evaluation of progress toward healing. Wound assessments should be documented. If a pressure injury does not show signs of healing as expected, despite adequate local wound care, appropriate surface support, pressure redistribution, and nutrition, then the client should be reassessed (EPUAP-NPUAP, 2009; RNAO, 2011).

Discharge/transfer of care arrangements. When discharging or transferring clients between settings, it is crucial that continuity of care is maintained. Information should be provided to the receiving facility to ensure that treatment is not compromised. Transfer information should include the client’s risk factors, details of pressure points and skin condition, requirements for pressure management and mobility equipment, details of healed and existing injuries, pressure injury history including treatments, current dressing protocol, any dressing allergies, and ongoing need for nutritional support. Both verbal and written communication should be used to convey client information. Discharge or transfer to another facility may require careful advance planning in anticipation of meeting client needs for pressure injury management (RNAO, 2011).

Client/patient/family education. When possible, it is recommended that healthcare providers include the client, family and caregivers in the treatment plan. Information should be provided regarding pain, discomfort, possible outcomes, treatment duration, support surfaces, and the role of the health care team members. Involvement of the client, family, and caregivers can enhance the ongoing management of pressure injuries (EPUAP-NPUAP, 2009; RNAO, 2011).

The RNAO endorses educational programs for the prevention of pressure injuries that is directed at all levels of health care providers, the clients, and family or caregivers. Educational programs should provide updated information in a structured and comprehensive format. According to evidence reviewed for the RNAO best practice guidelines, education programs may be beneficial by reducing the prevalence and incidence of pressure injuries and producing desired outcomes for clients. Education should be based on adult principles of learning and the mode of delivery. Effectiveness of pressure injury prevention education should be evaluated by means of quality indicators and chart audits. Educational programs should provide information of the etiology and risk factors for pressure injury development, use of risk assessment tools such as the Braden scale, skin assessment, pressure injury staging, pressure management support surfaces, skin care, positioning and transferring techniques, documentation, and the roles and responsibilities of the health care team members (RNAO, 2011).

Organization and policy recommendations. Overall for best practice pressure injury prevention programs to be effective, organizations and policies should be mechanisms of support and guidance. The RNAO recommends that organizations ensure availability of resources needed for the prevention of pressure injuries. Resources may include access to therapeutic surfaces and consultants (occupational therapists, physiotherapists, wound specialists) and appropriate skin care products. Organizational readiness and barriers to education should be identified. A qualified person should be committed to providing support and education regarding best practices for pressure injury prevention. Quality indicator monitoring for prevalence and incidence are recommended to gauge effectiveness of pressure injury prevention programs. Outcomes can be used to guide policy development and funding decisions (RNAO, 2011).

Pressure Injury Knowledge and Education

Given the complexity of the guidelines, healthcare providers need to know a great deal of information and possess the appropriate skills to prevent pressure injuries. Guidelines are not enough as evidenced by the continued prevalence and incidence of pressure injuries. As Elliott (2011) suggested, even with guidance from best practice guidelines, it is up to the clinician to remain up-to-date and to transfer guideline knowledge into practice. Studies have shown that nurses do not have sufficient knowledge about pressure injury prevention and management. Studies also suggest that education and other strategies can improve pressure injury knowledge and practices.

For the purposes of this literature review, studies examining various levels of nursing staff regarding knowledge of pressure injury prevention and management are discussed. Other studies were included that evaluated the effectiveness of educational interventions regarding pressure injury prevention and management for licensed nursing staff (registered nurses and practical nurses) and non-licensed care providers (personal care assistants) . Finally, research studies examining the effectiveness of education as part of a larger multicomponent strategy to improve knowledge and outcomes regarding pressure injuries are briefly summarized.

The studies used for this literature review concerning knowledge and education were appraised according to the Public Health Agency of Canada's Infection Prevention and Control Guidelines Critical Appraisal Tool Kit (2014). Studies examining pressure injury knowledge were descriptive designs and were assessed to be either low or medium quality. The studies examining the effects of pressure injury education were all descriptive uncontrolled before and after designs and assessed to be of low or medium quality. Despite the limitations associated with design and quality, useful information and trends were gleaned from the studies. The table summarizing knowledge studies can be seen in Appendix D and those about the effects of education in Appendix E. The studies are discussed in the following sections.

Knowledge gaps. Several studies were located in the literature to evaluate the knowledge of nursing staff pertaining to pressure injuries. Researchers have used different tools to evaluate pressure injury knowledge of nurses (Altun & Zencirci, 2011; Aydin & Karadağ, 2010; Ayello, Baranoski, & Salati, 2005; Chianca, Rezende, Borges, Nogueira, & Caliri 2010; Forseth, 2010; Gallant et al., 2010; Gunningberg et al., 2013; Kwong, 2011; Miyazaki et al., 2010; Pieper & Mattern, 1997; Pieper and Mott, 1995; Sinclair et al., 2004; Thomas, 2012). Among the tools, the Pieper's Pressure Ulcer Knowledge Test or adapted versions were commonly used to evaluate the knowledge of nursing staff (Chianca et al., 2010; Forseth, 2010; Gallant et al., 2010; Kwong, 2011; Miyazaki et al., 2010; Pieper & Mattern, 1997; Pieper and Mott, 1995; Sinclair et al., 2004).

Pieper and Mott (1995) developed the Pieper's Pressure Ulcer Knowledge Test based on the recommendation by the Agency for Health Care Policy and Research (AHCPR) that pressure injury educational programs be based on the learner's level of knowledge. Therefore, the test was tailored to examine nurses' knowledge in three categories: 1) pressure ulcer risk and prevention, 2) pressure ulcer staging, and 3) wound description. Clinical practice guidelines developed by the AHCPR guided the content of the test which consisted of 47 true or false items. A total score could be obtained while subscores could also be assessed from each of the three categories. Content validity was tested by four enterostomal therapy nurses as experts and the test was piloted on 228 nurses (Beeckman et al., 2010; Pieper & Mott, 1995). Cronbach's alpha to assess reliability was reported as .91 (Pieper & Mattern, 1997). The reliability and Cronbach's alpha values were also determined for each subsection as: pressure ulcer risk and prevention (.80), pressure ulcer staging (.49), and wound description (.59) (Chianca et al., 2010). The test developers set 90% as the cut off score for passing because the content was considered basic for nursing care (Pieper & Mott, 1995).

Among those studies used to evaluate nursing knowledge with the Pieper's Pressure Ulcer Knowledge Test, knowledge gaps were found. In the study for which the test was originally developed, only 17 (36%) items were answered correctly by 90% of the nurses (Pieper & Mott, 1995). The mean percentage of correct answers was identified at 71.7%. In a follow-up study, the mean percentage of correct answers was 71.3% for critical care nurses (n=75) who completed the test, revealing a knowledge deficit (Pieper & Mattern, 1997).

There were four North American studies located for which the Pieper's Pressure Ulcer Knowledge Test was used to assess pressure injury knowledge. In a US study, nurses (n=295) without certification in wound care or other specialty area who practiced in Montana rural and urban hospitals and long term care facilities completed the Pieper's Pressure Ulcer Knowledge Test. The test was also used as part of a master's thesis to measure the effect of an educational intervention for nursing staff in a Montana state critical access/nursing home facility. The pre-test average score for RNs was 81% and 79% for LPNs (Forseth, 2010). In a Canadian study of Registered Nurses (n=595), and Licensed Practical Nurses (n=59) working in acute care settings, despite different scoring methods, the pre-mean test scores showed knowledge deficiencies for both the RNs (42.3%) and LPNs (35%) (Sinclair et al., 2004). In a Canadian university hospital setting, the mean score was 75% for nurses (n=256) who completed an adapted version of the Pieper's Pressure Ulcer Knowledge Test (Gallant et al., 2010). Taking into consideration that 90% was identified by one of the test developers as the acceptable lowest score, the studies overall demonstrated that knowledge regarding pressure injuries is lacking.

The test was adapted to Portuguese for two studies in Brazil. Nurses (n=386) of several designations (BSN, nurse auxiliaries and technicians) were assessed for their knowledge of pressure injuries in a tertiary São Paulo state hospital. Knowledge deficits were found with a mean score of 73.6% for the nursing auxiliaries/technicians and 79.4% for the nurses (Miyazaki et al., 2010). In another study, the mean score for nurses (n=106) practicing in other Brazilian health institutions was 63.6% showing knowledge deficits (Chianca et al., 2010).

In the first two American studies by Pieper and Mott (1995) and Pieper and Mattern (1997) for the RNs, the mean scores ranged from 9% to 98% and 15% to 83%, respectively. In more recent studies, in Canada, the US, and Brazil, mean scores for nurses ranged from 61% to 81% (Chianca et al., 2010; Forsyth, 2010; Gallant et al., 2010; Miyazaki et al., 2010). Score ranges were not reported in other studies cited here.

In previous studies using Pieper's Pressure Ulcer Knowledge Test, the number of correctly answered Risk and Prevention items ranged from 10 to 19 out of 33 for RN participants. In studies where details were provided about the scores within subcategories or to specific items, some trends were found. Examples of items that tended to be answered correctly by RN participants included items about risk assessment on admission; documentation of pressure injury care; adequate dietary intake; avoidance of bony prominence on bony prominence; incontinence management; effects of friction when moving up in the bed; the benefits of education; use of chair cushions; heel elevation; pressure injury risk factors; and keeping the skin clean (Chianca et al., 2010; Forseth, 2010; Gallant et al., 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995). Gallant et al. (2010) compared the response rate to some items on the test to documented practices, for example, even though the 97% of the nurses correctly answered the item about the risk assessment on admission, only 24% of Braden Risk assessments were done on admission.

There were items that tended to have a low correct response rate in the previous studies as well. Fewer than 50% of the RNs correctly answered between three and twelve Risk and Prevention items. Items that tended to yield a poor correct response rate included those about massage of bony prominences; use of donuts; frequency of shifting weight while up in a chair; interpretation of a low Braden score; side lying position; turning frequency in bed; and chair repositioning frequency (Chianca et al., 2010; Forseth, 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995).

As well trends were found for RNs in previous studies using Pieper's Pressure Ulcer Knowledge Test in response to the Wound Description subcategory. There tended to be a good correct response rate to items about the skin being the largest organ of the body, the definition of slough, and the two items about eschar. For the Staging subcategory, the correct response rates tended to be high in response to items about Stage

1 and 4 pressure injuries, and heel blisters (Chianca et al., 2010; Forseth, 2010; Miyazaki et al., Piper & Mattern, 1997; Piper & Mott, 1995).

In the previous studies using Pieper's Pressure Ulcer Knowledge Test, there were trends indicating that RN participants had poor knowledge about some of the Wound Description items. These included items about undermining, the false item that pressure ulcers are sterile wounds, and about pressure ulcer scar tissue. For the Staging subcategory, the items about Stage 2 and 3 pressure ulcers were not well known (Chianca et al., 2010; Forseth, 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995).

There were also trends found in previous studies examining pressure injury knowledge of unlicensed nursing staff. For example, in a study using a modified version of the Pieper's Pressure Ulcer Knowledge test, nursing auxiliaries/technicians demonstrated knowledge gaps with a mean score of 73.6 (Miyazaki et al., 2010). In the modified Chinese study by Kwong et al. (2011), the non-licensed care providers also showed a gap in knowledge with a mean score of 70.2. Additional studies also assessed knowledge using different tools and are discussed in the next sections.

Ayello et al. (2005) conducted a large study using a 23 item survey questionnaire about wound care knowledge and practices involving respondents (n=692) of various nursing designations (BSN, LPN, RN diploma, and MSN) regarding wound care knowledge. The respondents were from 48 states, five Canadian provinces, and seven other countries and worked in various settings such as hospital, long term or subacute care, and home health care. Less than half felt they could consistently stage a pressure injury accurately. Only 44% understood that the Braden risk assessment tool was developed to identify persons at risk of developing a pressure injury and instead erroneously answered that it was a tool to assess risk for a vascular injury. Nurses in long term care were less likely than hospital nurses or those in home/community settings to do daily skin assessments. Only 30% of all respondents felt they received sufficient education on chronic wounds in their basic nursing education. Of the nurses from long term care and home/community settings, presumably working with clients considered the most vulnerable to chronic wounds, only 20% felt they received sufficient education. Even though this survey questionnaire by Ayello et al. did not use a survey tool tested for validity and reliability, the findings are included here as they are consistent with other studies concerning pressure injury knowledge.

In a Swedish study, Gunningberg et al. (2013) included RNs, assistant nurses, and student nurses (n=415) in their study using a two part pressure injury knowledge assessment tool to assess and compare knowledge. The knowledge test had been previously tested to have acceptable psychometric values (Cronbach's alpha= 0.77) in the Netherlands and Belgium. They found that knowledge was below acceptable levels. Items that tended to have the highest correct response rate were about nutrition, while those that yielded to lowest correct response rate were about reducing pressure and shear.

Overall, knowledge surveys using different tools revealed that knowledge regarding pressure injury prevention and assessment may not be adequate in nursing staff of variable education backgrounds.

The effects of education. Even though knowledge of pressure injuries may be inadequate among nursing staff across healthcare settings, it has been demonstrated that education can be effective in improving knowledge. Several studies have been conducted to determine the effectiveness of educational interventions to improve pressure injury knowledge. For example, in the United States, a training program was developed by the National Database of Nursing Quality Indicators to improve nursing accuracy and reliability in identifying and staging pressure injuries among 5,200 nurses. Feedback was sought from the participants and approximately half of those who responded (n=937) felt that the program helped them improve pressure injury identification and staging (Bergquist-Beringer et al., 2009). A similar educational program showed post-test improvement on staging pressure injuries among registered general nurses in British hospitals even though no statistical significance was reported and the sample was small, (Briggs, 2006). An interactive lecture-based workshop on the management of pressure injuries provided to nurses in a Turkish hospital resulted in statistically significant improvement in knowledge of workshop content ($p<.001$) (Altun & Zencirci, 2011). Similarly, in a study by Sinclair et al. (2004) in three Canadian acute care hospitals, higher post-test scores were found compared to pre-test scores ($p<.001$) following a pressure injury prevention education workshop provided to Registered Nurses and Licensed Practical Nurses. Thomas (2012) reported that in a New Jersey LTC facility, after two pressure injury and wound documentation sessions, knowledge scores among LPNs and RNs improved by over one standard deviation four weeks later and by two standard deviations at eight weeks. In addition, all aspects of wound care documentation frequency improved substantially but tests of significance were not applied. In a thesis study to assess the effect of a pressure injury education program in community critical-access hospital, in Montana, US, RNs (n=3) and LPNs (n=4) improved their knowledge scores from pre to post-test, although there was no statistically significant difference (Forseth, 2010).

Pressure injury education for nursing staff may also improve practice outcomes related to pressure injuries. In a Hong Kong nursing home, pressure injury prevalence and incidence rates decreased from 9% to 2.5% and 2.5% to 0.8% respectively, after both nurses and non-licensed care providers completed a tailored pressure injury training program (Kwong et al., 2011). Evidence reviewed by RNAO supports that ongoing education programs are beneficial in reducing the prevalence and incidence of pressure injuries and producing desired outcomes for clients (RNAO, 2011).

Multicomponent strategies. While some studies suggest that education may be effective at improving pressure injury knowledge and outcomes, other studies focused on multicomponent strategies to improve pressure injury prevention and management. Two literature reviews were located that explored quality initiatives involving bundle type strategies, using various components. These initiatives included education and training as part of the bundles. Because multiple strategies were used, it would be difficult to determine if a single component was more effective than another or if it was a combination of factors. These studies reinforce that education is a critical to the improvement of pressure injury knowledge and practices, however, it is likely more effective when used as part of a multipronged approach. More importantly, regardless of the strategy, staff education is necessary for the successful implementation of any quality initiatives. Two literature reviews are discussed in the next sections.

Sullivan and Schoelles (2013) completed a systematic review of the evidence supporting multicomponent strategies to prevent pressure injuries. The review covered the years from 2000 to 2012 with a focus on adults in U.S. acute care and LTC settings with reported pressure injury rate six months after implantation of the chosen strategy. There were 26 studies that demonstrated moderate strength of evidence for a combination of several components that were effective in reducing pressure injury rates.

In addition to examining the strategies, Sullivan and Schoelles (2013) looked at factors that were facilitators or barriers to improving pressure injury prevention strategies. In the reviewed studies, for example, certain motivators were found to be effective in bringing attention to pressure injuries, some positive and some negative. A positive motivator was found to be stakeholders' commitment to improving patient outcome and provision of quality service. Negative motivators included finding Stage IV pressure injuries and exceeding the national benchmark for pressure injury rates. The most sustainable pressure injury interventions that were found to be helpful did not depend on having enough staff, for example, changing to pressure relief mattresses and using risk assessment tools. Interventions such as implementing turning schedules were less sustainable due to the need for enough staff. Some studies suggested that promoting nurses' ownership and leadership support were effective components. Quarterly prevalence studies, mandatory demonstration of competence for RNs and LPNs, along with regular updates on products were also found to be useful. Understanding facilitators and barriers to increasing awareness of pressure injuries is very useful for any stakeholders in healthcare facilities. The information can be used to guide policy development and to implement practical strategies that are shown to be successful, for example, ensuring a risk assessment is used or using pressure relief mattresses.

The most commonly reported barrier was staff disruption of initiatives. Staff members were often not involved in planning any initiatives while they were also more focused on wound care products and support surfaces than on nursing care. Staff turnover, unmotivated staff, poor documentation, and ineffective communication were also reported as barriers in the studies reviewed (Sullivan & Schoelles, 2013). Such findings underscore the importance of involving staff in any improvement initiatives along with effective communication of any strategies.

The components of the strategies found to be most effective included the use of a simplified and standardized documentation system that could produce reports for use in rounds and unit meetings. Additional components included involvement of multidisciplinary teams, leadership, skin champions, ongoing audits with feedback, and ongoing education (Sullivan & Schoelles, 2013).

Sullivan and Schoelles (2013) found that their appraisal of the studies was similar to those found in previous reviews, emphasizing that quality improvement initiatives and nurse-focused initiatives were effective and led to positive outcomes. The studies reviewed did not focus on any individual components that were included in pressure injury prevention bundles. Consequently, the effectiveness of any specific intervention was not assessed. However, the majority of studies assessed a combination of individual components that included: education, risk assessments, skin inspections, use of therapeutic support surfaces, repositioning, moisture management, prevention of shear and friction, and optimizing nutrition and hydration. Generally pressure injury prevention bundles were implemented according to practice guidelines.

Niederhauser et al. (2012) also completed a systematic review of 24 studies to examine evidence supporting the use of a combination of interventions to prevent pressure injuries in both acute care and long term care facilities. Eleven of the studies were also reviewed by Sullivan and Schoelles (2013). Common activities found in the studies that made up the multicomponent strategies included preparation (review of best practice, gauging staff knowledge, baseline prevalence and incidence surveys), staff education, implementation of best practices, clinical monitoring and feedback, and the use of skin care champions. Overall the studies reported positive outcomes, some of which were supported by either by pressure injury rates and/or care processes measures. The authors found however, that the level of evidence from the reviewed studies was weak in supporting any specific methods to prevent pressure injuries. It was also found that involvement of frontline staff at all levels of program development and implementation enhanced program success. Regular monitoring of charts was considered another useful intervention.

Even though the reviews by Sullivan and Schoelles (2013) and Niederhauser et al. (2012) did not solely focus on education and knowledge concerning pressure injuries, they highlighted that pressure injury prevention success depends on an integrated approach. Both reviews also demonstrated that there is a need for more research using stronger study design. However, before planning any studies with a stronger design, descriptive exploratory studies can provide useful baseline information. Any strategies and interventions must begin with understanding what nursing team members know or do not know. Any approach taken requires their involvement along with ensuring they receive relevant education and training to contribute to an adequate knowledge and skill base.

Literature review summary. The literature indicates that although pressure injury knowledge may not be adequate among nursing staff, education has been demonstrated to improve knowledge and outcomes regarding pressure injuries in healthcare settings. Pressure injury knowledge tests allow for determination of gaps that can help in the development of a strategic educational program. Education should be a component of a larger comprehensive plan that is supported by all stakeholders to improve both knowledge and practice relating to pressure injuries (Young et al., 2010).

Additionally, education for healthcare workers regarding pressure injury prevention and management is endorsed by best practice recommendations so that such recommendations can be translated into practice. Education programs should be planned and developed to address any identified learning needs while targeting all involved healthcare workers (RNAO, 2011; Miyazaki et al., 2010).

The literature supports that frontline nursing team members are in a pivotal position to ensure pressure injury prevention in all healthcare settings. Pressure injuries are a complex problem, underscoring the need for frontline nursing staff to be knowledgeable and skilled on the topic. Without adequately skilled and knowledgeable nursing staff, the problem of pressure injuries will persist. Even if organizational policies are in place, if these are not known by nursing staff, the policy recommendations will not be actualized. Ensuring ongoing and updated education about pressure injuries for nursing staff is a crucial component in preventing and managing pressure injuries.

Chapter 3: Methodology

This chapter describes the methods used in this study, including the study design, sites, study population, sample selection and recruitment, data collection procedure and instruments, data management and analysis, and ethical considerations.

Study Design

This was a descriptive-exploratory study that consisted of two components related to pressure injuries: 1) a knowledge assessment and 2) a practice assessment. To assess pressure injury knowledge, two versions of a multi-part Pressure Ulcer Knowledge Questionnaire were administered. Registered Nurses (RNs) and Licensed Practical Nurses with wound care education (LPNwcs) completed one version and a modified, condensed version was administered to Personal Care Attendants (PCAs) and Licensed Practical Nurses who did not have wound care education (LPNnowcs). Results from each version of the questionnaire are discussed separately. To assess practices related to pressure injury prevention, a retrospective chart review was completed using a Pressure Ulcer Risk Assessment Audit tool. The research methods for both the knowledge assessment and the practice assessment will be described separately in the following sections.

Knowledge Assessment

Sites. To assess the knowledge of nursing staff, questionnaires were administered to staff members at the four sites selected for this study: Hoyles-Escasoni, Agnes Pratt, Lion's Manor, and the Blue Crest Nursing Home. These sites were purposely chosen out of 17 of the LTC sites in EH to reflect the range of staff, skill mix, facility size, and residents that exists in EHLTC. Table 3.1 summarizes the characteristics of the sites selected for the knowledge assessment component of this study.

Table 3.1

Site Characteristics for Knowledge Assessment

Site Characteristics*	Hoyles Escasoni Complex	Agnes Pratt Nursing Home	Lion's Manor	Blue Crest Nursing Home
# of Beds	377	134	75	61
# of Staff (RNs, LPNs, and PCAs)**	70 RNs 222 LPNs 168 PCAs	30 RNs 80 LPNs 61 PCAs	11 RNs 36 LPNs 9 PCAs	9 RNs 24 LPNs 4 PCAs
Status of Skills Mix	Partially implemented	Fully implemented	Not implemented	Partially implemented
Location, Size and Region	St. John's, large urban	St. John's, midsize urban	Placentia, midsize rural	Grand Bank, small rural

*Characteristics present prior to start of study
**Includes all full-time, part-time, and casual staff

The selection of sites also reflected both urban and rural regions in EH. While all of these sites accepted admission of residents requiring moderate to total assistance, it was reasonable to expect some variability of resident needs and pressure injury risk factors both within and between sites.

Population and sample. There were four groups working in EHLTC who were targeted for the knowledge assessment component of this study: 1) RNs, 2) LPNwcs, 3) PCAs and 4) LPNnowcs. Because of expected similarities in their theoretical ability to answer the questionnaire items about pressure injuries, these four groups were then collapsed into two groups: 1) RNs and LPNwcs, and 2) PCAs and LPNnowcs. The RNs and LPNwcs were expected to have similar knowledge about pressure injury prevention and management, given both groups would have some wound care education. However, because the LPNnowcs did not have wound care education, their level of pressure injury knowledge was expected to be similar to that of the PCAs.

Non-probability, convenience sampling was used to select a nursing staff sample for the knowledge assessment. This was a descriptive-exploratory study and not analytical in nature. No hypothesis was being tested; therefore, a predetermined sample size was not calculated. The researcher endeavored to recruit as many participants as feasible with the intent to recruit a minimum of 100 participants from the combined sites. A total of 120 participants were recruited from the chosen sites: 1)18 RNs, 2) 38 LPNwcs, 3) 36 PCAs, and, 4) 28 LPNnowcs. The response rate was 15% for the RNs and PCAs and 18% for the LPNs (LPNwcs and LPNnwcs combined). Participation rates reasonably reflected the staff numbers and distribution at each site.

Recruitment. Approximately two weeks before initiating the study, email communication and print correspondence was sent to all Resident Care Managers at the selected sites to inform them of the study purpose and plans to seek staff volunteers to complete the knowledge questionnaires. A copy of the email and print correspondence can be found in Appendix F. Prior to commencing the study the researcher offered to meet with the Resident Care Managers to provide further opportunities to discuss study details and to address any questions or concerns. However, any clarification needed was provided by email correspondence with no requests for meetings. Support was sought and provided from the Resident Care Managers to allow willing participants sufficient time away from the nursing unit to complete the questionnaires.

To recruit nursing staff from the targeted population groups, flyers were posted up to a week in advance to notify staff of the intent to recruit voluntary participants. Flyers were posted on all units and in high traffic staffing areas such as staff lounges, cafeterias, main lobbies, break rooms and locker rooms. At the urban sites, the researcher posted the flyers. At the rural sites, the Resident Care Managers were asked for assistance to have the flyers posted. A copy of the flyer can be found in Appendix G. On the days and times designated for questionnaire administration, an overhead paging system was used to call for voluntary participants to come to the designated room which was booked at each site. Three Clinical Nurse Specialist colleagues helped with recruitment at Lion’s Manor in Placentia as well as at Agnes Pratt and Hoyles Escasoni in St. John’s, as their time permitted. The script for the paging announcements can be found in Appendix H.

Data collection procedure. Data were collected over a six month period, from November 2011 to April 2012**.** A room was booked at each of the selected sites for the purpose of questionnaire administration to ensure participants were provided with a convenient, quiet environment outside of the site’s nursing units. Holding the questionnaire administration in a room away from the nursing units also allowed for appropriate invigilation of the process by the researcher. Once voluntary participants arrived at the designated room to participate in the study, they were asked to read a brief information letter that outlined the purpose of the study. The information letter can be found in Appendix I. The researcher answered any questions regarding the study. The participants were then asked to read and sign the consent form, and were given a copy to keep. The consent form can be found in Appendix J. Upon consent, the participant identified the appropriate nursing level category (RN, LPN, or PCA). To ensure the appropriate version of the Pressure Ulcer Knowledge Questionnaire was provided, the LPNs were asked if they had or had not received any education in wound care through the basic education program or any post-basic wound care education. All participants were then offered the applicable questionnaire and asked to sit and complete the questionnaire. Participants were asked not to discuss the questionnaire while completing it and when they returned to their units.

Snacks and refreshments were available and offered when participants had completed the questionnaire. In the booked rooms, as space permitted, the area for snacks was separated from the area designated for the test administration in order to help reduce the level of noise and distraction for those who were writing the test.

There were two drop-in sessions per shift for two shifts at each site. Each drop-in session was planned for approximately two hours. This plan allowed for participation from staff working on opposite teams during a day and a night shift. Holding two sessions per shift facilitated staff taking turns to attend so that staffing needs and resident care were not unduly impacted.

Instruments. A multi-part Pressure Ulcer Knowledge Questionnaire was used for the data collection in the knowledge assessment component. Two versions of the questionnaire were used: 1) Pressure Ulcer Knowledge Questionnaire A, which was the version administered to the RNs and LPNwcs, and 2) Pressure Ulcer Knowledge Questionnaire B, which was the version administered to PCAs and LPNnowcs. Both questionnaires A and B can be found in Appendices K and L, respectively. Each questionnaire was comprised of three sections: a) demographics b) learning needs, and c) Pieper's Pressure Ulcer Knowledge Test. The questionnaires are described in more detail in the next sections.

Pressure ulcer knowledge questionnaire A: demographics. The demographic profile was the first section in the Pressure Ulcer Knowledge Questionnaires for RNs and LPNwcs. Questions were asked regarding professional designation including the amount of work experience in their profession and in LTC. Additionally, participants were asked if any recent pressure injury education had been received, and if so, when and what type of education e.g., internet, formal education session, print material, conference, work in-service. A space was also included on the demographic profile for the participants to provide an identifying code. This identifying code was unique to the participant, who provided the information to be used. To create this code, the participant selected month of birth, first initial of mother's maiden name, and day of birth (month/first initial of mother's maiden name/day of birth). The code was used for analysis of the questionnaire results by demographic characteristics. A participant-generated code was used so that if the same test is used in a future evaluation of an education program, as tentatively planned, they can use the same code as it will be easy for them to reconstruct, thereby making it possible to compare pre and post education results even though the purpose of this study was not as a baseline assessment. The researcher did not keep a record of these codes and participants' names.

Pressure ulcer knowledge questionnaire A: learning needs. A learning needs section was developed by the researcher and included in the Pressure Ulcer Knowledge Test for the RNs and LPNwcs. While this section contained items to identify learning needs, items were also added here to test knowledge regarding pressure injury risk assessment, related policies, and pressure injury staging. These items were added to help identify other areas of pressure injury knowledge, and thus learning needs, that were not tested in the true/false knowledge items on Pieper's Pressure Ulcer Knowledge Test contained in the third section.

In total, this section of the questionnaire contained six questions in the form of multiple choice and open-ended styles and took approximately five minutes to complete. Two questions were included to identify perceived learning needs and preferences. Three open-ended questions were included regarding pressure injury risk assessment practices and policies, including when the Braden Scale should be completed and by whom. The last question contained two parts; each included a picture of a different stage of a pressure injury for the participant to identify and then stage according to the choices listed. This section was pilot tested with two RNs and three LPNs at a site not included in this study. Feedback did not warrant any changes to be made.

Pressure ulcer knowledge questionnaire A: knowledge. The third section on the questionnaire consisted of the Pieper's Pressure Ulcer Knowledge Test and was administered to RNs and LPNwcs. This test can be found as part of Questionnaire A in Appendix K. This test covered content on risk and prevention, pressure injury staging, and wound assessment. It contained 47 true/false/don't know items. While Pieper's Pressure Ulcer Knowledge Test was originally developed in 1995 to evaluate acute care nurses' knowledge of pressure injuries, it had since been used in other studies to evaluate knowledge of nurses, auxiliary nurses, nursing students, and nurse technicians from various settings including long term care regarding pressure injuries. It had also been assessed to have acceptable psychometric parameters. As discussed in Chapter 2, in the original study, content validity was tested by four enterostomal therapy nurses as experts and the test was piloted on 228 nurses (Pieper & Mott, 1995). The Cronbach's alpha used to assess reliability was reported as .91 (Pieper & Mattern, 1997). The reliability and Cronbach's alpha values were also determined for each subsection as: .80 for pressure injury risk and prevention, .49 for pressure injury staging and .59 for wound description (Chianca, et al., 2010).

Although the test was developed for an acute care setting and no psychometric testing was done for the LTC setting, pressure injury risks, prevention, staging, and wound descriptors are consistent regardless of health care setting. Consequently, this test was deemed appropriate for the purposes of evaluating knowledge of nursing staff in EHLTC related to pressure injuries.

For the purposes of this study, slight wording changes were made to Pieper's Pressure Ulcer Knowledge Test to reflect Long Term Care and Canadian health care. Where the words "hospital" and "patient" were used, "long term care" and "resident" were substituted. In addition, one question was rephrased, #22, "The incidence of pressure ulcers is so high that the government has appointed a panel to study risk, prevention, and treatment". For this study, to better reflect the Canadian healthcare system, this item was substituted with "The prevalence of pressure ulcers is so high that Accreditation Canada has identified Pressure Ulcer Prevention as a Required Organizational Practice". It was not anticipated that these slight changes would affect the validity and reliability of the test.

Pressure ulcer knowledge questionnaire B: demographics. The modified Pressure Ulcer Knowledge Questionnaire administered to the PCAs and LPNnowcs also contained a demographics section. This section contained the same questions as those found in the demographics section contained in the Pressure Ulcer Knowledge Questionnaire A administered to the RNs and LPNwcs and can be found in Appendix L.

Pressure ulcer knowledge questionnaire B: learning needs. A learning needs section was developed for the PCAs and LPNnowcs. Additional questions were included in this section to assess knowledge regarding pressure ulcer prevention. There were a total of four questions with two questions included to identify learning needs and preferences and two questions related to pressure injury prevention. This section was pilot tested with three PCAs and two LPNnowcs and who did not work at a site selected for this part of the study. Based on feedback, no modifications were required.

Pressure ulcer knowledge questionnaire B: knowledge. Pressure injury staging and wound assessment are not part of the scope of practice for PCAs and LPNnowcs, therefore, a condensed version of the Pieper's Pressure Ulcer Knowledge Test was used to test these participants' knowledge. Therefore, questions pertaining to wound assessment and staging were excluded and only questions pertaining to pressure injury risk and prevention were taken from the Pieper Pressure Ulcer Knowledge Test for this version of the test. This modified version had the same wording changes previously described. A total of 24 questions were selected.

The condensed version of the Pieper's Pressure Ulcer Knowledge Test was pilot tested with two PCAs and two LPNnowcs at a site not included in this study. Feedback did not warrant any changes to be made to the condensed version of the Pieper Pressure Ulcer Knowledge Test.

Practice Assessment

Sites. All of the 17 Eastern Health LTC sites were targeted for the purposes of the practice assessment component of this study. A list of the sites can be found in Appendix M.

Population and sample. The target population consisted of all residents who were admitted to EHLTC between September 1, 2010 and April 30, 2011. These dates allowed for collection of data for a minimum of a six month period from the time of admission.

Once permission was obtained to access charts as discussed in a later section, admissions and discharge data were reviewed to identify eligible charts. Residents who were discharged or who died during that period were excluded, as were respite admissions. These exclusion criteria were chosen so that a minimum period of six months could be reviewed.

Of the 356 admissions from September 1, 2010 to April 30, 2011, a total of 269 charts from 17 EHLTC sites met the study criteria and were accessible for review. For the purposes of this study, the 17 LTC sites were broadly categorized as either urban or rural. There were 173 charts reviewed from the eight urban sites and 96 charts from the nine rural sites. As it was feasible to review all the eligible charts, it was not necessary to calculate a sample size.

Data collection procedure. Data collection was conducted by reading the eligible charts. Once all necessary approvals were obtained, chart reviews occurred from mid-December, 2011 to April 30, 2012. The researcher reviewed chart data documented over a minimum period of six months from the admission date. The Pressure Ulcer Risk Assessment Audit Tool was used to collect the practice data. This tool can be found in Appendix N.

Documentation methods varied between sites. Different versions of the Meditech electronic documentation system were in place in all but one of the rural sites. A client server electronic system was in place in the urban sites. Electronic charts were audited from the researcher’s computer where there was access to each type of electronic documentation. The researcher traveled to the four sites where paper documentation was in use. The researcher conducted all chart reviews to ensure consistency in data collection. The same data were extracted, regardless of paper or varied versions of electronic charting systems.

Instrument. For this study, to assess practices related to pressure injury prevention and management, the Pressure Ulcer Risk Assessment Audit Tool was used to collect pertinent data. This tool was developed by the researcher, based on the Braden Audit Tool contained in the Newfoundland and Labrador Skin and Wound Care Manual found in Appendix O. The Braden Audit Tool contained eight questions to determine if documentation supported that the Braden Scale has been completed at the right times and whether or not corresponding interventions were incorporated into the plan of care. It did not include questions to capture data regarding dates of assessments and reassessments and did not ask questions related to details regarding recommended and implemented interventions. Because the Braden Audit tool was limited in capturing such details, the Pressure Ulcer Risk Assessment Audit Tool was developed to capture more data regarding practice assessments. This newly developed tool contained questions that identified if the Braden Risk Assessment was completed, when the first assessment and subsequent reassessments were completed, and what interventions were implemented. The Pressure Ulcer Risk Assessment Audit Tool was not tested for validity and reliability.

One audit tool was completed per resident's chart and it was labeled with the applicable long term care site and an assigned research code. A master list of residents and corresponding research codes was kept in a locked file cabinet in the researcher's office and destroyed once results were finalized as per Eastern Health policy. The residents' names were not written on the audit form or entered into the data base.

Data Analysis

All statistical analyses were conducted using the statistical software package Stata 12.1 (StataCorps. 2011). The researcher entered the data into a database in Stata. Descriptive statistics were used to summarize results as described in the next sections. Since there were few statistically significant differences found with bivariate analysis, multivariate analysis was not warranted. Missing data were minimal with no patterns or trends.

Knowledge Tests Results

Pressure ulcer knowledge questionnaires A and B: demographics. Descriptive statistics were used to summarize demographic characteristics of the participants.

Pressure ulcer Knowledge Questionnaires A and B: knowledge. A previous study, in which the Pieper's Pressure Ulcer Knowledge Test was implemented, determined that for knowledge to be considered adequate, the participants were expected to correctly answer 90% or more of the test items (Pieper & Mattern, 1997). For this reason, an overall test score of 90% was considered the standard to determine if knowledge was adequate for all groups on both the Pieper's Pressure Ulcer Knowledge Test and the condensed version.

Each answer on both the Pieper's Pressure Ulcer Knowledge Test and the condensed version, including the two pictures for staging, were categorized as correct or incorrect. Correct answers were given a score of 1 while incorrect or "don't know" answers were given a score of 0. The scores of individual items were then summed to give subscores per section for Questionnaire A (Risk and Prevention, Pressure Ulcer Staging and Wound Description). All items were then summed for the total score. For Questionnaire B, which contained only items related to risk and prevention, items were summed for a total score. The highest possible score for Questionnaire A was 47; the highest possible score for Questionnaire B was 24. For each participant, the scores were converted to a percentage value, for example, by dividing the number of total correct responses by 47 or 24, respectively, and then the respective number was multiplied by 100. The converted scores are discussed rather than the raw scores.

The total score and the subscores on two out of the three categories from the Pressure Ulcer Knowledge Test from Questionnaire A were not normally distributed, and so the medians, interquartile ranges, and ranges were reported rather than the means and standard deviations. The median subscores of each category and median total scores were calculated separately for the RN group and the LPNwc group.

The scores on the Pressure Ulcer Knowledge Test from Questionnaire B for each group (PCAs and LPNnowcs) were of a reasonable normal distribution, therefore the means and standard deviations were reported. The mean scores were calculated separately for the PCA group and the LPNnowc group.

The participants' scores were variable with no outstanding patterns, therefore, the total scores and each of the three category subscores from the Pressure Ulcer Knowledge Test were grouped into one of the three following score range categories: 1) less than 65.0%, 2) between 65.0% and 79.0% and, 3) greater than 79.0%. These categories reflect Memorial University's grading system of 'C', 'B', and 'A', respectively. The total scores and subscores were compared by participants' position (RN vs. LPNwc and PCA vs. LPNnowc).

To determine the level of participants' knowledge in specific content areas, responses to each questionnaire item were reviewed. For each category on the Pressure Injury Knowledge Test (Risk and Prevention, Wound Description, and Pressure Injury Staging), the numbers and proportions of participants who answered each item correctly were calculated and compared by group for each questionnaire (e.g., RN vs. LPNwcs and PCAs vs. LPNnowcs).

The median subscores and overall median scores (Questionnaire A) and mean scores (Questionnaire B) were also calculated and compared by category (e.g., LPNnowc vs. PCA), by region, by years of experience, and by recent exposure to pressure injury education.

For the two staging questions on Questionnaire A, RNs and LPNwcs could choose one of the following answers: a) Stage I, b) Stage II, c) Stage III, d) Stage IV, e) Suspected Deep Tissue Injury, or f) unstageable. The results were assessed according to the number and percent of responses by each group (RN and LPNwc) and compared by group (RN versus LPN), by region of work, by experience, and by recent exposure to education in pressure injuries.

Because the Pressure Ulcer Knowledge Tests from Questionnaires A for the RNs and LPNwcs and B for the LPNnowcs and PCAs differed, the overall results were not comparable. Therefore, the results to the 24 items common to both versions of the Pressure Injury Knowledge Test were compared and summarized for all groups of participants (RNs, LPNwcs, LPNnowcs, and PCAs). For each participant, the scores were converted to a percentage value by dividing the number of total correct responses by 24 and then the respective number was multiplied by 100. Because these results were of a reasonable normal distribution, the means were reported.

Differences in proportions of responses between groups were tested for significance using Fisher's Exact Test. Differences in medians were tested using the Wilcoxin Rank-sum (Mann-Whitney) test and comparisons in means were tested using t-tests and ANOVA. Statistical significance was assessed using the aforementioned tests only when the differences between proportions and the differences in scores were greater than five percentage points because preliminary analyses not reported here showed that smaller differences were not statistically significant. Differences were considered significant if $p<.05$, with the alpha set at .05.

Pressure ulcer knowledge questionnaires A and B: learning needs. In response to the open-ended question: "Regarding the topic of pressure ulcers, what would you like to learn about?" on Questionnaires A and B, there were a total of 186 topics identified, which were then categorized into the seven broader themes for analysis. Additionally, the participants were asked to rank their three most preferred methods of education delivery. Ranking results were described by the number and percentage of participants who selected each method of education delivery. Descriptive statistics were used to summarize the themes from the identified learning needs and the rank ordering of preferred education delivery methods. Results were analyzed for each group.

The themes from the participants' responses identifying their learning needs were further explored to determine if they reflected the scores from the Pressure Ulcer Knowledge Tests. First, the content from each of the items on both Pressure Ulcer Knowledge Tests were assessed for the most appropriate fit with a theme and categorized accordingly. The average correct response rates for the items in each theme category were then calculated for each group of participants. If there was only one item found to be related to a theme, the respective correct response rate was used. Because there were two versions of the Pressure Ulcer Knowledge Test, the average correct response rates were assessed separately for the RN and LPNwc groups and then the LPNnowc and PCA groups, according to their version of the test. The average correct response rates to the themed items from the Pressure Ulcer Knowledge Test were compared with the frequency of corresponding perceived learning needs themes. Descriptive statistics were used to summarize the correspondence between the frequency of themed learning topics and the themed test items.

Practice Assessment Results: Policy Knowledge and Application

There were multiple choice and open ended knowledge questions pertaining to pressure injury policies that were included on Questionnaires A and B. The application of this policy knowledge was assessed in practice via retrospective chart reviews and so it was decided to include the methods discussion of both the policy knowledge and its application in this section.

For the three open-ended questions used to determine policy knowledge regarding when the Braden Risk Assessment is done, who can complete it and which policies exist, the answers were categorized as correct, partially correct or incorrect. The percentage and number of RNs and LPNwcs for each type of response was calculated. The answers were analyzed by group (RN versus LPNwcs), by LTC site and then compared by recent exposure to education in pressure injuries.

For this study, the correct response to the open-ended question on Questionnaire A about the required Braden Risk Assessment frequencies was determined according to the Braden Scale Adults-Only Policy (BSAOP) and contained four assessment period categories: 1) within 48 hours of admission, 2) then weekly for four weeks, 3) then quarterly, and 4) if there is a change in health status. Even though the policy states "within 48 hours of admission", for this study, "on admission" was considered an acceptable as a response. A response identifying all four assessment periods was considered the correct response. If the response contained only one to three of the four periods, it was considered partially correct. If a response contained none of the identified periods, it was considered incorrect.

For the open-ended question on Questionnaire A, asking who could complete the Braden Risk Assessment, the answer was determined as per the BSAOP which states the RN or LPN and this was considered the correct response. Identifying only the RN or only the LPN was considered partially correct. A response naming a `PCA and LPN’, or `PCA and RN’, or `PCA, RN, and LPN’ was considered partially correct. A response of ` PCA’ or `don’t know’ was considered incorrect.

The response to the open ended question on Questionnaire A asking the RNs and LPNwcs to name the pressure injury related policies had to contain identification of all three policies: a) the BSAOP, b) the Pressure Ulcer Prevention Policy (PUPP), and c) the Wound Management Policy (WMP). If the response contained content similar to one policy, it was considered acceptable for the corresponding policy. If the response named only one or two of the policies, it was considered partially correct and if no policies were identified, incorrect.

There were two multiple choices questions on Questionnaire B for LPNnowcs and PCAs concerning the frequency of skin assessments and to whom to report concerning findings. For the frequency of skin assessments, participants could select either: a) daily, b) weekly, or c) other. The correct response was `daily’. For the question concerning to whom to report concerning findings, participants could choose either: a) RN, b) LPN,

c) RN or LPN, d) PCA, e) don't know. If the response named either `RN', or `LPN', or `RN and PCA', or LPN' or `PCA', it was considered partially correct. If the response was `PCA' or `don't know', it was incorrect. The correct response was `RN or LPN'. The responses were analyzed according to the number and percent of each answer from each group (LPNnowc and PCA).

Retrospective chart reviews were conducted to assess application of policy knowledge. Data were reviewed to determine if initial Braden Skin Risk assessments and reassessments documented at the right times (per policy): a) within 48 hours of admission, then at b) week one, c) week two, d) week three, e) week four, f) first quarterly, and g) second quarterly. For each resident, according to the policy, seven risk assessments should have been completed during the reviewed period, over seven months post-admission. The proportions of risk assessments that were actually completed were calculated. The proportions of risk assessments that were completed by either an RN or an LPN were also calculated, since the Braden scale risk assessment can be done by an RN or an LPN. As well, completed risk assessments were presented by the time range that lapsed between the expected dates and actual dates of completion. Data concerning the proportions of risk assessments that were completed were compared by region and by sites where policy education occurred versus sites where policy education did not occur.

It was anticipated that risk assessments may not be completed exactly on schedule as per the BSAOP, therefore, this study sought to determine if assessments were completed on time, or close to the expected date. If not completed close to the expected date, they were considered early or late. Determination of the expected date of completion of each risk assessment was based on the schedule outlined in the BSAOP.

For each risk assessment interval, time range periods were arranged into several categories. There were risk assessments completed that did not correspond to either of the expected required intervals and these were placed in separate category of “other”.

For admission assessments, time range categories were: 1) within 48 hours, 2) 3 to 7 days, and 3) 8 days up to 1 month, and 4) initial assessments completed over a month post-admission. According to the BSAOP, admission risk assessments must be completed within the first 48 hours of a resident’s admission. For the first four weekly risk assessment intervals, there are three time range categories: 1) within 7 days (before or after the expected date of completion), 2) early (more than 7 days before the expected date of completion), and 3) between 8 and 21 days after the expected date of completion.

The first quarterly assessment was expected three months after the fourth weekly interval and the second quarterly would then be expected three months after the first quarterly assessment. Because there was variability in the time range for the completion of the admission and the first four weekly assessments, this led to increased variability in when to expect subsequent quarterly assessments. Therefore, to accommodate this variability, for this study, the first quarterly assessment was expected within three to five months after admission while the second quarterly was expected to occur within six to eight months after admission. If the completed first and second quarterly assessments did not occur in the aforementioned respective time frames, then the assessment dates were categorized as either early or late; they occurred earlier or later than the respective outlined time frames.

Analyses were conducted to determine the proportions of Braden Scale Risk Assessments completed at each scheduled interval for the LTC sites where healthcare staff had received BSAOP education and at those sites where the education did not occur. Additional analyses were performed to determine whether or not there were any significant differences in the proportions of completed Braden Risk assessments within both the urban and rural regions according to previous BSAOP education. Further analysis was done to determine if the proportions of RNs and LPNs who completed risk assessments differed by exposure to BSAOP education. The proportions of assessments that were completed by RNs and LPNs were tabulated for each region where staff had received BSAOP education or had not.

For the knowledge data, Fisher's Exact Test was used to assess significant differences between proportions of responses for each group by characteristics such as region of work, post-basic pressure ulcer education, and experience. For the practice data, Fisher's Exact Test was used to test significant differences between the proportions of completed assessments by region and by exposure to BSAOP education. Differences were considered significant if $p<.05$, with the alpha set at .05.

The charts were also reviewed for any documented interventions added to the plan of care and requests for consults from the Physiotherapist (PT), the Occupational Therapist (OT), and the Registered Dietitian (RD) that corresponded to the Braden Scale score and its subscores. The highest possible score on the Braden Scale is 23. According to the BSAOP, there are three main score risk categories determined from the total Braden scale score: low risk (≥19), mild to moderate risk (13 to 18), and high risk (≤12), each corresponding to the risk level of developing a pressure injury. There are six categories (sensory perception, moisture, activity, mobility, nutrition, and friction/shear) on the Braden scale and each can be given a score of 1 to 4, where 1 represents the highest risk and 4 the lowest level of risk. If the score is two or less on the nutrition or the mobility components, a referral to a registered dietitian or an occupational therapist/ physiotherapist (respectively) must be completed. Chart data was reviewed for scores obtained from the assessments and reassessments and for documentation of appropriate interventions and required consults.

The proportions of Braden risk assessments that resulted in low (≥19), mild to moderate (13 to 18), and high risk scores (≤12) were determined along with the level of risk indicated by the subscores from the Braden scale categories (sensory perception, moisture, activity, mobility, nutrition, and friction/shear). Chart results from urban and rural sites were compared.

Descriptive statistics were used to report the data by percentage and number of risk assessments, the corresponding scores and subscores by region. Descriptive statistics were also used to report the proportions and number of high risk assessments with documented pressure injury interventions and consults.

Ethical Considerations

The research proposal, along with all the necessary documentation, was submitted to both the Health Research Ethics Authority (HREA) and to the Research Proposal Approval Committee of Eastern Health (RPAC). Ethical approval was obtained from HREA and RPAC as well as from the program directors. A copy of the letter to the two Directors of LTC can be found in Appendix P. Data access was requested in writing and approved by the data custodian of Eastern Health. A copy of the request for data access can be found in Appendix Q. This study also involved chart audits. There was no anticipated risk to the residents and thus the HREA ruled that consent was not required from individual residents. A summary of the data obtained from this study will be shared with the stakeholders of EHLTC and staff participants.

Participation in the study by staff members was entirely voluntary. A detailed information sheet was read and a copy was provided to the participants in person. Consent was obtained from participants to complete the knowledge questionnaires. Data collection was not invasive in nature. The potential participants were under no obligation to complete the knowledge tests. There were no repercussions if they chose not to participate. For those who agreed to participate, anonymity and confidentiality were preserved. The identity of the staff member was not recorded on the questionnaires. The researcher was not able identify who completed the questionnaires.

There was no remuneration for the staff participants, however, because participants may have completed the questionnaires during scheduled breaks, snacks and refreshments were offered to those who participated. The questionnaires were estimated to take approximately 20 minutes of the staff members' time to complete. There was no risk associated with participation, nor any expected immediate benefit. Participation, however, may have increased nursing staff curiosity about pressure injuries and thus improved receptivity to pressure injury education.

If participants requested answers to any of the questionnaire items, they were informed that answers could be provided after the knowledge assessment portion of the study was completed. If any participants had more pressing questions regarding pressure injuries that may arise as a result of completing the questionnaire, the researcher offered a separate time to discuss the questions with them either by phone or in person. Since completion of the study, no participants approached the researcher seeking the knowledge test answers or pressure injury information.

Data access was controlled as per the requirements of the HREA and RPAC. Paper charts were not removed from the site unit and were reviewed at the site in an area that did not compromise confidentiality. Electronic charts were viewed on the researcher's office computer where confidentiality was upheld.

A master list was developed containing the provincial medical number and a research code. This information was used only to verify and correct any information accessed from the chart. Only the research code was documented on each resident's audit form.

All confidential materials were kept in a secure, locked area. Computers used to store information and conduct analysis were password protected and accessible only to the researcher. Only research codes, i.e. no provincial medical numbers or other staff or resident identifiers, were entered into the computer. Once all data was entered into the computer, the data collection forms, master list, and tests were locked in a secure area and were kept for the required time frame. They were destroyed in April, 2016.

Chapter 4

Results

Participant Knowledge

This chapter focuses on results pertaining to participant knowledge about pressure injury prevention, assessment, and management, addressing the first three questions. The results from the remaining three questions are presented in Chapter 5. Specifically, this chapter describes the results from both versions of the Pressure Ulcer Knowledge Tests and relevant questions that were included on Questionnaire A for RNs and LPNs who had wound care education (LPNwcs) and Questionnaire B for PCAs and LPNs who did not have wound care education (LPNnowcs). First, a descriptive profile of the questionnaire participants is presented. Then the results of the study are presented according to the research question they address. Also included is a brief summary of the results in terms of participant characteristics, specifically LTC experience, professional experience, pressure injury education, and region or work.

4.1 Questionnaires: Participant Profile

A convenience sample of a total of 120 participants recruited from four Eastern Health Long Term Care facilities completed the questionnaires. The participants were comprised of RNs, LPNwcs, LPNnowcs, and PCAs.

4.1.1 Site and position. Table 4.1 shows the distribution of participants by site and by position. Participant representation by position is shown in the row "Total by Position" and by site in the column "Total by Site". The two largest groups were LPNwcs (31.7%) and PCAs (30.0%). The LPNnowcs comprised 23.3% of the total sample while RNs represented the smallest group at 15.0%. The majority of all participants, 36.6%, were from the midsize urban site, while the small rural site had the smallest proportion of all participants (15%). Overall, each site was reasonably well represented.

Table 4.1

Participants by Site and Position

Site	% (n) [a]				Total by Site [b] % (n)
	RN	LPNwc	LPNnowc	PCA	
Midsize Urban	9.1% (4)	27.3% (12)	27.3% (12)	36.4% (16)	36.6% (44)
Large Urban	25.7% (9)	25.7% (9)	31.4% (11)	17.1% (6)	29.2% (35)
Midsize Rural	17.4% (4)	43.5% (10)	8.7% (2)	30.4% (7)	19.2% (23)
Small Rural	5.6% (1)	38.9% (7)	16.7% (3)	38.9% (7)	15.0% (18)
Total by Position[c] %(n)	15.0% (18)	31.7% (38)	23.3% (28)	30.0% (36)	100.0%(n=120)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. [a] % (n) = n is the number of participants in the specified position from the specified site (midsize urban = 44, large urban = 35, midsize rural =23, and small rural= 18); % is n divided by the total number of all participants at the specified site and then multiplied by 100. [b] Total by site % (n) = n is the combined total number of participants at the specified site; % is n divided by all 120 participants multiplied by 100. [c]Total by position % (n) = n is the combined total number of participants in the specified position (18 RNs, 38 LPNwcs, 28 LPNnowcs, 36 PCAs); % is n divided by all 120 participants multiplied by 100.

As shown in Table 4.1, out of all the participants at the small rural site, PCAs and LPNwcs equally comprised the largest groups (38.9%) and the RNs the smallest group (5.5%). At the midsize urban site, PCAs comprised the largest group (36.4%) and RNs again the smallest group (9.1%). In contrast, at the midsize rural site, LPNwcs made up the largest group (43.5%) and the LPNnowc the smallest group (8.7%). At the large urban site, the distribution was different with the LPNnowc group being the largest (31.4%) and the PCAs the smallest group (17.1%).

Because of the small numbers in each subgroup by position and site, the four site categories were collapsed into two regional categories: urban and rural. The decision to compare urban versus rural rather than by size was based on anecdotal comments concerning differences in their access to resources. These collapsed categories will be used for all future analyses contained in this chapter.

4.1.2 Experience. Table 4.2 summarizes the experience of the participants in each of the participant groups. The LPNnowc participants had the most experience in LTC and in their profession with all of them having more than 10 years of experience. The majority of RN participants also had more than 10 years of experience in their profession (72.2%) but only half had more than 10 years of experience in LTC. Almost half of the LPNwc group had more than 10 years of experience in both LTC (n=18) and their profession (n=17). The PCA group was the least experienced; 75% had less than 5 years of experience in both LTC and in their profession.

Table 4.2

Years of Experience in Long Term Care and Identified Profession

Experience	RN	LPNwc	LPNnwc	PCA	Total [b] % (n)
	% (n) [a]				
Long Term Care					
>10 Years	50.0% (9)	47.4% (18)	100.0% (28)	11.1 (4)	49.2% (59)
<5 Years	27.8% (5)	23.7% (9)	0.0% (0)	75.0% (27)	34.2% (41)
5-10 Years	22.2% (4)	29.0% (11)	0.0% (0)	13.9% (5)	16.7% (20)
Identified Profession					
>10 Years	72.2% (13)	44.7% (17)	100.0% (28)	8.3% (3)	50.8% (61)
<5 Years	11.1% (2)	31.6% (12)	0.0% (0)	75.0% (27)	34.2% (41)
5-10 Years	16.7% (3)	23.7% (9)	0.0% (0)	16.7% (6)	15.0% (18)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnwc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. [a] % (n) = n is the number of participants in each position with the specified characteristic; % is n divided by the total number of all participants the specified position and then multiplied by 100. [b]Total % (n) = n is the combined total with the specified characteristic; % is n divided by all 120 participants multiplied by 100.

Again, due to the small numbers of participants within each subgroup by LTC and professional experience, these categories were collapsed from three groups to two groups: "<10 years" and "> 10 years". These collapsed categories will be used for all future analyses contained in this chapter.

4.1.3 Pressure Injury Education. Table 4.3 shows the proportion and number of participants in each group who did or did not receive any pressure injury education outside of their basic training programs. Just over half of all participants (55.5%) did not receive additional pressure injury education outside of their basic training programs. A fairly large proportion of the RN group (77.8%) said they had pressure injury education compared with only 20.0% of the PCA participants. Within the LPNwc and LPNnowc groups, very similar proportions did (46.4% and 50.0% respectively) or did not (52.6% and 50.0% respectively) have pressure injury education.

Table 4.3

Previous Pressure Injury Education

Previous Pressure Injury Education	% (n) [a]				Total out of all Participants [b] % (n)
	RN	LPNwc	LPNnowc	PCA	
No [c]	22.2% (4)	52.6% (20)	50.0% (14)	80.0% (28)	55.5% (66)
Yes [d]	77.8% (14)	47.4% (18)	50.0% (14)	20.0% (7)	44.5% (53)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnwc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. [a] % (n) = n is the number of participants in the specified position with or without previous pressure injury education; % is n divided by the total number of participants in the specified position (18 RNs, 38 LPNwcs, 28 LPNnowcs, 28 PCAs minus one missing response) and then multiplied by 100. [b]Total out of all participants % (n) = n is the total with or without previous pressure injury education; % is n divided by all participants (n=119) multiplied by 100. [c]No = had no pressure injury education outside of basic training. [d]Yes = had pressure injury education outside of basic training.

For the 53 participants who indicated they did receive pressure injury education outside of their basic training, Table 4.4 shows when the education was received. A larger proportion of the participants (37.7%) obtained the pressure injury education outside of their basic training programs more than three years prior to this study compared to more recent times. Only 13.2% reported that they had the education less than one year prior to this study. Almost one third of the participants who reported that they had pressure injury education outside of their basic education programs did not indicate when.

Table 4.4

When Previous Post Basic Pressure Injury Education was Received

When	% (n)[a] RN (n=14)	LPNwc (n=18)	LPNnowc (n=14)	PCA (n=7)	Total out of all who had PU Education[b] % (n)
>3 Years PTS	42.9% (6)	33.3% (6)	50.0% (7)	14.3% (1)	37.7% (20)
1 to 3 Years PTS	28.6% (4)	27.8% (5)	14.3% (2)	0.0% (0)	20.8% (11)
<1 Year PTS	7.1% (1)	27.8% (5)	0.0% (0)	14.3% (1)	13.2% (7)
Missing Response	21.4% (3)	11.1% (2)	35.7% (5)	71.4% (5)	28.3% (15)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. PU Education = pressure injury education. PTS= prior to this study. [a] %(n) = n is the number of participants in the specified position who received pressure injury education in the indicated time frame; % is n divided by the total number in the each position who had previous pressure injury education (14 RNs, 18 LPNwcs, 14 LPNnowcs, 7 PCAs) and then multiplied by 100. [b] Total out of all who had PU Education % (n) = n is the total of all participants who received pressure injury education in the indicated time frame; % is n divided by all participants who received pressure injury education (n=53) multiplied by 100.

Because of the small numbers within each subgroup, the three timeframe categories were collapsed to two categories: “<3 years” and “>3 years”. These collapsed categories will be used for all future analyses contained in this chapter.

4.1.3.1 Delivery method of the pressure injury education received. Table 4.5 shows the delivery method of the pressure injury education that the 53 participants received outside of their basic training programs. In-service at work was reported more frequently than other categories to be the delivery method of the pressure injury education received by participants. None of the RN or PCA participants said they received education from a formal education program outside of work compared to 16.7% of the LPNwc group and 7.1% of the LPNnwc group. Of the PCA participants who did receive pressure injury education, none of them did so through a work related conference compared to 28.6% of the RN participants and 27.8% of the LPNwc participants.

Table 4.5

Delivery Method of the Pressure Injury Education Received Outside of Basic Training

	% (n)[a]				
Delivery Method of Education [b]	RN (n=14)	LPNwc (n=18)	LPNnowc (n=14)	PCA (n=7)	Total by Delivery Method[c] % (n)
In-service at Work	78.6% (11)	72.2% (13)	78.6% (11)	57.1% (4)	73.6% (39)
Print Material e.g., nursing journals, newsletters	57.1% (8)	11.1% (2)	28.6% (4)	28.6% (2)	30.2% (16)
Work Related Conference	28.6% (4)	27.8% (5)	14.3% (2)	0.0% (0)	20.6% (11)
Self-Initiated on the Internet	21.4% (3)	11.1% (2)	0.0% (0)	14.3% (1)	11.3% (6)
Formal Education Program Outside of Work	0.0% (0)	16.7% (3)	7.1% (1)	0.0% (0)	7.6% (4)
Total by Position who Received PU Education[d] % (n)	77.8% (14)	47.4% (18)	50.0% (14)	20.0% (7)	44.5% (53)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnow = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. PU Education = pressure injury education. [a] % (n) = n is the number of participants in each position who had the specified education delivery method; % is n divided by the total number of participants in the specified position who had pressure injury education. [b]Delivery Method of Education = More than one type could be selected, therefore the percentages do not add up to 100%. [c] Total by Delivery Method % (n) = n is the combined total number of participants who had the specified delivery method of education; % is n divided by all participants who had pressure injury education (n=53) multiplied by 100. [d] Total who had PU Education % (n) = n is the total in specified position who had PU Education; % is n divided by total number of participants in the specified position multiplied by 100.

4.2 Research Question #1: What is the Level of Knowledge of Eastern Health RNs and LPNs who have Completed Education in Wound Care with Respect to Pressure Injury Prevention, Assessment, and Management?

To assess their level of knowledge with respect to the prevention, assessment, and management of pressure injuries, Questionnaire A included a Pressure Ulcer Knowledge Test. As described in Chapter 3 correct answers were given a score of 1 while incorrect or “don’t know” answers were given a score of 0. Scores of individual items were summed to give subscores per category and a total score. The highest possible total score was 47. Scores were then converted to a percentage value. For example, the total score was calculated by dividing the number of total correct responses by 47 and then that number was multiplied by 100 (#correct ÷ 47 x 100). The subscores for each category were calculated in a similar way. The converted scores are discussed here rather than the raw scores.

The total score and the subscores on two out of the three categories from the Pressure Injury Knowledge Test were not normally distributed, and so the medians, interquartile ranges, and ranges are reported rather than the means and standard deviations. The median subscores of each category and median total scores were calculated separately for the RN group and the LPNwc group. As described in Chapter 3, tests of significance, using the Fisher’s Exact Test, were reported only when differences in scores/subscores between groups were greater than 5 percentage points because preliminary analyses not reported here showed that smaller differences were not statistically different.

Also, as explained in Chapter 3, Questionnaire A included two pictures of differing stages of pressure injuries. Participants were asked to stage the pressure injuries from the choices listed. Answers were categorized as correct or incorrect.

The results of the Pressure Ulcer Knowledge Test and the staging picture items are presented in the next sections of this chapter. The scores from the Pressure Ulcer Knowledge Test are provided according to the total scores obtained and the subscores from each category (risk and prevention, wound description, and pressure injury staging). In addition to the scores, the proportions of participants who answered each item correctly are presented by position for each category. Lastly, results from the pressure injury staging picture questions are provided and presented by position. Any noteworthy trends in results with respect to participant characteristics, specifically LTC experience, professional experience, pressure injury education, and region or work are also briefly summarized.

4.2.1 Pressure Ulcer Knowledge Test: overview of category and total scores. The median subscores obtained in each of the three categories of questions and the median total score are shown in Table 4.6 for both the RN and the LPNwc groups. For the RN group, the greatest variability in Interquartile Range (IQR) was found in the Pressure Injury Staging subscores (57.1 to 85.7), while the widest ranges were noted for the Wound Description and the Pressure Ulcer Staging categories (42.9 to 100.0%). For the LPNwc group, the range of scores was widest (14.3 to 100.0) and the variability in IQR was greatest (42.9 to 71.4) on the Wound Description category.

Table 4.6 shows that the median total score and median subscore on Risk and Prevention were slightly higher for the RNs (74.5 and 72.7 respectively) than those for the LPNwcs (70.2 and 69.7 respectively) but the median subscores were the same (71.4) for the Pressure Injury Staging category. However, there was a statistically significant difference between the median subscores in the Wound Description category (p = .0132) with the RN median subscore (71.4) being higher than the LPNwc median subscore (57.1).

Table 4.6

Median, IQR, and Range: Subscores and Total Score

Category	RNs (n=18)		LPNwcs (n=38)	
	Median (IQR)	Range	Median (IQR)	Range
Risk and Prevention Items (33)	72.7 (66.7 to 78.8)	57.6 to 84.8	69.7 (66.6 to 75.8)	51.5 to 81.8
Wound Description Items (7)	71.4 (71.4 to 85.7)	42.9 to 100.0	57.1 (42.9 to 71.4)	14.3 to 100.0
Pressure Ulcer Staging Items (7)	71.4 (57.1 to 85.7)	42.9 to 100.0	71.4 (71.4 to 85.7)	42.9 to 100.0
Total Score	74.5 (70.2 to 76.6)	59.6 to 83.0	70.2 (63.8 to 74.5)	53.2 to 80.9

Note. RNs = Registered Nurses. LPNwcs = Licensed Practical Nurses with wound care education.
IQR= Interquartile Range.

4.2.2 Distribution of score range categories. The participants' scores were variable with no outstanding patterns, therefore, the total scores and each of the three category subscores from the Pressure Ulcer Knowledge Test were grouped into one of the three following score range categories: 1) less than 65.0%, 2) between 65.0% and 79.0% and, 3) greater than 79.0%. In the following sections, for both the RN and LPNwc groups, graphs are used to show how the total scores and the subscores were distributed across the score range categories.

4.2.2.1 Total scores by position. Figure 1 shows that 31.6% of the LPNwc participants scored below 65.0% compared to 16.7% of the RN participants with no significant difference between groups (*p*= .402). The majority of RN participants (77.8%) and the LPNwc participants (65.8%) scored between 65.0% and 79.0%: one RN scored 83.0% and one LPNwc scored 80.9%. In this study, for knowledge to be considered adequate, the participants were expected to correctly answer 90% or more of all the test items. No participants from either the RN or LPNwc groups obtained such a score.

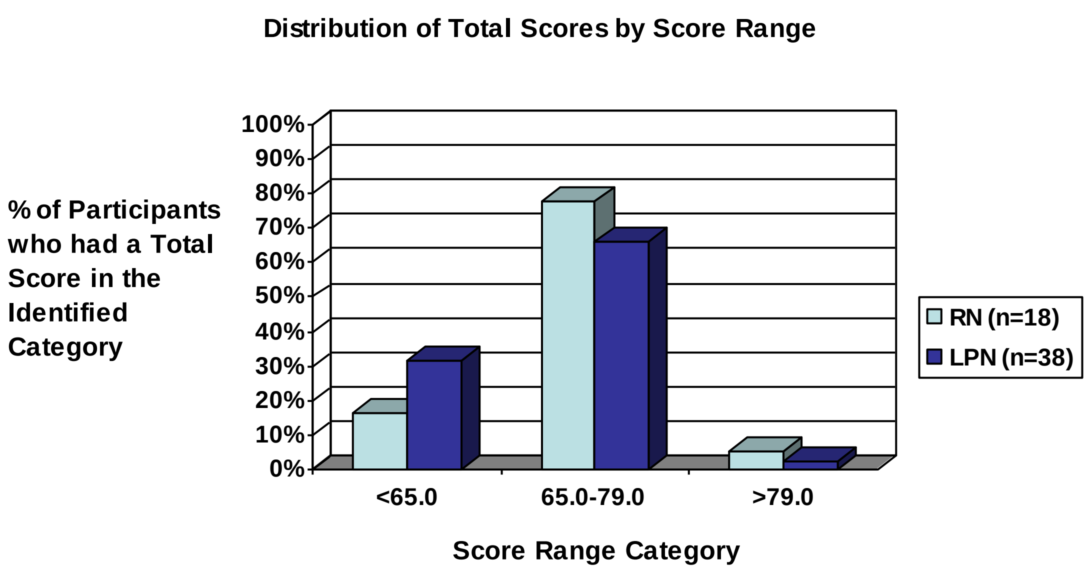


Figure 2. Percent of participants' total scores in each score range category from the Pressure Ulcer Knowledge Test.

4.2.2.2 Distribution of RN and LPNwc participants' subscores by score range. Figure 2 shows that the majority of the RN participants scored between 65.0% and 79.0% (72.2%) on the Risk and Prevention category and almost half (44.4%) scored over 79.0%

on the Wound Description category. On the Pressure Ulcer Staging category, however, while 38.9% of RNs scored between 65.0% and 79.0%, slightly smaller but similar proportions scored less than 65.0% (27.8%) and over 79.0% (33.3%). Overall, for the identified categories on the Pressure Ulcer Knowledge items, no consistencies were found in the distribution of subscores across the categories. The fewest low scores were found on the Risk and Prevention category while the most were found on the Wound Description category.

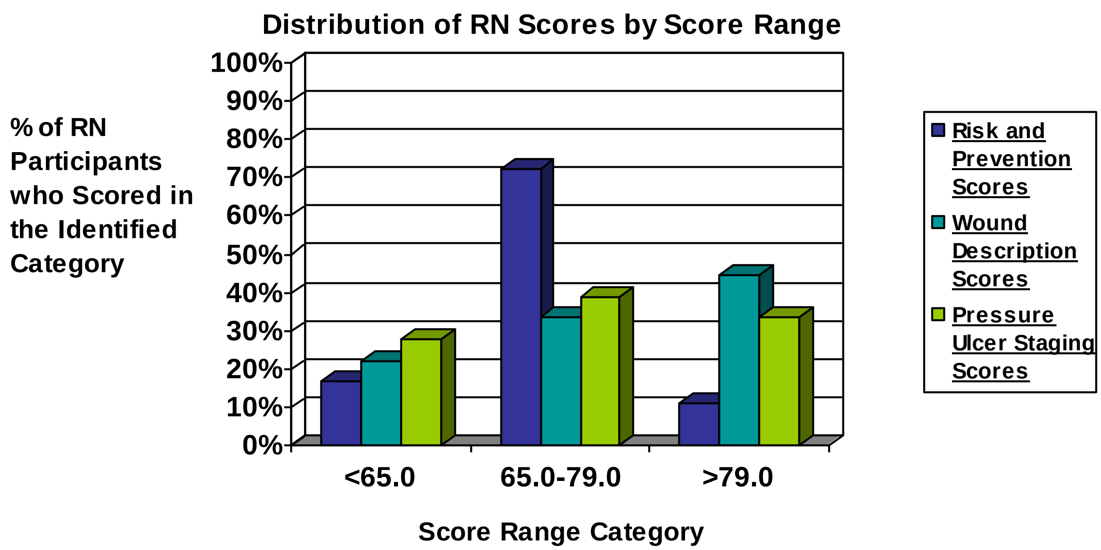


Figure 3. Percent of RN participants who scored in each score range category from the Pressure Ulcer Knowledge Test.

Figure 3 shows that for the Risk and Prevention category, the majority of LPNwc participants (76.3%) scored between 65.0% and 79.0%, fewer scored less than 65.0% (21.2%), and only one (2.6%) scored over 79.0%. Similarly, while the largest proportion

(60.5%) scored between 65.0% and 79.0% on the Pressure Ulcer Staging category, approximately a quarter of the LPNwcs (26.3%) scored over 79.0% but fewer (13.2%) scored less than 65.0%. In contrast, on the Wound Description category, the largest proportion (55.3%) scored less than 65.0% and similar proportions scored between 65.0% and 79.0% (21.1%) and over 79.0% (23.7%). Again, as with the RN group, no consistent trends in the distribution of scores were found for the identified item categories for the LPNwc group, but the RNs tended to score higher than the LPNwcs on the Wound Description category.

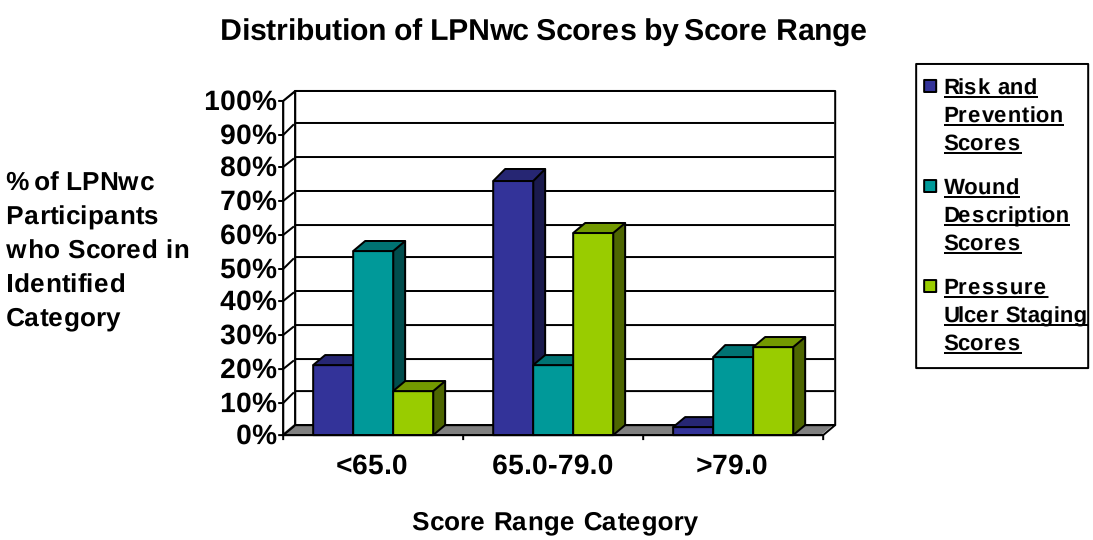


Figure 4. Percent of Risk and Prevention Category subscores in each score range category from the Pressure Ulcer Knowledge Test.

4.2.3 Responses by item. To determine the level of participants' knowledge in specific content areas, responses to each questionnaire item were reviewed. For each category on the Pressure Ulcer Knowledge Test (Risk and Prevention, Wound

Description, and Pressure Ulcer Staging), the numbers and proportions of participants who answered each item correctly are presented separately in the following sections with results shown for both the RN and LPNwc groups.

4.2.3.1 Risk and Prevention items. Due to the high number of items pertaining to risk and prevention, for clarity of presentation, the 33 items were grouped by correct response rates as follows: 1) less than 65%, 2) between 65% and 90%, and 3) more than 90%. Additionally, results for which there was a discrepancy of more than 10 percentage points between responses correctly answered by the RN and LPNwc groups were singled out and presented in a separate table.

Table 4.7

Risk and Prevention Items Correctly Answered by <65% of Participants

Item	RNs (n=18)		LPNwcs (n=38)	
	n[a]	% correct[a]	n[a]	% correct[a]
Persons who can be taught should shift their weight every 30 minutes while sitting in a chair. (F)	1	5.6	2	5.3
A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair. (F)	1	5.6	5	13.2
A low-humidity environment may predispose a person to pressure injuries. (T)	4	22.2	8	21.1
Hot water and soap may dry the skin and increase the risk for pressure ulcers. (T)	9	50.0	18	47.4
A low Braden score is associated with increased pressure ulcer risk. (T)	10	55.6	18	47.4
It is important to massage bony prominences. (F)	10	55.6	18	47.4

Note. F = false. T = true. RNs = Registered Nurses. LPNwc = Licensed Practical Nurses with wound care education. [a]n and % correct = total number and percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.

Table 4.7 shows the items that fewer than 65% of participants correctly answered. Two of the items related to frequency of repositioning for those chair bound yielded a very low correct response rate (<15%) for both RN and LPNwc groups. Roughly 20% of each group correctly answered the item pertaining to the risks of a low humidity environment. Only about half of each group recognized that hot water and soap may dry the skin and increase the risk for pressure injuries or that a low Braden score is associated with increased pressure injury risk. Similarly, approximately half of each group correctly answered false to the item “It is important to massage bony prominences”.

Table 4.8 shows the Risk and Prevention items that were correctly answered by 65% to 90% of participants. Although usually more RNs compared to the LPNwc participants answered these items correctly with the exception of the item pertaining to use of underpads to manage moisture, the discrepancy between groups was minimal. Just over two thirds of all participants correctly answered items pertaining to minimizing exposure to incontinence, high prevalence of pressure injuries, and when to use a pressure redistribution mattress. The majority (>80%) of both the RN and LPNwc participants correctly answered items identifying the recommended frequency of skin inspections for at-risk residents and that macerated skin tears easily.

Table 4.8

Risk and Prevention Items Correctly Answered by 65% to 90% of Participants

Item	RNs (n=18)		LPNwcs (n=38)	
	n[a]	% correct[a]	n[a]	% correct[a]
To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture. (T)	12	66.7	28	73.7
The prevalence of pressure ulcers is so high that Accreditation Canada has identified Pressure Ulcer Prevention as a Required Organizational Practice. (T)	13	72.2	26	68.4
Every person assessed to be at risk for developing pressure injuries should be placed on a pressure-redistribution bed surface. (T)	13	72.2	26	68.4
All residents in Long Term Care at risk for pressure ulcer should have a systematic skin inspection at least daily. (T)	16	88.9	31	81.6
Skin macerated from moisture tears more easily. (T)	16	88.9	31	81.6

Note. F = false. T = true. RNs = Registered Nurses. LPNwcs = Licensed Practical Nurses with wound care education. [a]n and % correct = total number and percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.

There were 10 items that were correctly answered by more than 90% of the RN and LPNwc groups; these are shown in Table 4.9. Two items were correctly answered by just fewer than 100% of both groups with similar correct response rates both the LPNwc and RN groups (97.4% vs. 94.4% respectively). These two items pertained to chair cushions for chair-bound persons and protection of bony prominences. Most of the LPNwc participants (97.4%) and all of the RNs correctly answered items regarding documentation, friction, and risk assessment on admission. There were four items correctly answered by 100% of both groups and these concerned nutrition, major risk factors, incontinence care, and effects of pressure injury education.

Table 4.9

Risk and Prevention Items Correctly Answered by Greater than 90% of Participants

Item	RNs (n=18) n[a]	RNs (n=18) % correct[a]	LPNwcs (n=38) n	LPNwcs (n=38) % correct[a]
Chair-bound persons should be fitted for a chair cushion. (T)	17	94.4	37	97.4
Bony prominences should not have direct contact with one another. (T)	17	94.4	37	97.4
The epidermis should remain clean and dry. (T)	18	100.0	36	94.7
All residents should be assessed on admission to a Long Term Care facility for risk of pressure ulcer development. (T)	18	100.0	37	97.4
All care given to prevent or treat pressure ulcers must be documented. (T)	18	100.0	37	97.4
Friction may occur when moving a person up in bed. (T)	18	100.0	37	97.4
An adequate dietary intake of protein and calories should be maintained during illness. (T)	18	100.0	38	100
Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness. (T)	18	100.0	38	100
For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals. (T)	18	100.0	38	100
Educational programs may reduce the incidence of pressure ulcers. (T)	18	100.0	38	100

Note. F = false. T = true. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. [a]n and % correct = total number and percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.

As shown in Table 4.10, there were 12 Risk and Prevention items where the correct response rates of the RN and LPNwc participants differed with a discrepancy of greater than 10 percentage points. Differences were not statistically significant for 10 of these items.

Table 4.10

Risk and Prevention Items Correctly Answered by RN and LPNwc Groups with >10 Percentage Point Discrepancy

Item	RNs (n=18)		LPNwcs (n=38)	
	n[a]	% correct[a]	n[a]	% correct[a]
Heel protectors relieve pressure on the heels. (F)	3	16.7	2	5.3
In a side lying position, a person should be at a 30 degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority. (T)	6	33.3	20	52.6
A pressure redistribution surface reduces tissue interface pressure below capillary closing pressure. (T)	11	61.1	18	47.4
Persons confined to bed should be repositioned every 3 hours. (F)	10	55.6	27	71.1
Creams, transparent dressings (e.g., Tegaderm, Opsite), and hydrocolloid dressings (e.g., DuoDerm, Comfeel) do not protect against the effects of friction. (F)	13	72.2	22	57.9
A good way to decrease pressure on the heels is to elevate them off the bed. (T)	14	77.8	35	92.1
A turning schedule should be written and placed at the bedside. (T)	15	83.3	36	94.7
The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions. (T)	15	83.3	28	73.7
Shear is the force that occurs when the skin sticks to a surface and the body slides. (T)	16	88.9	27	71.1
Rehabilitation should be instituted if consistent with the patient's overall goals of therapy. (T)	18	100.0	33	86.8
Devices that suspend the heels protect the heels from pressure. (T)[1]	10	55.6	33	86.8
Donut devices/ring cushions help to prevent pressure ulcers. (F)[2]	13	72.2	9	23.7

Note. F = false. T = true. RNs = Registered Nurses. LPNwcs = Licensed Practical Nurses with wound care education. [a]n and % correct = total number and percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.
[1]$p = .017$, [2]$p = .001$.

As Table 4.10 shows, despite the discrepancy of more than 10 percentage points between groups, fewer than 65% of both groups were able to correctly answer three items which pertained to heel protectors, side lying positioning, and pressure redistribution surfaces. Conversely, more than 70% of both groups correctly answered five items that concerned heel elevation, turning schedules, head of bed positioning, the definition of shear, and rehabilitation. There was no consistent pattern in RNs versus LPNwcs correctly answering the items.

There were two items where less than 60% of one group and more than 70% of the other group correctly answered the items. A larger proportion of LPNwcs compared to RNs correctly answered the item regarding repositioning frequency for persons confined to bed (71.1% vs. 55.6% respectively). However, 72.2% of RNs versus 57.9% of LPNwcs correctly answered the item pertaining to the friction prevention properties of creams and dressings. The differences on these items were not statistically significant.

Table 4.10 also shows, in the shaded rows, two Risk and Prevention items for which there was a statistically significant difference between the correct responses rates of the RN and LPNwc groups. Compared to 55.6% of the RN group, 86.8% of the LPNwc group correctly answered the item concerning devices that suspend heels (p = .017). In contrast, 72.2% of the RN group correctly answered the item concerning donut devices compared to 23.7% of the LPNwc group (p = .001).

4.2.3.2 Wound Description items. There were a total of seven items pertaining to wound description on the Pressure Injury Knowledge Test. Table 4.11 shows the number and proportion of RN and LPNwc participants who correctly answered these items.

All of the RNs and most of the LPNwcs (94.7%) knew that the skin is the largest organ of the body. Approximately half of each group correctly answered the item defining undermining and that pressure injuries are not sterile wounds.

Table 4.11

Number and Proportion of Wound Description Items Correctly Answered by RN and LPNwc Groups

	RNs (n=18)		LPNwcs (n=38)	
Item	n[a]	% Correct[a]	n[a]	% Correct[a]
Undermining is the destruction that occurs under the skin. (T)	10	55.6	21	55.3
Pressure ulcers are sterile wounds. (F)	10	55.6	21	55.3
Eschar is good for wound healing. (F)[1]	**12**	**66.7**	**10**	**26.3**
Eschar is healthy tissue. (F)[2]	**15**	**88.3**	**18**	**47.4**
Slough is yellow or creamy necrotic tissue on a wound bed. (T)	16	88.9	25	65.8
A pressure ulcer scar will break down faster than unwounded skin. (T)	16	88.9	29	76.3
The skin is the largest organ of the body. (T)	18	100.0	36	94.7

Note.; RNs = Registered Nurses. LPNwcs = Licensed Practical Nurses with wound care education. F = false. T = true. Shaded Rows = RN and LPNwc percentages differing by more than 10 percentage points. [a]n and % correct = total number and percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.
[1]p= .007, [2]p= .019.

The shaded rows in Table 4.11 show that there were four out of the seven Wound Description items with a discrepancy of more than 10 percentage points between the RN and LPNwc groups' correct response rates. A larger proportion of the RNs compared to the LPNwcs correctly answered all four of these items which described terms related to necrotic tissue and the nature of scar tissue. The difference was significant for two of these four items: the item falsely identifying eschar as good for wound healing (p= .007) and the item falsely identifying eschar as healthy tissue (p= .019).

4.2.3.3 Pressure Ulcer Staging items. Table 4.12 summarizes the number and proportion of RN and LPNwc participants who correctly answered the Pressure Ulcer Staging items from the Pressure Ulcer Knowledge Test.

Compared to the high correct response rates to the items about Stages 1 and 4 pressure injuries, the participants had more difficulty with the items describing tissue damage in Stages 2 and 3 pressure injuries. All participants from both groups correctly answered "false" on the item that heel blisters are not concerning while 80% or more of both groups correctly answered the items concerning the definitions of skin blanching and Stage 1 and 4 pressure injuries. Fewer participants (61.1% of the RN group and 71.1% of the LPNwc group) correctly answered the item about tissue damage related to Stage 2 pressure injuries. The correct response rate was even lower concerning the item about pain associated with Stage 2 pressure injuries (52.6% of the LPNwc group 61.1% of the RN group). Only small proportions of the RN and LPNwc groups correctly answered the item defining a Stage 3 pressure injury (11.1% and 5.3% respectively). The results are shown in Table 4.12.

Table 4.12

Number and Proportion of Pressure Ulcer Staging Items Correctly Answered by RN and LPNwc Groups

Item	RNs (n=18) n[a]	RNs (n=18) % Correct[a]	LPNwcs (n=38) n[a]	LPNwcs (n=38) % Correct[a]
A Stage III pressure ulcer is a partial thickness skin loss involving the epidermis and/or dermis. (F)	2	11.1	2	5.3
Stage II pressure ulcers are a full thickness skin loss. (F)	11	61.1	27	71.1
Stage II pressure ulcers may be extremely painful due to exposure of nerve endings. (T)	11	61.1	20	52.6
Stage I pressure ulcers are defined as intact skin with nonblanchable erythema in lightly pigmented persons. (T)	15	83.3	34	89.5
A Stage IV pressure ulcers is a full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structure. (T)	16	88.9	38	100.0
Blanching refers to whiteness when pressure is applied to a reddened area. (T)	17	94.4	36	94.7
A blister on the heel is nothing to worry about. (F)	18	100	38	100.0

Note. RNs = Registered Nurses. LPNwcs = Licensed Practical Nurse with wound care education. F = false. T = true.[a]n and % correct = total number percentage of 18 RNs or 38 LPNwcs who gave the correct response to item identified.

4.2.4 Staging Picture Questions. To further explore the level of knowledge of RNs and LPNwcs, they were shown two pictures of different stages of pressure injuries and asked to identify the stage from the choices listed: Stages I to IV, as well as Suspected Deep Tissue Injury, and Unstageable. Picture A showed a Suspected Deep Tissue Injury pressure injury while Picture B showed a Stage I pressure injury. The results are presented according to the number and percent of correct responses by each group (RN and LPNwc).

Table 4.13

Picture A Staging Question (Suspected Deep Tissue Injury): Responses

Picture A: Available Responses	% (n)[a]		
	RN (n=18)	LPNwc (n=38)	Total (n=56)[b]
Stage I	5.6% (1)	2.6% (1)	3.6% (2)
Stage II	22.2% (4)	10.5% (4)	14.3% (8)
Stage III	50.0% (9)	29.0% (11)	35.7% (20)
Stage IV	0.0% (0)	34.2% (13)	23.2% (13)
Suspected Deep Tissue Injury[c]	**16.7% (3)**	**23.7% (9)**	**21.4% (12)**
Unstageable	5.6% (1)	0.0% (0)	1.8% (1)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with Wound Care Education. [a] % (n) = percentage and number of 18 RNs or 38 LPNwcs who gave the identified the response. [b]Total = percentage and total number of 56 RN and LPNwc participants who gave the identified response. [c]Suspected Deep Tissue Injury = correct response to Picture A staging question.

4.2.4.1 Picture A: Suspected Deep Tissue Injury. Table 4.13 summarizes the results for the Picture A staging question. Only 21.4% of all participants were able to correctly identify Picture A as a Suspected Deep Tissue Injury pressure injury. A larger proportion of LPNwcs (23.7%) compared to RNs (16.7%) provided the correct response. Even larger proportions of participants from each group incorrectly selected Stage III out of the available choices as the answer to Picture A (50.0% of RNs and 29.0% of LPNwcs). None of the differences between proportions of correct responses by both groups were statistically significant.

4.2.4.2 Picture B: Stage I pressure ulcer. Table 4.14 summarizes the results for the Picture B (Stage I pressure injury) staging question. The majority of all participants (82.1%) were able to correctly identify Picture B as a Stage I pressure injury. A larger proportion of the LPNwc group (84.2%) compared to the RN group (77.8%) provided the correct response, however the difference was not significant (p=.711).

Table 4.14

Pressure Ulcer Picture B (Stage I) Staging Question: Responses

Picture A: Available Responses	% (n)[a]		
	RN (n=18)	LPNwc (n=38)	Total (n=56)[b]
Stage I[c]	**77.8% (14)**	**84.2% (32)**	**82.1% (46)**
Stage II	11.1% (2)	10.5% (4)	10.7% (6)
Stage III	0.0% (0)	2.6% (1)	1.8% (1)
Stage IV	0.0% (0)	2.6% (1)	1.8% (1)
SDTI	0.0% (0)	0.0% (0)	0.0% (0)
Unstageable	11.1% (2)	0.0% (0)	3.6% (2)

Note. RN = Registered Nurse; LPNwc = Licensed Practical Nurse with Wound Care Education. SDTI = Suspected Deep Tissue Injury. [a] % (n) = percentage and total number of 18 RNs or 38 LPNwcs who gave the identified the response. [b]Total = percentage and total number of 56 RN and LPNwc participants who gave the identified response. [d]Stage I = correct response to Picture B question.

To further assess staging knowledge, individuals' responses to the Picture B Stage 1 pressure injury question were cross tabulated with their responses to the item on the Pressure Ulcer Knowledge Test concerning the correct definition of a Stage 1 pressure injury. The former question tested the participants' skill in actual staging while the latter question tested their recognition of the correct written definition and so the congruency between the results from these two questions was assessed.

The cross tabulated responses showed that 61.1% of RN participants and 73.7% of the LPNwc participants provided the correct responses to both the Stage 1 pressure injury definition item and the Stage 1 pressure injury picture question. There were 22.2% of the RNs and 15.8% of LPNwcs who correctly answered only the definition item but not the staging picture. There were 16.7% of the RNs and 10.5% of the LPNwcs who correctly labeled the staging picture but incorrectly answered the Stage 1 definition item. None of the RNs or LPNwcs got both the questions wrong.

4.2.5 Experience, region of work, and previous pressure injury education. For the RN and LPNwc groups, results from the Pressure Ulcer Knowledge Test and staging questions were further analyzed to determine if there were any significant differences in results related to amount of experience in LTC, amount of experience in the identified profession, region of work, and previous post-basic pressure injury education. When experience and region of work were analyzed, no consistent patterns were found for the RN and LPNwc groups on the Pressure Ulcer Knowledge Test. These detailed results are not reported here. However, with respect to pressure injury education, the results were less definitive in terms of a pattern found for both groups. For the staging questions, some minor trends were found concerning experience, previous post-basic pressure injury education, and region of work. These results are described in the following section.

For those who had previous post-basic pressure injury education compared to those who did not, the total median scores, the Risk and Prevention median subscores, and the Wound Description median subscores were all somewhat higher for the RNs (74.5 vs. 70.2, 74.2 vs. 66.7, and 78.6 vs. 71.4, respectively) and for the LPNwcs (71.3 vs. 69.1, 69.7 vs. 68.2, and 64.3 vs. 57.1, respectively). None of the differences were statistically significant and timing of the education was not an influencing factor. On the Pressure Ulcer Staging category, however, the trend of higher scores for those who had previous post-basic education was not found; median subscores were the same (71.4) for the RN and the LPNwc groups, regardless of previous post-basic pressure injury education.

With respect to those who correctly identified the Suspected Deep Tissue Injury picture, there tended to be larger proportions of LPNwcs with more experience compared to those with less in both LTC (33.3% vs. 15.0%) and in their profession (29.4% vs. 19.1%). As well, for the LPNwcs, a larger proportion of those who did not have previous post-basic pressure injury education were correct compared to those who did (30.0% vs. 16.7%). All three of the RNs who got the question right were from the urban sites with none from the rural sites. Despite any of these trends, there were no statistically significant differences.

With respect to those who correctly identified the Stage 1 pressure injury picture, there were larger proportions of both RNs and LPNwcs who had less than 10 years of professional experience compared to those who had more (80.0% vs. 76.9% and 90.5% vs. 76.5%, respectively). As well, larger proportions of both the rural RNs and rural

LPNwcs were correct compared to those from the urban sites (100.0% vs. 69.2% and 94.1% vs. 76.2%, respectively). None of these differences were statistically significant.

Overall, except for findings reported above, no other patterns emerged from the data to suggest that experience or region of work influenced pressure injury knowledge for the RN and LPNwc groups.

4.2.6 Research Question #1 summary. Regarding results from the Pressure Ulcer Knowledge Test, the majority of both the RNs and the LPNwcs scored between 65.0% and 79.0%, but more LPNwcs than RNs scored below 65.0%. Only one participant from each group scored over 80.0% and none scored over 90.0%. The RN participants did better on the Risk and Prevention and Wound Description categories compared to Pressure Ulcer Staging. The LPNwc participants did better on Pressure Ulcer Staging compared to the other categories. There were no statistically significant differences between groups for the total median scores or any of the median subscores.

When the items from the Pressure Ulcer Knowledge Test were analyzed individually, for the Risk and Prevention items, the correct response rate was less than 65% on six items, between 65% and 90% on five items, over 90% on 10 items, while there was a discrepancy of more than 10 percentage points between the RN and LPNwc groups on 12 items with the statistically significant difference on two of those items. The poorest correct response rate for any Risk and Prevention items were related to chair and bed positioning, interpretation of the Braden Scale score risk, heel protectors and pressure redistribution surface reduction.

Of the seven Wound Description items, there were five with a discrepancy of more than 10 percentage points between the RN and LPNwc groups in the correct response rate. The correct response rate was higher for the RNs than LPNwcs with a statistically significant difference on two items. There was poor correct response rate from all participants for the item defining wound undermining and for the item falsely identifying pressure ulcers as sterile wounds. In contrast, however, there was a very high correct response rate to the item identifying the skin as the body's largest organ.

Of the seven Pressure Ulcer Staging items, there were four with a correct response rate of greater than 80% for both the RN and LPNwc groups. There were no statistically significant differences between groups in the correct response rate. All participants correctly answered the item stating that heel blisters are not concerning while the majority correctly answered the items about Stage 1 and Stage 4 pressure injuries. There were fewer correct responses to items about Stage 2 and Stage 3 pressure injuries.

With respect to the staging picture questions, over 80% of both groups were able to correctly identify the picture of a Stage 1 pressure injury. This was reflective of the correct response rate of over 80% to items about Stage 1 pressure injuries on the Pressure Ulcer Knowledge Test. In contrast, though, very few participants correctly identified the Suspected Deep Tissue Injury pressure injury. As with the item on the Pressure Ulcer Knowledge Test defining a Stage I pressure injury, higher proportions of the LPNwc group compared to the RN group were able to correctly stage the picture of a Stage 1 pressure injury. There were no statistically significant differences between groups in proportions of correct answers to either of the picture staging questions.

In summary, the key findings were: 1) pressure injury knowledge was lacking, 2) there was minimal variation between sub-categories, 3) there was variation in scores within the sub-categories, and 4) characteristics such as amount of experience or place of work did not influence knowledge scores.

4.3 Research Question #2: What is the Level of Knowledge of Eastern Health LTC PCAs and LPNs who Have not Completed Education in Wound Care with Respect to Pressure Injury Prevention and Assessment?

To assess their level of knowledge with respect to the prevention and assessment of pressure injuries, PCAs and LPNs who have not completed wound care education (LPNnowcs) were asked to complete Questionnaire B. As described in Chapter 3, Questionnaire B included a modified version of the Pressure Ulcer Knowledge Test containing 24 true/false/don't know items. Correct answers were given a score of one while incorrect or "don't know" answers were given a score of zero. Scores of individual items were summed to give a total score. The highest possible total score was 24. The scores were converted to a percentage value for each participant by dividing the number of total correct responses by 24 and then that number was multiplied by 100 (#correct ÷ 24 x 100). The converted scores are discussed in this chapter rather than the raw scores.

The scores on the Pressure Ulcer Knowledge Test for the PCA and the LPNnowc groups were of a reasonably normal distribution, therefore the means and standard deviations are reported. As described in Chapter 3, to compare mean scores, tests of significance were performed using t-tests. Differences were considered statistically significant if the p value was < .05. Tests of significance were reported only when differences in scores between groups were greater than 5 percentage points because preliminary analyses not reported here showed that smaller differences were not statistically different.

First, an overview of the participants' total scores obtained from the Pressure Ulcer Knowledge Test is presented. Then the individual items from the Pressure Ulcer Knowledge Test are shown according to the proportions of PCAs and LPNnowcs who answered each correctly. Any notable trends in results with respect to participant characteristics, specifically LTC experience, professional experience, pressure injury education, and region or work are also briefly summarized.

4.3.1 Pressure Ulcer Knowledge Test: overview of total scores. Of the 24 items on the Pressure Ulcer Knowledge Test for the LPNnowc and PCA groups, 22 were from the Risk and Prevention category, one was from the Wound description category and the other was a Staging related question. Because the majority of items were related to risk and prevention, only a total score is presented.

For the LPNnowc group, the mean total score (78.4; 95% CI: 75.81- 81.02) was slightly higher compared to the PCA group (75.9: 95% CI: 73.07- 78.78) with comparable confidence intervals. The range in scores was broader for the PCA group (54.2 to 91.7; SD: 8.6) compared to the LPNnowc group (62.5 to 91.7; SD: 6.9). There were no statistically significant differences between the LPNnowc and PCA mean scores.

4.3.2 Distribution of score range categories. The participants' total scores from the Pressure Ulcer Knowledge Test were grouped into one of the three following score range categories: 1) less than 65.0%, 2) between 65.0% and 79.0%, and 3) greater than 79.0%, with the results displayed in graphs in the following sections.

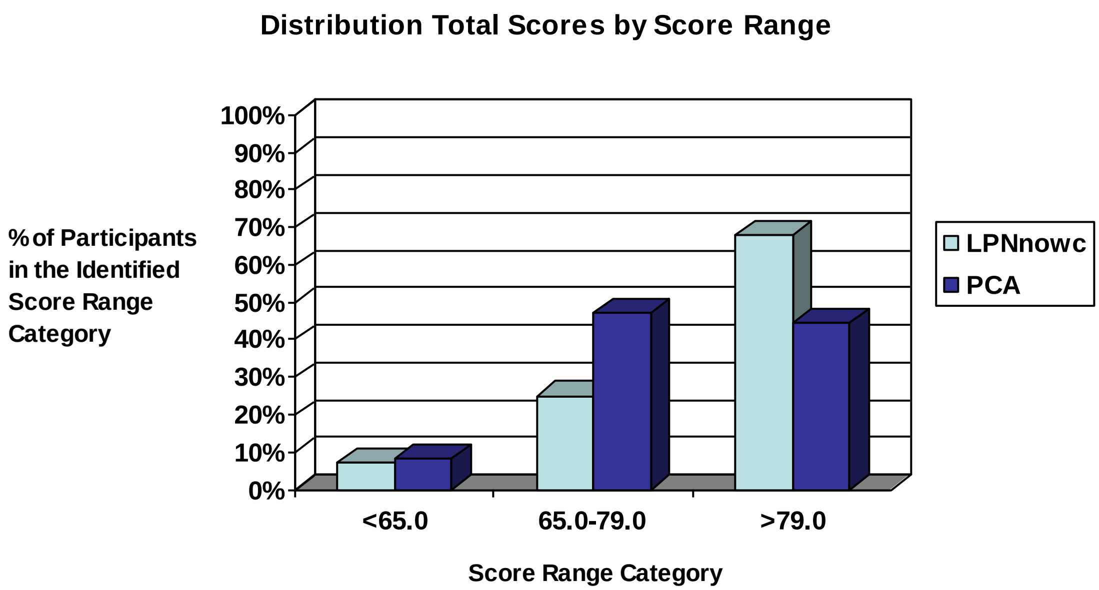


Figure 5. Percent of participants' total scores in each score range from the Pressure Ulcer Knowledge Test.

4.3.2.1 Total scores by position. Figure 4 shows that there were similar proportions of LPNnowc and PCA participants who scored below 65.0% (7.1% and 8.3% respectively). Almost half of the PCAs (47.2%) scored between 65.0% and 79.0% compared to a quarter of the LPNnowcs (25.0%). Larger proportions of the LPNnowcs scored over 79.0% compared to the PCAs (67.9% vs. 44.4%). Two (7.1%) out of 28 LPNnowcs and two (5.6%) out of 36 PCAs scored over 90.0%.

4.3.4 Responses by item. In the following sections, the results from the Pressure Ulcer Knowledge Test are presented by the numbers and proportions of the LPNnowc and PCA participants who answered each item correctly. For clarity of presentation, the results for the 24 items were grouped into three categories: 1) items correctly answered by more than 90% of each group, 2) items correctly answered by less than 90% of each group, and 3) items correctly answered by LPNnowcs and PCAs with a discrepancy of more than 10 percentage points in correct response rates.

Table 4.15 shows the seven items that were answered correctly by fewer than 90% of the LPNnowc and PCA participants. None of the LPNnowcs and only 8.3% of the PCAs were correct about how often a chair bound person should be repositioned. Fewer than five percent of both groups correctly answered the item about how often persons should shift weight when seated. Half of the PCAs and just under half (42.9%) of the LPNnowcs correctly answered the false item that it is important to massage bony prominences. Approximately 60% (57.1% to 64.3%) of both groups correctly answered the items pertaining to the risk of washing with hot water and soap and about side lying positioning. More than 75% of both groups correctly answered the items concerning heel protective devices and the correct positioning of the head of the bed.

Table 4.15

Items Correctly Answered by <90% of Participants

Item	LPNnowcs (n=28) n	LPNnowcs (n=28) % Correct	PCAs (n=36) n	PCAs (n=36) % Correct
A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair. (F)	0	0.0	3	8.3
Persons who can be taught should shift their weight every 30 minutes while sitting in a chair. (F)	1	3.6	1	2.8
It is important to massage bony prominences. (F)	12	42.9	18	50.0
In a side lying position, a person should be at a 30 degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority. (T)	16	57.1	21	58.3
Hot water and soap may dry the skin and increase the risk for pressure ulcers. (T)	18	64.3	21	58.3
The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions. (T)	21	75.0	29	80.6
Devices that keep the heels off the mattress protect the heels from pressure. (T)	25	89.3	32	88.9

Note. F = false. T = true. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 28 LPNs and 36 PCAs who gave correct response to specified item.

Table 4.16 shows the 10 items that were correctly answered by more than 90% of all the participants. Slightly smaller proportions of the PCAs compared to the LPNnowcs correctly answered items concerning use of a turning schedule and the importance of adequate dietary protein. The majority of both groups, but slightly larger proportions of PCAs than LPNnowcs, correctly answered items regarding when a chair cushion is needed, when to clean soiling from incontinence, and documentation. All of the LPNnowcs and the majority of the PCAs correctly answered pertaining to friction-associated risk, heel elevation, and the need for daily skin inspections. All participants correctly answered the item concerning keeping the skin clean and dry as true and the item that a heel blister is nothing to worry about as false.

Table 4.16

Items Correctly Answered by > 90% of Participants

	LPNnowcs (n=28)		PCAs (n=36)	
Item	N	% Correct	n	% Correct
A turning schedule should be written and placed at the bedside. (T)	26	92.9	33	91.7
Chair-bound persons should be fitted for a chair cushion. (T)	26	92.9	35	97.2
For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals. (T)	27	96.4	35	97.2
All care given to prevent or treat pressure ulcers must be documented. (T)	27	96.4	35	97.2
An adequate dietary intake of protein and calories should be maintained during illness. (T)	27	96.4	34	94.4
Friction may occur when moving a person up in bed. (T)	28	100.0	34	94.4
A good way to decrease pressure on the heels is to elevate them off the bed. (T)	28	100.0	34	94.4
All residents at risk for pressure ulcers should have a systematic skin inspection at least daily. (T)	28	100.0	35	97.2
The skin should remain clean and dry. (T)	28	100.0	36	100.0
A blister on the heel is nothing to worry about. (F)	28	100.0	36	100.0

Note. F = false. T = true. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 28 LPNs and 36 PCAs who gave correct response to the specified item.

There were seven items with a discrepancy of greater than 10 percentage points between the correct response rates of the LPNnowcs and the PCAs as shown in Table 4.17.

Table 4.17

Items Correctly Answered by LPNnowc and PCA Groups with >10 Percentage Point Discrepancy and no Statistically Significant Differences

Item	LPNnowcs (n=28)		PCAs (n=36)	
	N	% correct	n	% correct
Shear is the force that occurs when the skin sticks to a surface and the body slides. (T)	17	60.7	26	72.2
Persons confined to bed should be repositioned every 3 hours. (F)	19	67.9	18	50.0
Skin macerated from moisture tears more easily. (T)	20	71.4	22	61.1
To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture. (T)	23	82.1	25	69.4
The skin is the largest organ of the body. (T)	27	96.4	28	77.8
Bony prominences should not have direct contact with one another. (T)	27	96.4	31	86.1
Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness. (T)	28	100.0	34	84.4

Note. F = false. T = true. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 28 LPNs and 36 PCAs who gave correct response to the specified item.

Table 4.17 shows that half of the PCAs and 67.9% of the LPNnowcs correctly answered the item concerning the repositioning frequency of persons confined to bed. A larger proportion of PCAs (72.2%) compared to LPNnowcs (60.7%) correctly answered the item defining shearing forces. For the two items pertaining to the risks of moisture, more than 60% (61.1 to 82.1) of both groups were correct. Even though there was a discrepancy of more than 10 percentage points, most (77.8% to 100.0%) of both groups were correct on three of the seven items which were about risk factors for pressure injuries, the protection of bony prominences, and the skin as the body's largest organ. Larger proportions of LPNnowcs compared to PCAs correctly answered six out of seven of the items. Despite the discrepancy between groups, there were no statistically significant differences between the proportions of correct responses on any of the items.

4.3.5 Experience, region of work, and previous pressure injury education. For the LPNnowc and PCA groups, results from the Pressure Ulcer Knowledge Test were further analyzed to determine if there were any significant differences in results related to amount of experience in LTC, amount of experience in the identified profession, region of work, and previous post- basic pressure injury education. Three trends were noted and are reported here. No further details are reported here.

For the PCA group, the mean score was slightly higher and the standard deviation was greater for those with less than 10 years of LTC and professional experience compared to those with more than 10 years (76.3 vs. 72.9 and 9.0 vs. 2.4; 76.3 vs. 72.2 and 8.9 vs. 2.4, respectively). None of these differences in mean scores were statistically significant with respect to amount of LTC experience (p = .4646) or professional experience (p = .4425).

In terms of region of work, the mean score was higher and the standard deviation was lower for the urban PCAs (77.5; SD: 7.4) compared to the rural PCAs (73.5; SD: 9.9) but the difference was not statistically significant (p =.1815). This trend was not found for the LPNnowc group with very similar mean scores for those from the urban and rural regions (78.4 and 78.3, respectively).

LPNnowcs who had previous pressure injury education outside of their basic training programs had a higher mean score than those who did not have this education (80.7 vs. 76.2) and the standard deviation was slightly greater (7.0 vs. 6.2). The opposite was seen for the PCA group, however; those with previous pressure injury education had a lower mean score than those without this education (70.8 vs. 77.2), but the standard deviations were similar (8.7 vs. 8.4 respectively). These differences were not statistically significant (p= .0815).

Overall, with the exception of the trends or any statistically significant differences reported above, there were no other consistent patterns to show that experience, previous post-basic pressure injury education, or region of work influenced pressure injury knowledge for the LPNnowc or PCA groups.

4.3.6 Research Question #2 summary. The majority of both groups were able to correctly answer 10 out of the 24 items on the Pressure Ulcer Knowledge Test for the LPNnowcs and PCAs. All of the participants correctly answered items pertaining heel blisters and skin hygiene. Of the seven items that fewer than 90% of the participants correctly answered, the correct response rates were similar for both the groups. Fewer than 10% of both groups correctly answered two of those items which were about positioning of chair bound persons. There were seven items with a discrepancy of more than 10 percentage points between correct response rates by each group, with a higher response rate found mainly for the LPNnowc group. The largest discrepancy between groups was found for the item identifying the skin as the body's largest organ.

In summary, the key findings were: 1) pressure injury knowledge was lacking, 2) there was variation in the correct response rate per item, 3) generally the LPNnowcs scored higher than the PCAs, and 4) characteristics such as amount of experience or place of work did not significantly influence knowledge.

4.4 Pressure Ulcer Knowledge Test Items contained in both Questionnaires A and B: a comparative summary of group results. Because the Pressure Ulcer Knowledge Tests from Questionnaires A for the RNs and LPNwcs and B for the LPNnowcs and PCAs differed, the overall results were not comparable. However, there were 24 items common to both tests; therefore to assess for any trends or discrepancies related to the 24 items, additional analyses were completed. As described in Chapter 3, tests of significance were determined, using ANOVA only when differences in scores between groups were greater than 5 percentage points because preliminary analyses not reported here showed that smaller differences were not statistically different.

For each group, even though there was some variation in the per-item correct response rate, the mean scores for the summed 24 items were similar. The mean score was highest for the LPNnowcs (78.4), followed by the LPNwcs (78.0), then the RNs (76.2), and lowest for the PCAs (75.9). The differences between mean scores were not statistically significant (p = .5147).

Because the per-item correct response rates varied, the correct response rate per-item for the RN group was chosen as a baseline parameter and the other three groups were compared against this parameter. The correct response rates were compared for each group (RNs, LPNwcs, LPNnowcs, and PCAs) according to items correctly answered by: 1) less than 65%, 2) between 65% and 90%%, and 3) more than 90%. The results are reported in the following sections.

Table 4.18

Pressure Ulcer Knowledge Items from both Questionnaires A and B Correctly Answered by <65% of the RN Group as Compared to the LPNwc, LPNnowc, and PCA Groups

Item	RN (n=18) % (n) correct	LPNwc (n=38) % (n) correct	LPNnowc (n=28) % (n) Correct	PCA (n=36) % (n) correct
Persons who can be taught should shift their weight every 30 minutes while sitting in a chair. (F)	5.6 (1)	5.3 (2)	3.6 (1)	2.8 (1)
A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair. (F)	5.6 (1)	13.2 (5)	0.0 (0)	8.3 (3)
In a side lying position, a person should be at a 30 degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority. (T)	33.3 (6)	52.6 (20)	57.1 (16)	58.3 (21)
Hot water and soap may dry the skin and increase the risk for pressure injuries. (T)	50.0 (9)	47.4 (18)	64.3 (18)	58.3 (21)
It is important to massage bony prominences. (F)	55.6 (10)	47.4 (18)	42.9 (12)	50.0 (18)
Persons confined to bed should be repositioned every 3 hours. (F)	55.6 (10)	71.1 (27)	67.9 (19)	50.0 (18)
Devices that keep the heels off the mattress protect the heels from pressure. (T)*	55.6 (10)	86.8 (33)	89.3 (25)	88.9 (32)

Note. F = false. T = true. RN = Registered Nurses. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 18 RNs, 38 LPNwcs , 28 LPNs and 36 PCAs who gave the correct response to item identified.
*p =.020.

Table 4.18 shows the seven items that were correctly answered by fewer than 65% of the RNs with comparisons to the LPNwcs, LPNnowcs, and PCAs. All groups had a poor correct response rate to the two items concerning chair repositioning. For example, the highest correct response rate was 13.2% for the LPNwcs and the lowest for the LPNnowc group (0.0%) on the item about how often to reposition a resident in a chair. However, the differences in correct response rates between groups were not statistically significant.

Table 4.18 also shows that compared to 33.3% of the RNs, just over half of all the other groups correctly answered the item about the sidelying position in bed. The correct response rates ranged from approximately 40% to 70% for the three items about using hot water and soap, massaging bony prominences, and the repositioning frequency for persons confined to bed. For the item about massaging of bony prominences, the correct response rate was lower for the LPNwcs and LPNnowcs (47.4% and 42.9%, respectively) compared to the RNs and PCAs (55.6% and 50.0%, respectively). However, in contrast, in response to the item about repositioning frequency for persons confined to bed, the RNs and PCAs had the lowest correct response rate (55.6% and 50.0%, respectively) compared to the LPNwcs and LPNnowcs (71.1% and 67.9%, respectively). None of the aforementioned differences were statistically significant. In response to the item about heel devices, the RNs had the lowest correct response rate (55.6%) compared to the LPNwcs, LPNnowcs, and PCAs (86.8%, 89.3%, and 88.9%, respectively) with a statistically significant difference (p = .020).

Table 4.19 shows the six items that were correctly answered by between 65% and 90% of the RNs with comparisons to the LPNwcs, LPNnowcs, and PCAs. The correct response rate was lowest for the RNs, but similar to the PCAs in response to the item about use of underpads. The RN correct response rate was also lowest in response to the item about heel elevation with a statistically significant difference (p =.049). Even though the response rate was over 80% for all groups on the item about a bedside turning schedule, it was lowest for the RN group.

The correct response rate was highest for the RNs but similar to the PCAs in response the items about the head of the bed elevation. In response to the item about macerated skin, the RNs had the highest correct response rate compared to all groups. None of the aforementioned differences were statistically significant. In response to the item concerning the frequency of a systematic skin inspection, even though the correct response rate was higher for the RN group compared to the LPNwc group, it was lower compared to the LPNnowc and PCA groups with a statistically significant difference (p = .020).

Table 4.19

Pressure Ulcer Knowledge Items from both Questionnaires A and B Correctly Answered by between 65% and 90% of the RN Group as Compared to the LPNwc, LPNnowc, and PCA Groups

Item	RN (n=18) % (n) correct	LPNwc (n=38) % (n) correct	LPNnowc (n=28) % (n) correct	PCA (n=36) % (n) correct
To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture. (T)	66.7 (12)	73.7 (28)	82.1 (23)	69.4 (25)
A good way to decrease pressure on the heels is to elevate them off the bed. (T)[1]	77.8 (14)	92.1 (35)	100.0 (28)	94.4 (34)
The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions. (T)	83.3 (15)	73.7 (28)	75.0 (21)	80.6 (29)
A turning schedule should be written and placed at the bedside. (T)	83.3 (15)	94.7 (36)	92.9 (26)	91.7 (33)
Skin macerated from moisture tears more easily. (T)	88.9 (16)	81.6 (31)	71.4 (20)	61.1 (22)
All residents at risk for pressure ulcers should have a systematic skin inspection at least daily. (T)[2]	88.9 (16)	81.6 (31)	100.0 (28)	97.2 (35)

Note. F = false. T = true. RN = Registered Nurses. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 18 RNs, 38 LPNwcs , 28 LPNs and 36 PCAs who gave the correct response to item identified.
[1]$p = .049$, [2]$p = .020$.

Table 4.20 shows the nine items that over 90% of the RNs correctly answered with a comparison to the correct response rates by the LPNwc, LPNnowc, and PCA groups. The correct response rate was 100.0% for seven out of nine of the items for the RN group. All participants correctly answered as false the item about heel blisters being nothing to worry about.

There was little variation and no statistically significant differences between groups in the correct response rate for six of the items. For example, the correct response rate was greater than 95% for all groups in response to two items, one was concerning documentation of pressure ulcer care and the other concerning cleaning of incontinence. Similarly, the correct response rate was greater than 90% for groups to four items which concerned chair cushions, dietary intake, friction, and skin hygiene.

In response to two items about bony prominences and risk factors, even though the correct response rate was good (>80%) for all groups, the PCAs had the lowest rates. However, the differences between groups were not statistically significant.

There was some discrepancy between the groups in correct response rate to the item pertaining to the definition of shear. The rates were highest for the RN and LPNwc groups, but lowest for the LPNnowc and PCAs, however the differences were not statistically significant. In response to the item about the skin being the largest organ, the response rate was greater than 90% for all groups except the PCAs, with a statistically significant difference ($p = .022$).

Table 4.20

Pressure Ulcer Knowledge Items from both Questionnaires A and B Correctly Answered by more than 90% of the RN Group as Compared to the LPNwc, LPNnowc, and PCA Groups

Item	RN (n=18) % (n) correct	LPNwc (n=38) % (n) correct	LPNnowc (n=28) % (n) correct	PCA (n=36) % (n) correct
A blister on the heel is nothing to worry about. (F)	100.0 (18)	100.0 (38)	100.0 (28)	100.0 (36)
All care given to prevent or treat pressure ulcers must be documented. (T)	100.0 (18)	97.4 (37)	96.4 (27)	97.2 (35)
For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals. (T)	100.0 (18)	100.0 (38)	96.4 (27)	97.2 (35)
Chair-bound persons should be fitted for a chair cushion. (T)	94.4 (17)	97.4 (37)	92.9 (26)	97.2 (35)
An adequate dietary intake of protein and calories should be maintained during illness. (T)	100.0 (18)	100.0 (38)	96.4 (27)	94.4 (34)
Friction may occur when moving a person up in bed. (T)	100.0 (18)	97.4 (37)	100.0 (28)	94.4 (34)
The skin should remain clean and dry. (T)	100.0 (18)	94.7 (36)	100.0 (28)	100.0 (36)
Bony prominences should not have direct contact with one another. (T)	94.4 (17)	97.4 (37)	96.4 (27)	86.1 (31)
Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness. (T)	100.0 (18)	100.0 (38)	100.0 (28)	84.4 (34)
Shear is the force that occurs when the skin sticks to a surface and the body slides. (T)	100.0 (18)	86.8 (33)	60.7 (17)	72.2 (26)
The skin is the largest organ of the body. (T)*	100.0 (18)	94.7 (36)	96.4 (27)	77.8 (28)

Note. F = false. T = true. RN = Registered Nurses. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Registered Nurse without wound care education. PCA = Personal Care Attendant. n and % correct = total number and percentage out of 18 RNs, 38 LPNwcs , 28 LPNs and 36 PCAs who gave the correct response to item identified.
*p =.022

4.4.1 Summary of results for 24 items contained on both Pressure Ulcers Knowledge Tests. The overall mean scores for each group were similar, ranging from 75.9 to 78.4 with no statistically significant differences found. The item by item comparison of the correct response rates showed variation for some items but no notable trends revealing one group doing consistently better than another. However, there were four items for which statistically significant differences were found.

On three of those four items, the correct response rate was highest for the LPNnowcs. In response the item about heel devices the LPNnowc correct response rate was highest but similar to the LPNwcs and PCAs, however, it was 20 percentage points higher than the RN group. In response to the item about skin inspections, even though the correct response rate was highest for the LPNnowc, it was similar to the PCA group, but greater than 10 percentage points higher than the RN and LPNwc groups. In contrast, in response to the item about the skin as the largest organ, the correct response rate was lowest for the PCAs and but similar and above 90% for the other three groups with a difference of just over 15 percentage points.

4.5 Research Question #3: What Learning Needs do Staff Members Perceive they have Related to Pressure Injury Prevention, Assessment, and Management?

As described in Chapter 3, on Questionnaires A and B participants were asked to answer the open-ended question: “Regarding the topic of pressure ulcers, what would you like to learn about?” Additionally, the participants were asked to rank their three most preferred methods of education delivery. The results from the two questions addressing learning needs are presented in the next sections.

4.5.1 Results: participants' perceived learning needs regarding pressure injuries. Out of the 120 participants, 112 responded to the question asking them what they would like to learn about regarding the topic of pressure injuries.

Table 4.21

What Participants Want to Learn About Regarding Pressure Ulcers: Themes Identified

Theme Identified from Topics	Frequency and % of Theme seen in Responses[a]				
	RN (n=18) 27 Themes Identified by Group	LPNwc (n=35) 55 Themes Identified by Group	LPNnowc (n=25) 45 Themes Identified by Group	PCA (n=34) 59 Themes Identified by Group	Total Frequency and % of Theme out of all 186 Themes[b]
Wound Care: Treatment and Dressings	**15 (55.6%)**	**20 (36.4%)**	**21 (46.7%)**	20 (33.9%)	**76 (40.9%)**
Prevention and Positioning	7 (25.9%)	16 (29.1%)	13 (28.9%)	**21 (35.6%)**	57(30.6%)
Assessment and Staging	2 (7.4%)	9(16.4%)	4 (8.9%)	10 (16.9%)	25 (13.4%)
General	2 (7.4%)	5 (9.1%)	2 (4.4%)	3 (5.1%)	12 (6.5%)
Causes/Etiology	1 (3.7%)	1 (1.8%)	4 (8.9%)	3 (5.1%)	9 (4.8%)
Effects	0 (0.0%)	2 (3.6%)	1 (2.2%)	2 (3.4%)	5 (2.7%)
Documentation	0 (0.0%)	2 (3.6%)	0 (0.0%)	0 (0.0%)	2 (1.1%)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. [a]Frequency and % of Theme seen in Responses = number and percentage of times the specified theme was identified in a response out of total number of themes identified by the specified group (27 by RNs, 55 by LPNwcs, 45 by LPNnowcs, and 59 by PCAs). [b]Total Frequency of Themes out of all 186 Themes = total frequency of the specified theme out of all 186 themes found in the responses.

There were a total of 186 topics mentioned in the responses which were then categorized into the following broader themes: 1) general, 2) wound care, treatment and dressings, 3) prevention and positioning, 4) assessment and staging, 5) causes/etiology, 6) effects, and 7) documentation.

Table 4.21 shows that topics related to “wound care, treatment, and dressings” were the most frequently (40.9%) mentioned in the participants’ 186 answers, followed by topics related to “prevention and positioning” (30.6%), and then “assessment and staging” (13.4%). “Documentation” was mentioned the most infrequently (1.1%) and only by the LPNwcs. The theme of “wound care, treatment, and dressings” was mentioned most often by the RNs (55.6%), the LPNwcs (36.4%) and the LPNnowcs (46.7%), while themes related to “prevention and positioning” were more frequently found in the responses by the PCAs (35.6%).

4.5.2 Assessment of perceived learning needs with results from the Pressure Ulcer Knowledge Tests. The themes from the participants’ responses identifying their learning needs were further explored to determine if they reflected the scores from the Pressure Ulcer Knowledge Tests. First, the content from each of the items on both Pressure Ulcer Knowledge Tests were assessed for the most appropriate fit with a theme and categorized accordingly. The average correct response rates for the items in each theme category were then calculated for each group of participants. For example, if there were three items categorized under the theme “documentation”, the proportions of a group of participants who correctly answered each item were totaled and then divided by three to give an average correct response rate to the items in the chosen theme category (e.g., 33% + 42% + 38% = 113, then 113/3 = 37.7% was the average correct response rate for the items in the specified theme). If there was only one item found to be related to a theme, the respective correct response rate was used. Because there were two versions of the Pressure Ulcer Knowledge Test, the average correct response rates were assessed separately for the RN and LPNwc groups and then the LPNnowc and PCA groups, according to their version of the test. The results are described in the next sections.

4.5.2.1 RN and LPNwc: correspondence of perceived learning needs to Pressure Ulcer Knowledge Test results. Table 4.22 shows the average correct response rate to the themed items from the Pressure Ulcer Knowledge Test for the RN and LPNwc groups with the frequency of the theme as their perceived learning need. Overall the average correct response rate of the themed items from the Pressure Ulcer Knowledge Test corresponded with the identified perceived learning needs for both the RNs and the LPNwcs. For example the item categorized as “wound care, treatment, and dressings” had the lowest correct response rate for the LPNwcs and the second lowest for the RNs reflective of this theme being identified most frequently as a perceived learning need. The average correct response rate was highest (>90%) for the items related to “documentation”, which was reflective of this theme being infrequently identified as a perceived learning need (0.0% for RNs and 3.6% for LPNwcs).

Table 4.22

RN and LPNwc Pressure Ulcer Knowledge Test Results and Perceived Learning Needs

Themes Found in Items from Pressure Ulcer Knowledge Test	# of Items	Average Correct Response Rate [a]		Learning Need Theme Identified by Participants (%)[b]	
		RN	LPNwc	RN	LPNwc
Wound Care, Treatment and Dressings	1	72.2%	57.9%	55.6%	36.4%
Prevention and Positioning	20	67.5%	66.9%	25.9%	29.1%
Assessment and Staging	13	70.5%	62.8%	7.4%	16.4%
General	4	90.3%	85.5%	7.4%	9.1%
Causes/Etiology	6	76.8%	72.4%	3.7%	1.8%
Effects	1	88.9%	76.3%	0.0%	3.6%
Documentation	2	91.7%	96.1%	0.0%	3.6%

Note. RN= registered nurse. LPNwc = Licensed Practical Nurse with wound care education. [a]Average Correct Response Rate= sum of correct response rates from the items in the specified theme divided by the number of respective items, then multiplied by 100. [b]Learning Need Theme Identified by Participants (%) = percentage of times the specified theme was identified in a response out of total number of themes identified by the specified group (27 by RNs and 55 by LPNwcs).

4.5.2.2 LPNnowcs and PCAs: correspondence of perceived learning needs to Pressure Ulcer Knowledge Test results. Table 4.23 shows the average correct response rate to the themed items from the Pressure Ulcer Knowledge Test for the LPNnowc and PCA groups with the frequency of the theme as their perceived learning need. The Pressure Ulcer Knowledge Test for the LPNnowcs and PCAs did not contain items related to wound care, treatment and dressings because wound care is not a function of their roles. However, the theme of “wound care, treatment and dressings” was identified as a perceived learning most frequently by the LPNnowcs and the second most frequently by the PCAs. There were also no items related to the theme of "effects", but this was only identified infrequently as a learning need. Otherwise, as with the RNs and LPNwcs, a similar trend was found; the frequency of a theme identified as a learning need tended to decrease with an increase in average correct response rate for the corresponding theme.

Table 4.23

LPNnowc and PCA Pressure Ulcer Knowledge Test Results and Perceived Learning Needs

Theme found in Items from Pressure Ulcer Knowledge Test	# of Items	Average Correct Response Rate [a]		Learning Need Theme Identified by Participants (%)[b]	
		LPNnowc	PCA	LPNnowc	PCA
Wound Care, Treatment and Dressings	0	N/A	N/A	46.7%	33.9%
Prevention and Positioning	14	71.4%	66.3%	28.9%	35.6%
Assessment and Staging	1	100.0%	100.0%	8.9%	16.9%
General	2	98.2%	87.5%	4.4%	5.1%
Causes/Etiology	5	79.3%	74.1%	8.9%	5.1%
Effects	0	N/A	N/A	2.2%	3.4%
Documentation	2	94.7%	94.5%	0.0%	0.0%

Note. LPNnowc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant. [a] Average Correct Response Rate= sum of correct response rates from the items in the specified theme divided by the number of respective items, then multiplied by 100. [b]Learning Need Theme Identified by Participants (%) = percentage of times the specified theme was identified in a response out of total number of themes identified by the specified group (45 by LPNnowcs, and 59 by PCAs).

4.5.3 Results: Three most preferred methods of education delivery. Table 4.24 shows the results from the question asking participants to identify their top three preferred methods of education delivery. A total of 113 out of 120 participants completed the question. Ranking results are presented by the number and percentage of participants who selected each method of education delivery.

Table 4.24

Preferred Learning Methods of Education Delivery Responses by Ranking in Top Three

Method of Education Delivery	% (n)[a]				
	RN (n=18)	LPNwc (n=35)	LPNnowc (n=27)	PCA (n=33)	Total [b] (n=113)
In-services offered at work	100.0% (18)	100.0% (35)	85.2% (23)	97.0% (32)	95.6% (108)
Informal group sessions	27.8% (5)	54.3% (19)	51.9% (14)	72.7% (24)	54.9% (62)
Self-paced learning module-paper	27.8% (5)	54.3% (19)	59.3% (16)	36.4% (12)	46.0% (52)
Individualized one on one	33.3% (6)	28.6% (10)	44.4% (12)	42.4% (14)	37.2% (42)
Organization offered conferences	44.4% (8)	34.3% (12)	33.3% (9)	27.3% (9)	33.6% (38)
Online self-paced learning module	38.9% (7)	11.4% (4)	25.9% (7)	12.1% (4)	19.5% (22)
Self study through journals, handouts, newsletters, online	27.8% (5)	17.1% (6)	11.1% (3)	12.1%(4)	15.9% (18)

Note. RN = Registered Nurse. LPNwc = Licensed Practical Nurse with wound care education. LPNnowc = Licensed Practical Nurse without wound care education. PCA = Personal Care Attendant.[a]%(n) = proportion and number of participants (18 RNs, 35 LPNwcs, 27 LPNnowcs, and 33 PCAs) who selected the specified type of method of education delivery as one of the top three choices. [b]Total = combined proportion and number of all participants from each position (n=113) who selected the specified method of education delivery out of all participants who answered the question.

4.5.3.1 Ranking of methods of education delivery. The number of times a given method of education delivery was chosen as one of the top three preferences by the participants can be seen in Table 4.24. In-services offered at work was selected by 95.6% of all participants as one of the top three choices. In-services at work was also predominantly a favored method, being identified by 60.2% as the most preferred method, by 23.9% as the second choice and by 11.0% as the third choice. Over half (54.9%) of the participants chose informal group sessions and 46.0% chose paper based self-paced learning modules as one of the top three preferred methods. Self-study was selected by only 15.9% of the participants.

When the methods of education delivery were analyzed by position, the majority of each group selected in-services at work as one of the top three choices. PCAs (72.7%) favored informal group sessions compared to the RNs (27.8%). Conversely, a larger proportion of RNs (38.9%) selected online self-paced learning modules compared to the LPNwcs (11.4%), the LPNnowcs (25.9%) and the PCAs (12.1%). This was similar for the self-study option as well which was selected by a larger proportion of RNs (27.8%) compared to the LPNwcs (17.1%), the LPNnowcs (11.1%), and the PCAs (12.1%).

4.5.4 Research Question #3 summary. Overall, the participants frequently identified several topics as learning needs and these were categorized as wound care, including dressings and treatment. Interestingly, even though PCAs and LPNnowcs do not provide wound care, these participants identified this topic more often than any other topic. Topics related to the theme of prevention and positioning appeared almost as often, however, more PCAs compared to the RNs, LPNwcs, and LPNnowcs, identified this topic as a learning need. There was a trend indicating that with a low correct response rate to items on the Pressure Ulcer Knowledge Test related to a specific theme, then that theme tended to be identified more often as a learning need.

Concerning methods of education delivery, the majority of participants selected `in-services at work' as the most preferred. The second most preferred method was `informal group sessions'. The least preferred method was `self-study through journals, handouts, newsletters, online'.

Chapter 5

Results

Policy Knowledge and Application

This chapter focuses on results from research questions pertaining to participants' knowledge and application of Eastern Health policies related to pressure injury prevention, assessment, and management. Specifically, this chapter describes the results from policy related questions that were included on Questionnaire A for RNs and LPNwcs and Questionnaire B for PCAs and LPNnowcs In addition, charts were reviewed to determine application of policy knowledge. Results from the chart audits are also presented in this chapter. The results of the study are presented according to the research question they address.

5.1 Research Question #4: Do RNs and LPNs who have Completed Education in Wound Care Know When the Braden Risk Assessment is to be used as per Eastern Health Policies?

As described in Chapter 3 there are three Eastern Health policies that pertain to pressure injuries: 1) the Braden Scale Adults-Only policy (BSAOP), 2) the Pressure Ulcer Prevention Policy (PUPP), and 3) the Wound Management policy (WMP). To address this fourth research question and as well to further explore the level of RN and LPNwc knowledge pertaining to these pressure injury related policies, three questions were included on Questionnaire A for the RN and LPNwc participants. The three open-ended questions were:

1) When should the Braden Risk Assessment Scale be done on residents in Long Term Care?
2) Who (RN, LPN, PCA, or any combination of RN, LPN, and PCA) can complete the Braden Risk Assessment?
3) What are the policies in Long Term Care related to pressure ulcer prevention and risk assessment?

Each question is discussed in separate sections including the results by position, by years of experience in LTC and identified profession, by previous post- basic pressure injury education, and by region.

5.1.1 Results: When should the Braden Risk Assessment be done on residents in Long Term Care? Participants were asked, "When should the Braden Risk Assessment Scale be done on residents in Long Term Care". No participants named all the correct times when the Braden Risk Assessment should be done, therefore their answers were categorized as partially correct or incorrect as outlined in Chapter 3.

Table 5.1 summarizes the responses provided by RN and LPNwc participants. None of the participants were able to identify all four of the scheduled periods. Three of the four assessment periods: "on admission, quarterly, and if change in health status", were identified by 38.9% of the RN participants and 5.3% of the LPNwc participants.

Table 5.1

Partially Correct Participant Responses to "When should the Braden Risk Assessment be done on residents in Long Term Care?"*

Partially Correct Responses Provided According to Frequency Category	% (n)[a] RN (n=18)	LPNwc (n=38)	Total (n=56)[b]
On Admission, then once weekly for 4 weeks, then quarterly and if change in health status (4 of 4)	0.0% (0)	0.0% (0)	0.0% (0)
On Admission, quarterly and if change in health status (3 of 4)	38.9% (7)	5.3% (2)	16.1% (9)
On admission and if change in health status (2 of 4)	5.6% (1)	13.2% (5)	10.7% (6)
On admission and quarterly (2 of 4)	16.7% (3)	5.3% (2)	8.9% (5)
Quarterly and if change in health status (2 of 4)	0.0% (0)	2.6% (1)	1.8% (1)
On Admission (1 of 4)	33.3% (6)	39.5% (15)	37.5% (21)
Change in health status (1 of 4)	0.0% (0)	15.8% (6)	10.7% (6)
No times identified at all	0.0% (0)	13.2% (5)	8.9% (5)
Other (different times, e.g., biweekly)	5.6% (1)	5.3% (2)	5.4% (3)
"On admission" as part of the response	61.1% (11)	23.7% (9)	35.7% (20)
"Change in health status" as part of the response	44.4% (8)	21.1% (8)	28.6%(16)
"Quarterly" as part of the response	5.6%(10)	13.2% (5)	26.8% (15)
"Once weekly for the first 4 weeks post-admission" as part of the response	0.0% (0)	0.0% (0)	0.0% (0)

Note. RN = Registered Nurse; LPNwc = Licensed Practical Nurse with wound care education.
[a]% (n) = percentage and number out of 18 RNs or 38 LPNwcs who gave the specified response.
[b]Total = percentage and total number of RN and LPNwc participants (n=56) who gave the specified response.
*Partially correct responses= no participants identified all four assessment periods to be fully correct, so the partially correct responses that were provided are shown.

Table 5.1 also shows that some responses contained different combinations of two assessment periods (2 of 4 categories), such as “on admission and change in health status” (5.6% of RNs and 13.2% of LPNwcs) or “on admission and quarterly” (16.7% of RNs and 5.3% of LPNwcs). Only one LPNwc (2.6%) and none of the RNs named “quarterly and if change in health status”. One third (33.3%) of the RNs and 39.5% of the LPNwcs identified only “on admission” (1 of 4 categories). A small percentage of the LPNwc group (7.9%) and none of the RN group identified only “change in health status” (1 of 4 categories).

Very small proportions of RN participants and the LPNwc participants (5.6% and 5.3% respectively) provided responses not considered correct but were categorized as ‘other’, for example, “biweekly”; “any time providing care to a resident”; and “depending on level of the resident”. There were 13.2% of the LPNwcs (29.0%) who could not identify any assessment periods. Responses such as “when pressure injury has broken through”; “whenever a lesion is open; and “when a reddened area that has been broken open or is starting to break down” were categorized as a change in health status.

To more accurately capture how often an assessment period was named, Table 5.1 also presents the percentage and number of participants who identified a specific assessment period as part of another response. Even though 37.5% of all participants identified only “on admission”, this assessment period was named by another 35.7% when included as part of a response with other assessment periods. Thus, a total of 73.2% of all participants knew “on admission” regardless of whether it was the sole answer or as part of another answer. Similarly, although 10.7% of all participants identified only “change in health status”, an additional 28.6% also identified it in combination with other assessment periods. So, almost 40% knew “change in health status” whether as the only answer or as part of another answer. No participants singled out “quarterly” or “once weekly for four weeks” as a response but 26.8% included “quarterly” in combination with other assessment periods in their responses while the latter was not included in any other responses.

5.1.2 Results: Who (RN, LPN, or PCA) can complete the Braden Risk Assessment? As described in Chapter 3, according to the Braden Scale Adults-Only Policy (BSAOP), an RN or an LPN can complete the Braden Risk Assessment. Identification of both the RN and LPN was considered correct. A response was considered partially correct if only “RN” or only “LPN” was identified. The answer “PCA” was incorrect.

As shown in Table 5.2, a third of the LPNwcs (33.3%) and over half of the RNs (55.5%) answered only the “RN”. No RNs and three LPNwcs (7.9%) answered only “LPN”. Over half the LPNwc group (55.6%) and 38.9% of the RN group gave the correct response “RN or LPN”. Even though LPNs can complete the Braden Risk Assessment, over a third of the LPNwc group (36.8%) did not identify ‘LPN’ as part of their response or on its own. Small proportions of the RN group (5.6%) and LPNwc group (2.8%) answered that the “RN, LPN, and PCA” can all complete the Braden Risk Assessment. None of the participants answered only “PCA”.

Table 5.2

Responses to "Who (RN, LPN, or PCA) can complete the Braden Risk Assessment?"

Response	% (n)[a]		
	RN	LPNwc	Total[b] % (n)
RN only	**55.6% (10)**	31.6% (12)	39.3% (22)
LPN only	0.0% (0)	7.9% (3)	5.4% (3)
PCA only	0.0% (0)	0.0% (0)	0.0% (0)
RN or LPN*	38.9% (7)	**52.6% (20)**	**48.2% (27)**
RN, LPN, and PCA	5.6% (1)	2.6% (1)	3.6% (2)
Don't Know	0.0% (0)	5.3% (2)	3.6% (2)

Note. RN = Registered Nurse; LPNwc = Licensed Practical Nurse with Wound Care Education; PCA = Personal Care Attendant. [a]% (n) = percentage and number out of 18 RNs or 38 LPNwcs who gave the specified type of response. [b]Total % (n) = percentage and total number of RN and LPNwc participants (n=56) who gave the specified response.
[*]RN or LPN = correct response.

5.1.3 Results: What are the policies in Long Term Care related to pressure ulcer prevention and risk assessment? As described in Chapter 3, participants could have answered this open ended question by naming three policies (WMP, PUPP, and BSAOP) or providing content deemed to correspond to a policy. Table 5.3 shows the number and percentage from each group who identified the specified policy as well as those who did not identify any policies.

Table 5.3

Policies Identified by Participants

Policies Identified	% (n)[a]		
	RN (n=18)	LPNwc (n=38)	Total [b] (n=56)
Braden Scale Adults-Only Policy (BSAOP)	33.3% (6)	15.8% (6)	21.4% (12)
Pressure Ulcer Prevention Policy (PUPP)	11.1% (2)	26.3% (10)	21.4% (12)
Wound Management Policy (WMP)	0.0% (0)	2.6% (1)	1.8% (1)
Braden Scale Adults-Only and Pressure Injury Prevention (BSOP and PUPP)	16.7% (3)	5.3% (2)	8.9% (5)
No Policies Identified	38.9% (7)	50.0% (19)	46.4% (26)

Note. RN = Registered Nurse; LPNwc = Licensed Practical Nurse with Wound Care Education. [a]% (n) = percentage and number out of 18 RNs or 38 LPNwcs who gave the specified response. [b]Total = percentage and total number of RN and LPNwc participants (n=56) who gave the specified response.

Table 5.3 shows that one third of the RN group and 15.8% of the LPNwc group identified only the BSAOP. A larger proportion of LPNwc than RN participants identified only the PUPP (26.3% vs 11.1%). A small proportion each of the LPNwcs (5.3%) and the RNs (16.7%) identified both the BSAOP and the PUPP. Overall, half the RNs and 21.1% of the LPNwcs named the BSAOP in their responses, either on its own or as part of another response. Just over a quarter (27.8%) of the RNs and 31.5% of the LPNwcs identified the PUPP either alone or part of another response. Therefore, the RNs tended to name the BSAOP more often while the LPNwcs tended to name the PUPP more often. Only one LPNwc and none of the RNs identified the WMP. Almost half of all participants identified no policies in their responses (50.0% of LPNwcs and 38.9% of RNs).

5.1.4 Experience, region of work, and previous post-basic pressure injury education. Results were analyzed to determine if there were any significant differences or trends related to amount of experience in LTC, amount of experience in the identified profession, region of work, and previous post-basic pressure injury education with respect to the three questions concerning: 1) the correct Braden Risk Assessment frequency, 2) who completes the Braden Risk Assessment, and 3) what are the policies related to pressure injuries. Results related to experience are not described here as no consistent patterns were found. However, with respect to region of work and previous post-basic pressure injury education, some trends were found and are briefly described here.

Concerning the question about who can complete the Braden Risk Assessment, larger proportions of rural RNs and LPNwcs gave correct answers compared to those from the urban sites (60.0% vs. 30.8% and 70.6% vs. 38.1%, respectively). With respect to the policy knowledge question, this trend was similar in terms of the proportions of partially correct responses provided by the rural LPNwcs compared to the urban LPNwcs (58.8% vs. 47.6%, respectively), but the proportions were similar for the RNs (60.0% vs. 61.5%, respectively). However, none of the differences were statistically significant.

With respect to knowledge about the frequency of the Braden Risk Assessment, a larger proportion of LPNwcs who had previous post-basic pressure injury education provided partially correct responses compared to those who did not have the education (88.9% vs. 55.0% respectively), with a statistically significant difference (p= .033). Similarly, concerning the question about who completes the Braden Risk Assessment, larger proportions of the RNs and LPNwcs who had previous post-basic pressure injury education gave correct answers compared to those who did not have the education (42.9% vs. 25.0% and 66.7% vs. 40.0%, respectively) but the difference was not statistically significant. Similarly, in response to the question about policy knowledge, larger proportions of with RNs and LPNwcs with previous post-basic pressure injury education had partially correct responses (none were completely correct) compared to those without this education (64.3% vs.50.0% and 61.1% vs. 45.0%, respectively). Again, the differences were not statistically significant.

Overall, except for findings reported above, no other patterns emerged from the data to suggest that amount of experience in LTC or the identified profession or timing of previous post-basic pressure injury education influenced knowledge about when the Braden Risk Assessment is completed, who completes the Braden Risk Assessment or policies related to pressure injuries.

5.1.5 Research Question #4 summary. Two key findings emerged from the participants' responses pertaining to knowledge about the BSAOP, the PUPP, and the WMP. In summary, responses revealed that: 1) policy knowledge was poor, both of their existence and content and 2) there were no consistent differences related to the effects of characteristics such as region of work, experience, or previous post-basic pressure injury education on knowledge.

5. 2 Research Question #5: What are the Practices of Eastern Health LTC PCAs and LPNs who Have not Completed Education in Wound care with Respect to Skin Inspections?

As described in Chapter 3, Questionnaire B contained a Pressure Injury Knowledge test for the PCAs and the LPNs who have not completed wound care education (LPNnowcs), the results of which were presented in Chapter 4. Two additional questions were included on their questionnaire so that more could be learned concerning these participants' knowledge and practice with respect to pressure injury prevention and assessment. The additional questions were:

1) How often do you complete skin assessments on residents in Long Term Care?
2) To whom (RN, LPN, or PCA) do you report any concerning findings from a skin assessment?

Consistent with the focus of this chapter on policy knowledge and application, the results from these two additional questions are presented here. First, the findings are reported and presented by position. Then, the results are shown by participant characteristics, specifically LTC experience, professional experience, pressure injury education, and region or work are summarized.

5.2.1 Question 1: Skin Assessment Frequency. Participants were asked "How often do you complete skin assessments on residents in LTC?" as part of Questionnaire

B. The results are shown in Table 5.4 according to the number and percent from each group (LPNnowc and PCA).

Table 5.4

Skin Assessment Frequency Responses Identified by Participants

Participant Response	Skin Assessment Frequency Response Options	% (n)[a]		
		LPNnowc	PCAs	Total
	Daily*	**89.3% (25)**	**94.4% (34)**	**92.2% (59)**
	Weekly	3.6% (1)	2.8% (1)	3.1% (2)
	Other	7.1% (2)	2.8% (1)	4.7% (3)

Note. LPNnowc = Licensed Practical Nurses without wound care Education. PCA=Personal Care Attendants. [a]% (n) = percentage and number out of 28 LPNs and 36 PCAs who gave the specified response. *Daily=the correct response is daily, according to the Pressure Injury Prevention Policy for the LTC program in Eastern Health.

Table 5.4 shows that the majority of both the LPNnowc (89.3%) and PCA (94.4%) participants answered that skin assessments are completed daily which is consistent with the policies in Eastern Health's LTC program. Small proportions of the LPNnowc (3.6%) and the PCAs (2.8%) identified weekly. Only a few participants answered "other" without any further explanation. None of the participants provided other frequencies such as "every three days" or "monthly".

5.2.2 Question 2: Reporting Concerning Findings. The LPNnowc and PCAs were asked "To whom (RN, LPN, or PCA) do you report any concerning findings from a skin assessment?", as part of Questionnaire B. Concerning findings can be reported to either an RN or an LPN, for example, the LPN can report to an RN or a PCA can report to an LPN, and both the LPNs and PCAs can report to the RN. None of the LPNnowcs and 16.7% of the PCAs correctly answered “RN or LPN”. The majority of both the LPNnowc (75.0%) and PCA (96.4%) participants identified “RN” which is partially correct. A very small proportion of the LPNnowcs (3.6%) and a slightly larger proportion of the PCAs (8.3%) answered “LPN” which is also partially correct. None of the participants incorrectly identified “PCA” in their responses.

5.2.3 Experience, region of work, and previous post-basic pressure injury education. With respect to the questions about the perceptions of how often skin assessments are done in LTC and to whom to report concerning findings, the results for the LPNnowc and PCA groups were further analyzed to determine if there were any significant differences related to amount of experience in LTC, amount of experience in the identified profession, region of work, and previous post-basic pressure injury education. When experience and previous post-basic pressure injury education were assessed, no consistent patterns were found in the results from either of the two questions for both the LPNnowc and PCA groups. Detailed findings from the two question are not reported here. Some trends related to region of work were found and are reported here.

With respect to region of work, the results from the question about skin assessment frequency showed that larger proportions of urban LPNnowcs and urban PCAs correctly identified “daily” compared to those from the rural sites (91.3% vs. 80.0% and 95.5% vs. 92.9%, respectively), but the differences were not statistically significant. No trend was found, however, for the results to the question about to whom to report concerning findings

Overall, the results did not suggest that LTC experience, professional experience, region of work, or previous post-basic pressure injury education had any influence on knowledge about when to complete a skin inspection and to whom concerning skin assessment findings should be reported.

5.2.4 Research Question #5 summary. In summary, several key findings emerged from the provided responses which were: 1) the majority of the PCAs and LPNnowcs knew that skin assessments are supposed to be done daily, 2) the majority of PCAs and LPNnowcs answered that they would report concerning findings to an RN only, and 3) with respect to participant characteristics, only region of work had any influence on the results.

5.3 Practice Assessment: Retrospective Chart Reviews

As described in Chapter 3, two research questions addressed practices related to pressure injury prevention: 1) Were initial Braden Skin Risk assessments and reassessments documented at the right times (per policy) for residents in Eastern Health LTC sites? and 2) Were interventions incorporated into the plan of care that reflected the Braden Scale score for the residents of Eastern Health LTC? To answer these research questions, retrospective chart reviews were completed using the Pressure Ulcer Risk Assessment Audit Tool found in Appendix N. Of the 356 admissions from September 1, 2010 to April 30, 2011, a total of 269 charts from 17 Eastern Health LTC sites met the study criteria and were accessible for review. For the purposes of this study, the 17 LTC sites were broadly categorized as either urban or rural. There were 173 charts reviewed from the eight urban sites and 96 charts from the nine rural sites. The charts were audited for practice data related to Braden Scale risk assessments that spanned a minimum of 6 months from admission.

Healthcare staff at several sites had received in-services regarding BSAOP over the summer months of 2010 prior to the targeted admission period used for the retrospective chart reviews. Chart audit results were compared between sites with and without the BSAOP education to determine if this education influenced risk assessment practices. In the next sections, the results from the chart audits are described as they pertain to each research question asked.

5.3.1 Research Question #6: Were Initial Braden Risk Assessments and Reassessments Documented at the Right Times (per policy) for Residents in Eastern Health LTC Sites? Each chart was reviewed to assess whether the following Braden risk assessments were done according to the schedule recommended in the Eastern Health BSAOP: a) within 48 hours of admission, then at b) week one, c) week two, d) week three, e) week four, f) first quarterly, and g) second quarterly. For each resident, according to the policy, seven risk assessments should have been completed during the reviewed period, over seven months post-admission. If all seven risk assessments were completed for each resident as per the policy, a total of 1,883 risk assessments (1,211 at urban sites and 672 at rural sites) would be expected for the 269 charts.

In the following sections, the proportions of risk assessments that were actually completed are shown. As well, completed risk assessments are presented by the time range that lapsed between the expected dates and actual dates of completion. The proportions of risk assessments that were completed by either an RN or an LPN are also presented since the Braden scale risk assessment can be done by an RN or an LPN. Data concerning the proportions of risk assessments that were completed are compared and presented first by region and then by sites where policy education occurred versus sites where policy education did not occur.

5.3.1.1 Completed Braden Scale risk assessments by region. As explained, for the 269 charts reviewed, if all seven risk assessments were done, a total of 1,883 should have been completed as recommended in the BSAOP. Table 5.5 shows the proportions of risk assessments that were actually completed. Out of the 1,883 risk assessments expected, there were 38.5% (725) actually completed. Larger proportions of risk assessments were done in the rural region compared to the urban region (52.4% vs. 30.6%), with a statistically significant difference ($p<.001$).

Table 5.5

Braden Scale Risk Assessments Completed Comparing Urban and Rural Sites

Braden Scale Risk Assessment Interval	% (n) of Braden Scale Risk Assessments Completed[a]			
	Urban (8 Sites/ 173 charts)	Rural (9 Sites/96 charts)	Total (urban and rural) by Assessment Interval[b]	*p* value*
Admission	86.1% (149)	78.1% (75)	76.6% (206)	*p*=.372
Week 1	4.1% (7)	39.6% (38)	16.7% (45)	***p*<.001***
Week 2	3.5% (6)	40.6% (39)	16.7% (45)	***p*<.001***
Week 3	5.8% (10)	39.6% (38)	17.8% (48)	***p*<.001***
Week 4	3.5% (6)	27.1% (26)	11.9% (32)	***p*<.001***
First Quarterly	59.0% (102)	68.8% (66)	62.8% (169)	*p*=.117
Second Quarterly	52.6% (91)	75.0% (72)	60.2% (162)	***p*<.001***
Total by Region[c]	30.6% (371/1211)	52.4% (354/672)	38.5% (725/1883)	***p*<.001***

Note. [a]%(n)= the proportion and number of the risk assessments completed for the specified interval in the corresponding region out of all the assessments expected in that region for the specified interval. [b]Total by assessment= proportion and number of risk assessments actually completed in the combined regions out of all (n=269 per interval) expected for the specified risk assessment interval. [c]Total by region= proportion and number of total risk assessments actually completed in the specified region out of all expected in that region (n=1211 urban; 672 rural). *$p<.05$, *p* value calculated using the Fisher's Exact test.

Of the charts reviewed, Table 5.5 shows there was greater adherence to completion of admission assessments compared to the subsequent reassessments. A slightly larger proportion of admission assessments were completed at the urban compared to rural sites (86.1% and 78.1%, respectively). Very small proportions of charts reviewed showed that the first four weekly assessments were completed at the urban sites (3.5% - 5.8%) compared to the rural sites (27.1% - 40.6%) with all differences found to be statistically significant (p<.001 for each weekly interval). The difference between the urban and rural regions was not as large for the first quarterly assessments (59.5% vs. 68.8%, respectively) but statistically significant for the second quarterly interval (52.0% vs. 75.0%, respectively; p<.001).

Each chart was also reviewed to determine the total number of assessments that were actually completed per resident out of the seven that were expected and the results were tabulated. The results can be seen in Table 5.6. The audit of 269 charts showed that overall; there were only 6.2% of residents who had all seven risk assessments completed, with the proportions much higher at the rural sites compared to the urban sites (16.7% vs. 0.6%, respectively). There were 8.2% and 4.1% of residents who had six and five assessments completed, respectively. Again, the proportions were much larger at the rural sites than urban. The proportions of residents who had between one and four assessments completed were also larger at the rural compared to the urban sites. There were 7.1% of the residents who had no assessments completed at all during the reviewed period, but the proportions were larger at the urban compared to the rural sites (7.5% vs. 6.3%). There were only four (1.5%) of residents who had more than seven assessments done. There were no statistically significant differences found between regions in terms of the numbers of assessments that were completed.

Table 5.6

Number of Braden Risk Assessments Completed per Resident

Total Number of Braden Risk Assessments Completed per Resident	**% (n) of Residents with Specified Number of Braden Risk Assessments Completed**			
	Urban (n=173)	**Rural (n=96)**	**Total (n=269)**	**P Value**
> 7	**1.2% (2)**	**2.0% (2)**	**1.5%(4)**	***p*>.99**
7 out of 7	**0.6% (1)**	**16.7% (16)**	**6.2% (17)**	***p*>.99**
6 out of 7	**1.2% (2)**	**16.7% (16)**	**8.2%(22)**	***p*>.99**
5 out of 7	**2.9% (5)**	**20.8% (20)**	**4.1% (11)**	***p*>.99**
4 out of 7	**7.5% (13)**	**6.3% (6)**	**7.1% (19)**	***p*>.99**
3 out of 7	**29.5% (51)**	**11.5% (11)**	**23.1% (62)**	***p*>.99**
2 out of 7	**30.6% (53)**	**18.8%(18)**	**26.4% (71)**	***p*>.99**
1 out of 7	**19.1% (33)**	**11.5% (11)**	**16.4% (44)**	***p*>.99**
0 out of 7	**7.5% (13)**	**6.3% (6)**	**7.1% (19)**	***p*>.99**

Note. % (n) = the proportion and number of residents with the specified number of Braden Risk Assessments completed in the corresponding region and the combined regions out of the total completed in each region and the combined total.

5.3.1.2 Completed Braden Scale risk assessments by BSAOP education. Table 5.7 shows the proportions of Braden Scale Risk Assessments completed at each scheduled interval for the LTC sites where healthcare staff had received BSAOP education and at those sites where the education did not occur. At the seven sites where BSAOP education occurred, there were 103 charts reviewed, while at the 10 sites where this education did not occur, there were 166 charts reviewed. When sites were compared by previous BSAOP education versus no previous BSAOP education, overall, the proportions of risk assessments completed were very similar (38.2% vs. 38.6%, respectively), with no statistically significant difference.

Table 5.7

Comparison of Risk Assessment Completion by Sites According to Previous Braden Scale Adults-Only Policy (BSAOP) Education

Braden Scale Risk Assessment Interval	% (n) of Braden Scale Risk Assessments Completed[a]		
	Previous BSAOP In-services Yes (7sites/103 charts)	Previous BSAOP In-services No (10 sites/166 charts)	*p* value
Admission	74.8% (77)	88.6% (147)	***p*=.003***
Week 1	19.4% (20)	15.1% (25)	*p*=.402
Week 2	15.5% (16)	17.5% (29)	*p*=.739
Week 3	18.5% (19)	17.5% (29)	*p*=.871
Week 4	10.7% (11)	12.7% (21)	*p*=.701
First Quarterly	62.1% (64)	63.3% (105)	*p*=.897
Second Quarterly	67.0% (69)	56.0% (93)	*p*=.096
Total by BSAOP Education[b]	38.2% (276/721)	38.6% (449/1162)	*p*=.887

Note. [a]%(n)= the proportion and number of the risk assessments completed for the specified interval in the corresponding column out of all the assessments expected at the respective sites during the specified interval. [b]Total by BSAOP education= proportion and number of total risk assessments actually completed in the specified sites (with or without BSAOP education) out of all expected in those sites (n=721 at sites with BSAOP education; 1162 at sites without BSAOP education).
*p<.05, p value calculated using the Fisher's Exact test.

Even though overall, there was no statistically significant difference between sites in the total assessments completed, when each Braden Risk Assessment interval was compared, there was a statistically significant difference in the proportions of admission assessments completed (*p*=.003), with a larger proportion completed at sites where no previous BSAOP education occurred (88.6%) compared to sites where it did occur (74.8%). Otherwise, at all other intervals, the proportions of assessments completed were similar regardless of previous BSAOP education.

5.3.1.3 Within region comparison of completed Braden Scale risk assessments by BSAOP education. Region of work rather than exposure to BSAOP education appeared to influence completion of risk assessment. Therefore, additional analyses were performed to determine whether or not there were any differences in the proportions of completed Braden Risk assessments within both the urban and rural regions according to previous BSAOP education. Table 5.8 shows the proportions of Braden Scale Risk Assessments completed at each scheduled interval for both the urban and rural sites where healthcare staff received BSAOP education and at those sites where the education did not occur.

As shown in Table 5.8, for the urban sites, except for the admission interval, the proportions of completed assessments were slightly larger at each scheduled interval for the sites where BSAOP education occurred compared to sites where it did not occur; none of the differences, however, were large or statistically significant. In contrast, for the rural sites, at each scheduled interval, the proportions of completed assessments were larger at sites where BSAOP education did not occur compared to sites where education had occurred and except for the second quarterly interval, all the differences were statistically significant. In summary, previous exposure to BSAOP education did not influence completion of Braden Risk assessments according to the BSAOP at either the urban or rural sites. On the contrary, adherence to the BSAOP was greater at the rural sites where healthcare staff did not receive BSAOP education.

Table 5.8

Comparison of Risk Assessment Completion in each Region According to Previous Braden Scale Adults-Only Policy (BSAOP) Education

Braden Risk Assessment Interval	**% (n) of Completed Braden Risk Assessments[a]**					
	Urban Sites BSAOP In-services (Yes or No)			**Rural Sites BSAOP In-services (Yes or No)**		
	Yes (n=43)	**No (n=130)**	***p* value**	**Yes (n=60)**	**No (n=36)**	***p* value***
Admission	**74.4% (32)**	**79.2% (103)**	***p*=.528**	**60.0% (36)**	**97.2% (35)**	***p*<.001***
Week 1	**9.3% (4)**	**2.3% (3)**	***p*=.065**	**26.7% (16)**	**61.1% (22)**	***p*=.001***
Week 2	**4.7% (2)**	**3.1% (4)**	***p*=.639**	**23.3% (14)**	**69.4% (25)**	***p*<.001***
Week 3	**7.0% (3)**	**5.4% (7)**	***p*=.711**	**26.7% (16)**	**61.1% (22)**	***p*=.001***
Week 4	**7.0% (3)**	**2.3% (3)**	***p*=.164**	**13.3% (8)**	**50.0% (18)**	***p*<.001***
First Quarterly	**65.1% (28)**	**56.9% (74)**	***p*=.376**	**60.0% (36)**	**83.3% (30)**	***p*=.023***
Second Quarterly	**58.1% (25)**	**50.8% (66)**	***p*=.482**	**73.3% (44)**	**77.8% (28)**	***p*=.808**
Total [b]	**32.2% (97/301))**	**28.6% (260/910)**	***p* =.243**	**40.5% (170/420)**	**71.4% (180/252)**	***p*< .001***

Note. [a]% (n) proportion and number of Braden Risk assessments completed at the specified interval out of all the assessments expected during that interval within the corresponding region according to previous BSAOP education (yes or no). Denominators for urban sites per interval = 43 charts from sites where there was education (yes) and 130 charts from sites where there was no education (no). Denominators for rural sites per interval = 60 charts from sites where there was education and 36 from sites without education (no). [b] Total = combined total % and number of Braden Risk assessments from all intervals completed out of the total number of risk assessments expected in the specified region according to previous BSAOP education (yes or no). $^*p < .05$, p value calculated using Fisher's Exact test.

5.3.1.4 Braden Scale risk assessments: time range between actual date of completion and expected date of completion. To answer the research question asking if the Braden Scale risk assessments were completed at the right times, the selected charts were reviewed to determine the time range that lapsed between the expected date of completion and the actual date of completion. It was anticipated that risk assessments my not be completed exactly on schedule as per the BSAOP, therefore, this study sought to determine if assessments were completed on time, or close to the expected date. If not completed close to the expected date, they were considered early or late. Determination of the expected date of completion of each risk assessment was based on the schedule outlined in the BSAOP.

For each risk assessment interval, time range periods were arranged into several categories. There were risk assessments completed that did not correspond to either of the expected required intervals and these were placed in separate category of “other”. Expected completion dates could not be determined for those categorized as “other”, therefore such assessments are not included in the ensuing findings.

The proportions of completed risk assessments that corresponded to a time range category were calculated and compared by region. In the ensuing sections, the time range categories and related data are described first for the admission interval, then for the weekly (first four weeks) intervals, and then quarterly (first and second) intervals in Tables 5.9, 5.10, and 5.11, respectively.

For admission assessments, time range categories were: 1) within 48 hours, 2) 3 to 7 days, and 3) 8 days up to 1 month, and 4) initial assessments completed over a month post-admission. According to the BSAOP, admission risk assessments must be completed within the first 48 hours of a resident’s admission. As shown in Table 5.9, in accordance with the BSAOP, most of the admission risk assessments were completed within 48 hours of admission (69.6%), however, the proportion was larger for the rural sites compared to the urban sites (84.0% vs. 62.4%). Of the admission risk assessments completed late, 10.3% were done between three and seven days after admission and 12.1% done between eight days and one month after admission, with larger proportions of all late assessments completed at the urban sites compared to rural sites (14.1% vs. 2.7%, 3 -7 days post admission and 14.1% vs. 8.0%, 8 days to 1 month post-admission). Chart documentation showed that there were 8.0% of residents who did not have their first assessment completed until over one month after admission, with a larger proportion at the urban sites compared to the rural sites (9.4% vs. 5.3%, respectively).

Table 5.9

Admission/Initial Risk Assessments: Completion Times

Time Range	% (n) of Admission Risk Assessments Completed in Specified Time Range[a]		
	Urban (n=149)	Rural (n=75)	Total by Time Range Category (out of 224)[b]
≤48 hours (On Time)	62.4% (93)	84.0% (63)	69.6% (156)
3 to 7 Days	14.1% (21)	2.7% (2)	10.3% (23)
8 Days up to 1 Month	14.1% (21)	8.0% (6)	12.1% (27)
> 1 Month	9.4% (14)	5.3% (4)	8.0% (18)

Note. [a]% (n)= the proportion and number of the admission risk assessments completed in the specified time range for the corresponding region out of all admission risk assessments completed in the region (n=149 urban; n=75 rural). [b]Total by time range category= proportion and number of admission risk assessments completed in the specified time range category out of the total (combined regions) completed (n=224).

For the first four weekly risk assessment intervals, there are three time range categories: 1) within 7 days (before or after the expected date of completion), 2) early (more than 7 days before the expected date of completion), and 3) between 8 and 21 days after the expected date of completion. The results are shown in Table 5.10.

Table 5.10

Completion Times of the First Four Weekly Braden Scale Risk Assessments

Braden Scale Risk Assessment Interval	Region	Time Range Between Actual Date of Completed Risk Assessment and Expected Date of Assessment % (n)[a]		
		+/- 7 Days	>7 Days Early	8 to 21 Days Late
Week 1 Risk Assessments	Urban Sites (n=7)	100.0% (7)	0.0% (0)	0.0% (0)
	Rural Sites (n=38)	100.0% (38)	0.0% (0)	0.0% (0)
	Total (n=45)	100.0% (45)	0.0% (0)	0.0% (0)
Week 2 Risk Assessments	Urban Sites (n=6)	100.0% (6)	0.0% (0)	0.0% (0)
	Rural Sites (n=39)	97.4% (38)	0.0% (0)	2.6% (1)
	Total (n=45)	95.7% (44)	0.0% (0)	2.2% (1)
Week 3 Risk Assessments	Urban Sites (n=10)	90.0% (9)	0.0% (0)	10.0% (1)
	Rural Sites (n=38)	97.4% (37)	0.0% (0)	2.6% (1)
	Total (n=48)	91.5% (46)	0.0% (0)	2.1% (2)
Week 4 Risk Assessments	Urban Sites (n=6)	83.3% (5)	0.0% (0)	16.7% (1)
	Rural Sites (n=26)	65.4% (17)	0.0% (0)	34.6% (9)
	Total (n=32)	68.8% (22)	0.0% (0)	31.2% (10)

Note. [a]% (n)= the proportion and number of the corresponding weekly assessments completed in the specified time range for each region out of all of the corresponding weekly assessments completed in that region.

Table 5.10 shows that overall for both the urban and rural sites, most (95.7% to 100.0%) of the first two weekly Braden Risk assessments were completed within seven days before or after the expected date of completion. For the third week, proportions were still above 90%, but larger for the rural sites compared to urban sites. For the fourth week, the proportions of assessments completed within seven days were smaller than for the previous weeks (68.8%), with larger proportions at urban compared to rural sites (83.3% vs. 65.4%). As well, for the fourth week, there were 31.2% of the assessments completed 8 to 21 days late, with larger proportions at the rural compared to the urban sites (34.6% vs. 16.7%).

In accordance to the BSAOP schedule, the first quarterly assessment was expected three months after the fourth weekly interval and the second quarterly would then be expected three months after the first quarterly assessment. Because there was variability in the time range for the completion of the admission and the first four weekly assessments, this led to increased variability in when to expect subsequent quarterly assessments. Therefore, to accommodate this variability, for this study, the first quarterly assessment was expected within three to five months after admission while the second quarterly was expected to occur within six to eight months after admission. If the completed first and second quarterly assessments did not occur in the aforementioned respective time frames, then the assessment dates were categorized as either early or late; they occurred earlier or later than the respective outlined time frames. Table 5.11 shows the proportions of quarterly assessments completed in each time range category for both regions.

Table 5.11

Completion of the First and Second Quarterly Braden Risk Assessments

Quarterly Assessment Completion Time Range		% (n) of Quarterly Risk Assessments Completed in Specified Time Range[a]			Odds Ratio, 95% Confidence Interval	*p* Value
		Urban (n=102)	**Rural (n=66)**	**Total (n=168)**		
1st Quarterly	**Within 3 to 5 Months[b]**	**67.6% (69)**	**71.2% (47)**	**69.0% (116)**	**N/A**	**N/A**
	Early (< 3 Months)	**31.4% (32)**	**16.7% (11)**	**25.6% (43)**	**2.29, [1.01, 5.47]***	***p*= 0.046***
	Late (> 5 Months)	**1.0% (1)**	**12.1% (8)**	**5.4% (9)**	**0.072, [0.002, 0.57]***	***p*= 0.003***
		Urban (n=91)	**Rural (n=72)**	**Total (n=163)**		
2nd Quarterly	**Within 6 to 8 Months[c]**	**42.9% (39)**	**75.0% (54)**	**57.1% (93)**	**N/A**	**N/A**
	Early (< 6 Months)	**56.0% (51)**	**22.2% (16)**	**41.1% (67)**	**4.4625, [2.13, 9.56]***	***p*< 0.05***
	Late (> 8 Months)	**1.1% (1)**	**2.8% (2)**	**1.8% (3)**	**0.39, [0.007, 7.65]**	***p*=0.583**

Note. [a]% (n)= the proportion and number of the first and second quarterly assessments completed in the specified time range for the corresponding region out of all of the corresponding quarterly assessments completed in the region. [b]Within 3 to 5 Months= first quarterly assessments completed within 3 to 5 months post admission. [c]Within 6 to 8 Months= second quarterly assessments completed within 6 to 8 months post admission.

As shown in Table 5.11, most (69.0%) of the completed first quarterly assessments were done within three to five months post admission, with a slightly larger proportion done in the rural sites than the urban sites (71.2% vs. 67.6%). Approximately a quarter (25.6%) was completed earlier than three months after admission. A larger proportion of the first quarterly assessments were completed early at the urban sites compared to the rural sites (31.4% vs. 16.7%) with a statistically significant difference (p=0.46). Even though very few (5.4%) of the first quarterly assessments were done later than five months after admission, the proportion was larger for the rural sites than the urban sites (12.1% vs. 1.9%) with a statistically significant difference (p=0.003). So, the early first quarterly assessments tended to occur at the urban sites while those done late tended to occur at the rural sites.

Just over half (57.1%) of all the completed second quarterly assessments were done within six to eight months post admission with a larger proportion found for the rural sites compared to the urban sites (75.9% vs. 42.9%). Almost half (41.1%) were done earlier than six months post admission with a larger proportion at the urban sites compared to the rural sites (56.0% vs. 22.2%) for a statistically significant difference (p< 0.05). Even though very few were completed later than eight months after admission (1.8%), there was a slightly larger proportion done late at the rural sites than at the urban sites (2.8% vs 1.1%) with no statistically significant difference (p=0.58).. The early second quarterly assessments tended to occur at the urban sites.

In summary, except for the urban second quarterly assessments, overall, the majority of quarterly assessments were completed within two months of when they were expected. There were more assessments completed early at the urban sites while for the first quarterly assessment, more tended to be late at the rural sites. For the second quarterly assessments, however, the proportions of late assessments were similar for the urban and rural sites.

5.3.1.4 Braden Scale risk assessments completed by RNs and LPNs. The proportions of Braden Scale risk assessments that were completed by either an RN versus an LPN were calculated for each region. Overall, the majority of all scheduled risk assessments were completed by the RNs rather than LPNs at all sites (91.7% vs. 8.3%). This trend was also found when regions were considered separately with most of the assessments completed by RNs instead of LPNs at the urban sites (97.3% vs. 2.7%) and the rural sites (85.9% vs. 14.1%).

Table 5.12

Braden Scale Risk Assessments Completed by RNs and LPNs

Braden Scale Risk Assessment Interval	% (n) of Who Completed Risk Assessments [a]							
	Urban Site Risk Assessments (n=371) BSAOP In-Services (Yes or No)				Rural Site Risk Assessments (n=354) BSAOP In-Services (Yes or No)*			
	Yes (n=102)		No (n=269)		Yes (n=174)		No (n=180)	
	RN	LPN	RN	LPN	RN	LPN	RN	LPN
Admission	100.0% (37)	0.0% (0)	98.2% (110)	1.8% (2)	90.0% (36)	10.0% (4)	97.1% (34)	2.9% (1)
Week 1	100.0% (4)	0.0% (0)	100.0% (3)	0.0% (0)	50.0% (8)	50.0% (8)	95.5% (21)	4.5% (1)
Week 2	100.0% (2)	0.0% (0)	75.0% (3)	25.0% (1)	50.0% (7)	50.0% (7)	96.0% (24)	4.0% (1)
Week 3	100.0% (3)	0.0% (0)	100.0% (7)	0.0% (0)	56.3% (9)	43.7% (7)	100.0% (22)	0.0% (0)
Week 4	100.0% (3)	0.0% (0)	100.0% (3)	0.0% (0)	62.5% (5)	37.5% (3)	100.0% (18)	0.0% (0)
First Quarterly	100.0% (28)	0.0% (0)	96.0% (72)	4.0% (3)	77.8% (28)	22.2% (8)	100.0% (30)	0.0% (0)
Second Quarterly	100.0% (25)	0.0% (0)	93.9% (61)	6.1% (4)	77.3% (34)	22.7% (10)	100.0% (28)	0.0% (0)
Total	100.0% (102)	0.0% (0)	96.2% (259)	3.8% (10)	72.4% (127)	27.6% (47)	98.3% (177)	1.7% (3)

Note. RN= Registered Nurse. LPN= Licensed Practical Nurse. [a]%(n)= the proportion and number of RNs compared to LPNs who completed the specified assessment out of all the assessments completed during the specified interval within the corresponding region according to previous BSAOP education (yes or no).

Further analysis was done to determine if the proportions of RNs and LPNs who completed risk assessments differed by exposure to BSAOP education. The proportions of assessments that were completed by RNs and LPNs were tabulated for each region where staff had received BSAOP education or had not. The results are shown in Table 5.12.

At the urban sites where BSAOP education occurred, at each scheduled interval, all assessments were completed by RNs rather than LPNs. At the urban sites where this education was not yet offered, except for the second weekly interval, most (>90%) of the assessments were also done by RNs rather than LPNs. At the second weekly interval, 75% of the assessments were completed by RNs and 25% by LPNs. There were no statistically significant differences in the proportions of assessments completed by RNs and LPNs at the urban sites regardless of BSAOP education.

In contrast, though, at the rural sites where BSAOP education occurred, RNs completed the majority of assessments. However, a greater proportion of assessments were completed by LPNs in rural sites where the BSAOP education occurred (27.6%) than at sites where it did not occur (1.7%). The difference was statistically significant ($p<.001$).

At the rural sites where there had been no BSAOP education, between 95% and 100% of assessments were completed by RNs rather than LPNs. In contrast, at the rural sites where BSAOP education occurred, except for the admission assessment, 50% to 77.8% of the assessments were done by RNs and 22.2% to 50% were done by LPNs. Except for the admission assessment, at each interval, there were statistically significant differences between rural sites where BSAOP education had a occurred and had not occurred in terms of assessments completed by RNs rather than LPNs. More LPNs completed risk assessments at rural sites where BSAOP education occurred compared to rural sites where it did not occur, consistent with the BSAOP that an RN or an LPN can complete a Braden Risk Assessment.

5.3.1.5 Research Question #6 summary. In response to the research question "Were initial Braden Skin Risk assessments and reassessments documented at the right times as (per policy) for residents in Eastern Health LTC sites?", the retrospective chart review showed several trends. The results showed that there were 7.1% of the residents who had no assessments done at all and only 6.2% had all seven assessments done. Adherence to the BSAOP was greatest at both the urban and rural sites for the admission assessments but weakest for the subsequent four weekly reassessments. Even though overall less than 20% of all the first four weekly reassessments were completed, adherence was greater for the rural sites compared to the urban sites. Just over half of the first and second quarterly reassessments were completed.

Except for the admission assessments, exposure to BSAOP education had little influence on adherence to completion of risk assessments at other intervals. On the contrary at rural sites where BSAOP education had not occurred, the proportions of completed assessments was larger than at the rural sites where this education had not occurred with a statistically significant difference.

The majority of admission risk assessments were completed on time. Of the four weekly reassessments that were completed, the majority were completed within seven days of the expected date of completion. For the quarterly assessments there was much variability in the amount of time that lapsed between the expected versus the actual dates of completion but most were completed within two months of when expected and many were completed earlier than when expected.

Although according to the BSAOP, LPNs and RNs can complete the Braden Scale Risk assessment, overall, the majority of all assessment and reassessments were completed by RNs. At the rural sites where BSAOP education occurred, however, more LPNs completed assessments.

In summary, the key findings from this retrospective chart review were: 1) overall adherence to the BSAOP was poor in terms of completion of the recommended frequencies and timelines with some significant differences by region , 2) BSAOP education had little influence on completion of risk assessments at any recommended intervals, instead adherence was greater at sites where no BSAOP education occurred, and 3) RNs completed most of the risk assessments, however, at rural sites where BSAOP education occurred, more LPNs completed the risk assessments.

5.3.2 Research Question #7: Were Interventions Incorporated into the Plan of Care that Reflected the Braden Scale Score for the Residents of Eastern Health LTC? As described in Chapter 3, to answer this research question, the charts were reviewed for any documented interventions added to the plan of care that corresponded to the Braden Scale score and its subscores. The highest possible score on the Braden Scale is 23. According to the BSAOP, there are three main score risk categories determined from the total Braden scale score: low risk (≥19), mild to moderate risk (13 to 18), and high risk (≤12), each corresponding to the risk level of developing a pressure injury. There are six categories (sensory perception, moisture, activity, mobility, nutrition, and friction/shear) on the Braden scale and each can be given a score of 1 to 4, where 1 represents the highest risk and 4 the lowest level of risk. If the score is two or less on the nutrition or the mobility components, a referral to a registered dietitian or an occupational therapist/ physiotherapist (respectively) must be completed. In the following sections, first the results are shown by scores obtained from the assessments and reassessments. This is then followed by results from the chart reviews for documentation of appropriate interventions and required consults.

5.3.2.1 Braden risk assessment total scores and subscores. The proportions of Braden risk assessments that resulted in low (≥19), mild to moderate (13 to 18), and high risk scores (≤12) were determined along with the level of risk indicated by the subscores from the Braden scale categories (sensory perception, moisture, activity, mobility, nutrition, and friction/shear). The results for the urban and rural sites are shown in Table 5.13 and Table 5.14 respectively.

Table 5.13 shows that when total scores from the 791 reviewed assessments were compared by risk category, there were similar proportions of those that were low risk and mild to moderate risk (46.3% and 45.6%, respectively) with little difference between the urban and rural regions. Overall, high risk scores comprised the lowest proportion of assessments at 8.1%, with larger proportions at the urban sites (11.5%) compared to the rural sites (4.4%).

Table 5.13

Urban and Rural Braden Scale Risk Assessments by Risk Level Score

Risk Level (Total Score)	% (n) of Risk Assessments in Specified Risk Level[a]		
	Urban Site (n=408)	Rural Sites (n=383)	Total by Risk Level[b] (n=791)
Low Risk (≥19)	42.2% (172)	50.7% (194)	46.3% (366)
Mild to Moderate Risk (13 to 18)	46.3% (189)	44.9% (172)	45.6% (361)
High Risk (≤12)	11.5% (47)	4.4% (17)	8.1% (64)

Note. [a]% (n)= the proportion and number with the specified total score (risk level) in the corresponding region out of the total number of assessments completed in the that region.

Table 5.14 shows the results for the completed assessments for each region according to the risk level results from the categories on the Braden Risk Assessment tool. Overall, for the combined regions, except for the nutrition category, the largest proportion of the subscores obtained for the other categories (sensory perception, moisture, activity, mobility, and friction/shear) were low risk (subscore= 4), with proportions ranging from 32.8% to 54.8%. On the nutrition category, instead the majority (63.3%) of the subscores were lower risk (score = 3).

Table 5.14

Urban and Rural Assessments/Reassessments by Risk Level Description per Category

Braden Scale Category[a]	Risk Level Description	Sub Score	% (n) of Risk Assessments in Specified Risk Level[b]		
			Urban Sites	Rural Sites	Total by Risk
Sensory Perception	Completely Limited	1	3.4% (14)	0.3% (1)	1.9% (15)
	Very Limited	2	14.6% (59)	8.6% (33)	11.7% (92)
Urban (n=405) Rural (n=383) Total (n=788)	Slightly Impaired	3	39.5% (160)	35.2% (135)	37.4% (295)
	No Impairment	4	**42.5% (172)**	**55.9% (214)**	**49.0% (386)**
Moisture	Constantly Moist	1	10.1% (41)	2.9% (11)	6.6% (52)
Urban (n=407) Rural (n=383)	Often Moist	2	10.1% (41)	11.5% (44)	10.8% (85)
Total (n=790)	Occasionally Moist	3	36.4% (148)	26.9% (103)	31.9% (252)
	Rarely Moist	4	**43.5% (177)**	**58.7% (225)**	**50.9% (402)**
Activity	Bedfast	1	10.1% (41)	4.7% (18)	7.5% (59)
Urban (n=406) Rural (n=383)	Chairfast	2	29.8% (121)	**34.7% (133)**	32.2% (254)
Total (n=789)	Walks Occasionally	3	27.3% (111)	27.7% (106)	27.5% (217)
	Walks Frequently	4	**32.8% (133)**	32.9% (126)	**32.8% (259)**
Mobility	Completely Immobile	1	6.9% (28)	8.3% (32)	7.6% (60)
Urban (n=403) Rural (n=383)	Very Limited	2	31.3% (126)	20.4% (78)	26.0% (204)
Total (n=786)	Slightly Limited	3	29.0% (117)	**36.3% (139)**	32.6% (256)
	No Limitations	4	**32.8% (132)**	35.0% (134)	**33.8% (266)**
Nutrition	Very Poor	1	2.7% (11)	2.9% (11)	2.8% (22)
Urban (n=402) Rural (n=383)	Probably Inadequate	2	15.9% (64)	14.9% (57)	15.4% (121)
Total (n=785)	Adequate	3	**65.4% (263)**	**61.1% (234)**	**63.3% (497)**
	Excellent	4	15.9% (64)	21.1% (81)	18.5% (145)
Friction/ Shear	Problem	1	6.4% (26)	14.6% (56)	10.4% (82)
Urban (n=404)	Potential Problem	2	30.7% (124)	39.2% (150)	34.8% (274)
Rural (n=383) Total (n=787)	No Apparent Problem	3	**62.9% (254)**	**46.2% (177)**	**54.8% (431)**

Note. [a]Braden Scale Category= Denominators (n= number of assessments completed) in each category varied if an assessment in the specified category was not reported. [b]% (n)= the proportion and number with the specified risk level in the corresponding category out of the total number of assessments completed for that category from each region.

Table 5.14 shows that risk assessments that resulted in the highest risk (score=1) on the individual categories ranged from 1.9% to 10.4%, while the next highest risk (score =2) ranged from 10.8% to 34.8%. So there were 1.9% to 34.8% of residents with high risk subscores on any of the categories that would require additional interventions added to the care plan to mitigate the respective risk. At the rural sites, on the activity category, the largest proportion of subscores (34.5%) were high risk (score= 2) meaning “chairfast”. On the mobility category, the largest proportion of subscores (36.3%) were slightly lower risk (score =3), meaning “slightly limited”.

5.3.2.2 Interventions added to the plan of care as indicated by the risk level. In the participating sites, the basic plan of care is set up with generic interventions concerning management of care such as incontinence, basic skin care, monitoring of daily nutritional intake and general assistance with activities of daily living (ADLs) as needed. Charts were reviewed for documentation of any additional interventions pertaining to pressure injury prevention and management that are not automatically part of a basic care plan.

For the purposes of this study question, chart selection and review was limited to those with high risk total scores (≤12) and high risk subscores (≤2). Interventions were acceptable for this study if they were consistent with the following as recommended in the BSAOP:

1) Observe skin for redness with attention to pressure points.

2) Keep head of the bed below 30° except mealtimes.

3) Ensure adequate nutrition. Consult dietitian if individual scores 2 or less on the "Nutrition" component.

4) Encourage ambulation.

5) Consult physiotherapy and/or occupational therapy if individual scores 2 or less on the "Mobility" component.

6) Consider use of a pressure relief surface(s) (e.g., mattress, chair).

7) Turn/reposition every 2 hours. Use pillows or covered wedges to help with repositioning small shifts in position frequently throughout the day.

8) Protect heels by keep heels of bed/chair (e.g., place pillows lengthwise under calf of leg).

Chart documentation showed that the majority of high risk assessments (score of ≤12) did not result in the appropriate additional interventions added to the plan of care. However, regionally, a slightly larger proportion of the high risk assessments from the urban sites did have the additional interventions documented compared to the rural sites (21.3% vs. 17.7%, respectively).

Charts were also reviewed for documentation that showed what consults were requested as recommended in the BSAOP. According to the BSAOP, when a total score is ≤12, if the mobility subscore is ≤2, an occupational therapist or a physiotherapist must be consulted and similarly, if the nutrition subscore is ≤2, a registered dietitian must be consulted.

There were 40 urban and 17 rural assessments that resulted in a high risk score of ≤12 as well as a mobility subscore of ≤2. Of the assessments with a total score of ≤12 and a nutrition subscore of ≤2 , 22 were from the urban sites and 12 were from the rural sites. The proportions of high risk assessments that resulted in the required consults are shown in Table 5.15.

Table 5.15

Physiotherapy, Occupational Therapy, and Registered Dietitian Consults if Total Score ≤12 with a Subscore of ≤2 on either Mobility or Nutrition

Consult Type Indicated		Consult Requested Yes or No	% (n) [a]		
			Urban	Rural	Total
Total Score ≤12 with Mobility Subscore ≤2 Urban (n=40) Rural (n=17)	Physiotherapist	Yes	15.0% (6)	5.9% (1)	12.3% (7)
		No	85.0% (34)	94.1% (16)	87.7% (50)
	Occupational Therapist	Yes	27.5% (11)	17.7% (3)	24.6% (14)
		No	72.5% (29)	82.3% (14)	75.4% (43)
Total Score ≤12 with Nutrition Subscore ≤2 Urban (n=22) Rural (n=12)	Registered Dietitian	Yes	18.2% (4)	0.0% (0)	11.8%(4)
		No	81.8% (18)	100.0% (12)	88.2% (30)

Note. [a] % (n)= proportion and number of high risk assessments (total score≤12) requiring the corresponding consults (subscore ≤2 on mobility or nutrition) that did and did not result in the specified consult for each region out of all high risk assessments requiring the corresponding consult in that region.

As shown in Table 5.15, of the high risk assessments with a high risk mobility subscore, a larger proportion of those from the urban region compared to the rural region resulted in physiotherapy consults (15.0% vs. 5.9%, respectively) and occupational therapy consults (27.5% vs. 17.7%, respectively). Similarly, of the high risk assessments with high risk nutrition subscores, a larger proportion of dietitian consults were made in the urban region than the rural region (18.2% vs. 0.0%). Overall, however, the majority of required consults were not documented to have been done (72.5% to 100.0).

5.3.2.3 Research Question #7 summary. Of all the Braden Risk assessments completed, those that resulted in a high risk score comprised the lowest proportion, compared to lower risk levels. The proportion of high risk assessments was larger for the urban sites compared to the rural sites. Concerning the risk level results from the individual components on the Braden Risk Assessment tool, except for the activity component, the majority comprised low risk scores with similar proportions for the urban and rural regions.

Of all the completed risk assessments resulting in a high risk total score, only approximately 20% resulted in additional pressure injury prevention and management interventions documented in the plan of care, with similar proportions regionally. Less than one third of the charts that resulted in a high risk total score and required an Occupational Therapist, Physiotherapist, or Registered Dietitian consult contained documentation to support that these consults were requested. In summary, reviewed care plans showed that even though a resident may be determined to be at a high risk for pressure injury development, few contained documentation supporting that preventative interventions were added or consults were completed as recommended in the BSAOP.

Chapter 6: Discussion

Chapter 6 discusses the findings from each research question within the context of the study's framework, current relevant best practices, and applicable literature. The strengths and limitations of the study are also presented. In keeping with the model developed for this study, nursing staff in LTC need knowledge of prevention and management strategies, risk factors, and assessment skills, such as the ability to identify pressure injuries,. The first three research questions addressed the knowledge levels of the different nursing team members as well as their perceived learning needs. As well, consistent with the logic model, good practice is also guided by appropriate policies which exist in the BSAOP, the PUPP, and the WMP, however, staff need to know them, which was addressed by the fourth research question. They need to apply their knowledge and skills in conducting skin assessments and risk assessments. Application of knowledge was addressed in the fifth and sixth research questions. Finally, the nursing team members need to act on the assessment findings and this was addressed by the seventh research question. Assessing all parts of the logic model developed for this study allows for identification of issues or gaps at various levels which is appropriate since the prevention of pressure injuries is complex. The following discussion is presented in accordance with the key concepts of the logic model in the following sequence: 1) knowledge and assessment related to pressure injury prevention and management, 2) policy knowledge, 3) knowledge and skills about skin assessments and risk assessments, and 4) application of knowledge and findings from assessments.

6.1 Knowledge and Assessment Skills

The results from the first two research questions are discussed in the context of the logic model for this study. In keeping with the logic model, optimal pressure injury prevention and management begins with sufficient knowledge and assessment skills, therefore, this discussion begins with the Pressure Ulcer Knowledge Test results from Questionnaires A and B. Assessment skills for this study were limited to asking the RNs and LPNwcs to stage pressure injuries shown in a picture. Participant learning needs will be discussed after the discussion of the Pressure Ulcer Knowledge Test results, addressing the third research question.

Knowledge deficits. Even though two versions of the Pressure Ulcer Knowledge Test were administered, the key findings from the analysis of both versions were similar: 1) pressure injury knowledge was lacking in all categories, 2) there was variation by item, and 3) characteristics such as amount of experience or place of work did not influence knowledge scores. In addition, the results for the 24 items common to both versions are compared by all groups (RNs, LPNwcs, LPNnowcs, and PCAs). Each key finding is discussed in the next sections.

Knowledge deficits of RNs and LPNwcs. As previously discussed, for pressure injury knowledge to be considered adequate, a score of 90% was expected on the Pressure Injury Knowledge Test (Miyazaki et al., 2010; Pieper & Mattern, 1997). In this study, only one RN scored above 80% and none scored above 90%. Similar previous studies also showed that few RNs scored above 90%. One reported that none of the RNs scored above 90% on the test and only 0.68% and 11.8% of the RN participants did so in two other studies (Miyazaki et al., 2010; Pieper & Mattern, 1997).

In this study, the median score for the RNs was 74.5% with a range of 59.6% to 83.0%. The majority scored between 65.0% and 79.0%, and 16.7% scored less than 65.0%. The results for the RNs are similar to previous studies that evaluated knowledge with the Pressure Injury Knowledge Test or a modified version. The first two American studies conducted using this test found that for RNs, the mean scores were 71.7% (range: 9% to 98%) and 71.3% (range: 15% to 83%) (Pieper & Mattern, 1997; Pieper & Mott, 1995). In more recent studies, in Canada, the US, and Brazil, mean scores for nurses ranged from 61% to 81% (Chianca, et al., 2010; Forsyth, 2010; Gallant et al., 2010; Miyazaki et al., 2010).

The median score for the LPNwcs was 70.2% with a range of 53.2% to 80.9%. Similar to the RN results, the majority scored between 65.0% and 79.0%. However, almost one third (31.6%) of them scored less than 65.0%. Only one scored above 80% and none above 90%. Only Forseth (2010) assessed LPNs as well and their mean score was 79%, much higher than LPNwcs' median score in this study. Forseth did not report if any participants scored over 90% or score ranges.

For each of the subcategories (Risk and Prevention, Staging, and Wound Description), there was little variation between median scores on the subcategories for the RNs: 72.7 on Risk and Prevention, 71.4 on Staging, and 71.4 on Wound Description. The LPNwc group had median scores that were also similar for the Risk and Prevention and Staging sub-categories (69.7 and 71.4, respectively). However, their median score was much lower on the Wound Description items (57.1). For the RNs, even though the median scores were similar, the fewest low scores were found on the Risk and Prevention items while the most were found on the Pressure Injury Staging items. In contrast, for the LPNwcs, the fewest low scores were found on the Pressure Injury Staging items, while the most were on the Wound Description items. The lower median score on the Wound Description items for the LPNwcs compared to the RNs may partially be attributable to the difference in the extent of training and educational background for these two professional groups.

The majority of the studies cited here for comparison purposes did not provide the mean or median scores from the subcategories and did not include LPNs as study participants. Consequently there is little comparability for the LPNs. As well in one study, a modified Brazilian version of the Pressure Injury Knowledge Test condensed and combined the Staging and Wound Description categories into one, for a total of eight items (Miyazaki et al., 2010). However, where mean subcategories were provided, they were fairly similar to the results in this study as explained below.

In the first two studies by Pieper and Mott (1995) and Pieper and Mattern (1997), the Risk and Prevention mean scores and ranges for the RNs were 71% (15.2% to 87.9%) and 70.9% (9.4% to 97.0%), respectively. These mean scores were close to the median subscore obtained by the RNs in this study at 72.7%, but the range was narrower at 57.6% to 84.8%. Even though the LPNs are not directly comparable, their median subscore in this study was also close at 69.7% but again the range was narrower at 51.5% to 81.8% compared to the previous studies. In the Brazilian study by Chianca et al.

(2010), the range was not reported, but the Risk and Prevention mean score was lower (65.2%) than the other reported means and median in this study. Again, the results have shown little change in knowledge about pressure injury risk and prevention over time for RNs. Given ease of access to information and increasing legal implications associated with pressure injuries, it is surprising that knowledge has not improved over time.

The Wound Description category mean scores and ranges for the RNs were 70% (0.0% to 100.0%) and 68.6% (0.0% to 100.0%) in the first two studies conducted by Pieper and Mott (1995) and Pieper and Mattern (1997), respectively. The median subscore for the RNs in this study was similar at 71.4%, but the range was much narrower. In contrast the LPNwcs in this study had a much lower Wound Description median subscore of 57.1% but a more similar range of 14.3% to 100.0%. Again, little has changed concerning RN wound description knowledge over time, showing knowledge deficits still persist. This also shows there are different knowledge gaps for the RNs compared to the LPNwcs. The LPNwc results, while not comparable, are also concerning given their ever expanding scope of practice that includes wound care in EHLTC settings.

Again, there were some similarities to the first two studies by Pieper and Mott (1995) and Pieper and Mattern (1997); the Staging category mean scores and ranges for the RNs were 79% (14.3% to 100.0%) and 75.7% (28.6% to 100.0%), respectively. The Staging median score for the RNs in this study was lower at 71.4% and the range was narrower at 42.9% to 100.0% and this was the same for the LPNwcs. Even though not directly comparable because Chianca et al. (2010) combined some Staging and Wound

Description items, their RN mean score for Staging was 57.4%, much lower than the other previously noted scores and those from this study. These results suggest that over time, knowledge about pressure injury staging has worsened. Front line staff must recognize and differentiate all of the stages of pressure injuries to plan appropriate care and to ensure accurate documentation.

While not directly comparable, the results from this study were consistent with results from similar published studies in previous years. Even though the studies using the Pieper's Pressure Injury Knowledge Test spanned time from 1995 to 2012, knowledge deficits have persisted and this study has shown that this was the case in 2011 in Eastern Health LTC. These results are concerning given the serious implications for a person who develops a pressure injury and for the involved healthcare institution. The results suggest that there is a need for more education on all aspects of pressure injury prevention and management for both the RNs and LPNwcs. With an aging population and the increasing acuity of persons entering healthcare facilities, there is substantial risk for the development of pressure injuries. This underscores the need for all those involved in care provision to be knowledgeable about pressure injuries. Research now needs to be directed toward how to improve this knowledge and application while exploring sustainable and effective methods.

Item response rate variation. In addition to finding some variation by category, there was also variation found in the correct response rates per item within the categories. No strong patterns emerged, however both groups knew some items well but did not know other items. Also, there were differences between groups in the correct response rates to certain items. The following sections provide comparisons within each subcategory to the existing literature where findings were comparable. Again, only one study assessed LPNs, so comparability for this group was limited.

For the Risk and Prevention items, over 90% of both the RNs and LPNwcs correctly answered 10 out of 33 (30.3%) of the risk and prevention items. In comparison, in previous studies, for the RN participants, the number of correctly answered Risk and Prevention items ranged from 10 to 19 (30.3% to 57.5%) out of 33. The correct response rate was not provided in the study that used LPNs (Forseth, 2010). Even though the majority correctly answered 10 items in this study, both the RNs and LPNwcs had a poor correct response rate to other Risk and Prevention themed items, for example, fewer than 15% correctly answered the items concerning chair repositioning and shifting weight and only approximately half correctly answered items about low Braden risk scores and massaging bony prominences. As described in Chapter 2, in previous studies, there were risk and prevention items that participants did or did not know. The findings were very similar to those found in this present study (Chianca et al., 2010; Forseth, 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995).

There were certain Wound Description items that the RNs and LPNwcs knew well in this study. For example, all of the RNs and the majority of the LPNwcs knew that the skin is the largest organ of the body. The correct response rate was also good concerning items about pressure injury scar breakdown and the definition of slough. The correct response rate was much higher for the RNs than the LPNwcs concerning the two items about eschar. For the Staging subcategory, the correct response rates tended to be high for both the RNs and LPNwcs to items about Stage I and IV pressure injuries. As well, all participants knew that heel blisters are concerning. These findings were similar to those found in previous studies where the RNs also tended to do well in response to the same items (Chianca et al., 2010; Forseth, 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995).

Only just over half of the RNs and LPNwcs in this study correctly answered the Wound Description items about undermining and falsely saying that pressure injuries are sterile wounds. In previous studies, the same items were also not well known, however unlike this study, the RNs tended to also have a poor correct response rate to items about pressure injury scar tissue. In response to the Staging items, less than 15% of RNs and even fewer LPNwcs knew the item defining Stage 3 pressure injuries. The two items about Stage 2 pressure injuries were also not as well-known as those about Stage 1 and 4. Again the results reflected those found in previous studies in which the RNs also tended to have a lower correct response rate to the items about the Stage 2 and 3 pressure injuries compared to Stage 1 and 4s. The results from this study and previous studies suggest the participants were more knowledgeable about the extreme pressure injury stages (Stage 1 and 4) compared those in between (Stage 2 and 3). Results for the Wound Description and Staging items in this study were again quite similar to those produced in previous similar studies (Chianca et al; Forseth, 2010; Miyazaki et al., 2010; Piper & Mattern, 1997; Piper & Mott, 1995).

In response to the questions asking the participants to stage a pressure injury shown in a picture, the majority of both groups were able to correctly identify the Stage I pressure injury. However, even though slightly more LPNwcs than RNs correctly staged the Deep Tissue Injury, they comprised only a small proportion of their respective groups. With respect to the high correct response rate in identifying the Stage 1 picture, the findings were consistent with the results to the item defining a Stage 1 pressure injury on the Pressure Ulcer Knowledge Test. Similarly, a study by Aydin and Karadağ (2010) found that 67% of nursing participants of various education levels were able to accurately identify a Stage I injury, but the majority (74.8%) did not correctly identify a Deep Tissue Injury pressure injury. These findings suggest that a knowledge gap exists in correctly staging pressure injuries. Not recognizing the correct stage could result in sub-optimal treatment.

There were many similarities between this study and previous studies using the Pressure Ulcer Knowledge Test with respect to items that were either well known or not, suggesting persistence of knowledge gaps over time. It would be valuable to have a deeper understanding as to why gaps persist, for example, why do nursing staff continue to have knowledge deficits concerning positioning frequencies or know definitions about Stage 1 and 4 pressure injuries but not about Stage 2 and 3 or Deep Tissue Injury pressure injuries? Perhaps these topics are not as well covered in basic or post-basic pressure injury education or maybe are just not well understood. Further exploration is warranted to determine what aspects of pressure injury prevention and management are not well understood and if these topics are given enough attention in nursing education.

Knowledge deficits of LPNnowcs and PCAs. To demonstrate adequate knowledge on the modified Pressure Ulcer Knowledge Test, a minimum of 90% was expected for the PCA and LPNnowc group. Even though the mean score for the PCAs was 75.9 and for the LPNnowcs, it was 78.4, there were two PCAs and two LPNnowcs who scored over 90%. But the mean scores demonstrated that the majority of both groups did not have adequate knowledge about pressure injury prevention and management.

Overall, the LPNnowcs tended to do better on the modified Pressure Ulcer Knowledge Test than the PCAs, but there were no statistically significant differences. The LPNnowcs had a higher mean score and tended to score in the higher ranges compared to the PCAs. For example, 67.9% of the LPNnowcs scored over 79.0% compared to 44.4% of the PCAs. In another study using a modified version of the Pieper's Pressure Ulcer Knowledge Test, nursing auxiliaries/technicians demonstrated knowledge gaps with a mean score of 73.6 (Miyazaki et al., 2010). In a Chinese study by Kwong et al. (2011) using a modified 30 item version of Pieper's Pressure Ulcer Knowledge Test, the non-licensed care providers also showed a gap in knowledge with a mean score of 70.2. In a Swedish study, using a different pressure injury knowledge tool, Gunningberg et al. (2013) found that assistant nurses were deficient in knowledge about pressure injury prevention. The findings from this study were comparable to similar studies which have also shown that similar types of employees have knowledge deficits about pressure injuries.

Item response rate variation. Overall, there were some items that both groups did not know well or did know well while there was a discrepancy between groups on other items. For example, fewer than 10% of both groups correctly answered two of the items concerning the frequency of chair repositioning. In contrast, all the participants in both groups correctly answered the items about heel blisters and skin hygiene. While there was a discrepancy between groups in the correct response rate to seven items, none of the differences were statistically significant. The largest discrepancy was noted in response to the items about the skin being the largest organ and bed repositioning frequency with the LPNnowcs having a higher correct response rate. Miyazaki et al. (2010) similarly found there were certain items answered poorly by both groups of participants (nursing auxiliaries/technicians and RNs), for example items about frequency of chair repositioning, the angle of the head of the bed, and side-lying position. Both groups tended to do well in response to items about keeping the skin clean and the need for chair cushions. These results are useful to guide development of education plans.

Of the seven items with a discrepancy of more than 10 percentage points, the LPNnowcs had a higher correct response rate than the PCAs. Even though a different test was used for their Swedish study, Gunningberg et al. (2013) found that the RNs and student nurses scored significantly higher than the assistant nurses. These findings are not surprising given that the LPN formal education is longer and more in depth than the programs for the PCAs. These findings suggest that differing knowledge gaps may exist for each group while both groups may have similar knowledge deficits regardless of designation. This information helps to identify specific learning needs for each group.

In EHLTC, LPNs and PCAs are increasingly making up the majority of healthcare workers, outnumbering the RNs. These healthcare workers spend the majority of time at the bedside, providing personal care to the residents, yet PCAs have the least amount of formal education required for their roles. In an American study, Needleman, Buerhaus, Mattke, Stewart, and Zelevinsky (2002) found that unlicensed nursing aides provided 21% of patient care time. This amount of care time has likely increased since 2002. For example, similar to the skills mix model in Eastern Health LTC, according to O'Donnell (2009) in New Brunswick, unregulated workers or resident attendants comprise 47.4% of the nursing staff mix in LTC versus 16.1% of RNs and 34.5% LPNs. This underscores the need for PCAs and LPNs to be knowledgeable about pressure injury prevention and skin care.

Knowledge deficits: LPNnowcs and PCAs compared to RNs and LPNwcs. A comparison of the results for all four groups (RNs, LPNwcs, LPNnowcs, and PCAs) on the 24 items contained in the modified Pressure Ulcer Knowledge Test showed that the overall means scores were similar, ranging from 75.9 to 78.4 and no statistically significant differences were found. No notable trends were found in the response rate to each item. As with the results from each test, all of the participants tended to know some items well or not know other items well. For example, all participants correctly answered the item about heel blisters; however, very few correctly answered the items about the frequency of chair repositioning. There were four items for which statistically significant differences were found. On three of those four items, the correct response rate was highest for the LPNnowcs. These items were about heel devices, skin inspections, and skin as the largest organ. The fourth item was about heel elevation. Interestingly, the RNs had the lowest correct response rate to both the items about heels. The majority of all groups correctly the item about the skin being the largest organ. The item about skin inspections was also well known, however, the correct response rate was higher for the LPNnowcs and the PCAs compared to the RNs and LPNwcs. RNs are the leads and coordinators of care on the nursing units who PCAs go to with concerning findings and guidance for interventions, therefore, it could be expected that RNs would know content at least as well as, if not better as PCAs or LPNnowcs, but this was not the case for some items. Again, these results show that knowledge among the groups may not be predictable. Overall, similar previous studies produced comparable findings suggesting pressure injury knowledge deficits across groups (Caliri et al., 2003; Forseth, 2010; Gunningberg et al., 2013; Kwong et al., 2011; Miyazaki et al., 2010; Pancorbo-Hidalgo et al., 2006).

While not directly comparable, the results from the Pressure Ulcer Knowledge Test in this study were consistent with results from similar published studies in previous years. Even though the studies using the Pieper's Pressure Ulcer Knowledge Test spanned time from 1995 to 2012, knowledge deficits have persisted and this study has shown that this was the case in 2011 in EHLTC. These results are concerning given the serious implications for a person who develops a pressure injury and for the involved healthcare institution.

It is important for each level of nursing to be very knowledgeable about pressure injury prevention and management. In the EHLTC settings, RNs and LPNs conduct risk assessments and so must be knowledgeable about assessment and interpretation. The RN develops the plan of care, and so must be very knowledgeable about interventions, while also directing and advising other nursing levels about pressure injury prevention and management interventions. PCAs provide direct nursing care and must be able to complete skin assessments and recognize abnormal findings while ensuring appropriate positioning techniques are implemented. All nursing team members also need to sufficiently document findings and care provided. Pressure injury knowledge for all nursing team members is an integral component of the foundation for prevention and appropriate management of pressure injuries, as outlined in the logic model for this study.

Influence of participant characteristics on knowledge. For this study, experience, region of work, and previous pressure injury education were analyzed to determine if these factors significantly influenced the participants' results on the Pressure Ulcer Knowledge Test. The results for the RNs and LPNwcs are first discussed followed by those for the LPNnowcs and PCAs.

Influence of participant characteristics on knowledge: RNs and LPNwcs. With respect to region of work and experience, no consistent patterns or significant differences were found for either the RN or LPNwc groups to show that these factors influenced their pressure injury knowledge. In contrast, the median scores tended to be higher for both the RN and LPNwc participants who had post-basic pressure injury education but the differences were not significant. Timing of this education did not influence the results either. More details are provided in this section.

With respect to the results from the staging picture questions, some minor trends were found concerning experience. The LPNwcs who worked longer in their profession and in a LTC setting tended to have a higher correct response rate in identifying the picture of the Deep Tissue Injury pressure injury. In comparison, RNs and LPNwcs with less LTC and professional experience had a higher correct response rate in identifying the Stage 1 pressure injury. In the two studies where experience was assessed, experience was not found to have any significant effect on the RNs' scores on the Pressure Injury Knowledge Test (Pieper & Mattern, 1997; Pieper & Mott, 1995). However, Miyazaki et al. (2010) found that, for nursing technicians/auxiliaries, scores tended to be lower with time since completing their professional education (r= 0.10; p= 0.009). Even though previous studies did not assess LTC settings, only Miyazaki et al. found a negative relationship between pressure injury knowledge and experience while the others were consistent with the present study demonstrating no influence.

With respect to region of work, the only three RNs who correctly identified the Deep Tissue Injury picture of a pressure injury were all from the urban sites versus the rural sites, but this difference was not significant. While geographical region of work was not assessed in the previous studies cited here, and so are not directly comparable, other factors such as area of work were explored in some, for example, direct care versus indirect care settings. Nurses who worked on adult or pediatric unit who provided direct care, for example, medicine, nephrology, ICU, tended to score higher on the Pressure Ulcer Knowledge Test than those who worked areas with more indirect care, such outpatients, maternity, or ambulatory units (Chianca et al., 2010). This finding is not surprising, given that inpatients on certain units would likely be higher risk for skin breakdown compared to those in outpatient or ambulatory areas.

Previous studies tended to demonstrate that some form of exposure to pressure injury education influenced the Pressure Ulcer Knowledge Test scores positively. For example, Zulkowski et al. (2007) found that exposure to pressure injury information such attending a lecture, reading an article or a website, or reading guidelines by the Agency for Health Care Research and Quality correlated to significantly higher scores. Additional training, reading about pressure injury, attending courses, and participating in activities about pressure injuries were all found to be associated with higher scores (Caliri et al., 2003; Chianca et al., 2010; Gallant et al., 2010; Piper & Mott, 1995). Timing of education also influenced scores; scores tended to be higher for those who attended a lecture within a year (Pieper & Mattern, 1997; Pieper & Mott, 1995).

Where level of nursing education was assessed, for example, bachelor degree, associate degree, or diploma, no significant differences were found in scores (Pieper & Mattern, 1997; Pieper & Mott, 1995). Certification in wound care is a form of additional continuing education above any nursing level curriculum. Not surprisingly, Zulkowski et al. (2007) found that wound care certified nurses scored significantly higher on the Pressure Ulcer Knowledge Test than those who were not certified in wound care or those certified in other areas. This finding could be expected, given those who become certified in wound care likely would have an interest in the topic and/or may work with wounds routinely.

Influence of participant characteristics on knowledge: LPNnowcs and PCAs. Overall, few patterns emerged concerning participant characteristics. There were no statistically significant differences in scores found when analyzed according to professional experience, long term care experience, region of work, and previous post-basic pressure injury education, however some trends were found.

PCAs with less experience in the profession and in LTC had a higher mean score than those more experienced. Miyazaki et al. (2010) similarly found that the percentage of correct answers decreased with more experience. This would suggest with increasing time away from formal education, knowledge becomes outdated or forgotten if not routinely used in the practice setting. Without receiving timely post-basic pressure injury education, experienced healthcare providers may use outdated practices or interventions that are no longer recommended.

The mean score was higher for the urban PCAs compared to the rural PCAs. The reason for this finding is not clear, however, it may suggest that urban PCAs have more access to resources such as clinical educators.

LPNnowcs who had previous post-basic pressure injury education had a higher mean score than those who did not, but the opposite trend was found for the PCAs. Again, the reason for this is unclear, but it is not known what type of post-basic education the PCAs had. As well, only 20% (n=7) PCAs said they had any post-basic pressure injury education compared to half of the LPNs did. The majority of LPNs had post-basic pressure injury education through work in-services, whereas only approximately half of the PCAs did. These findings demonstrate that education is important but the learning needs of each group as well as their preferred methods of education delivery must be considered and addressed in the educational strategy.

In other previous studies, tailored education for non-RN healthcare providers was shown to be effective not only in improving knowledge but also by decreasing the incidence and prevalence of pressure injuries. In an American educational intervention study with nursing assistants, Howe (2008) found that most nursing assistants did not have an understanding about the implications of health care-acquired injuries such as pressure injuries. However, after receiving education that focused on comprehensive skin care and pressure injury prevention, the rate of acquired pressure injuries decreased from 2.17% in 2002 to 1.71% in 2003. Similarly in the Chinese study, after non-licensed care providers received tailored pressure injury education, there was a statistically significant improvement in knowledge and skills while pressure injury prevalence and incidence rates decreased from 9% to 2.5% and 2.5% to 0.8%, respectively (Kwong et al., 2011). Investing time into exploring the learning needs and developing education for PCAs and LPNs regarding pressure injuries is very valuable considering their expanding role in healthcare facilities.

Influence of participant characteristics: summary. Overall, no strong patterns emerged from the present study and previous studies to indicate that amount of experience, geographical region of work and level of nursing education influenced pressure injury knowledge. However, results from the similar previous studies and this study suggest that pressure injury education or exposure to pressure injury content in journal articles, online, in texts or through training or lectures have been found to positively influence scores on the Pressure Ulcer Knowledge Test. Additionally, more recent exposure also more positively influenced the scores. This finding is also not surprising and supports that education is useful in improving pressure injury knowledge but also that education must be provided at routine intervals for the knowledge level to be sustained. When developing strategies and education to improve pressure injury knowledge, no assumptions can be made concerning amount of experience or region of work.

Learning needs. In addition to determining nursing knowledge about pressure injuries in Eastern Health LTC, it is also important to explore staff perception of their own learning needs as well as their preferred methods of education delivery. This helps ensure a more comprehensive strategy to meet any identified needs. As explained in Chapter 3, participants were surveyed regarding topics related to pressure injuries that they wanted to learn more about, as well as how they preferred their education delivery

There were several key findings from the responses provided by the participants: 1) all participants identified wound care, treatment, and dressings as the most pressing learning needs, followed by prevention and staging, 2) participant's perceived learning needs corresponded to the identified knowledge gaps from the Pressure Injury Knowledge Test, and 3) the majority of all participants ranked in-services at work as their most preferred method of education delivery. Each key finding is discussed in the following sections.

Participants' perceived learning needs and correspondence to the Pressure Ulcer Knowledge Test results. The participants frequently identified several topics as learning needs and these were categorized as wound care, including dressings and treatment Interestingly, even though PCAs and LPNnowcs do not provide wound care, these participants identified this topic more often than any other topic. Topics related to the theme of prevention and positioning appeared almost as often, however, more PCAs, compared to the RNs, LPNwcs, and LPNnowcs, identified this topic as a learning need. While the PCAs and LPNnowcs would be more often involved in the positioning of residents, all groups need to understand how and when to position residents optimally to prevent pressure injuries. As well, the correct response rate tended to be low for all groups in response to items about repositioning frequency suggesting this is an area that needs focus in education programs.

Interestingly, participants identified perceived learning needs that reflected the knowledge deficits found in the results to the Pressure Ulcer Knowledge Test. This suggests that they are aware of their own gaps in knowledge concerning pressure injuries. For example, the RNs and LPNwcs more frequently identified topics related to `wound care, treatment, and dressings' and `prevention and positioning' as desired topics, while the items related to these topics tended to have the lowest correct response rate compared to other topics. Similarly, after topics related to wound care, the PCAs and LPNnowcs most frequently identified topics related to `prevention and positioning' and their correct response rate to items with these topics tended to be lower than other items. Even though PCAs and LPNnowcs have very limited involvement in wound care, dressings, and treatment, these topics emerged most often as a perceived learning need for this group. This finding prompts further exploration to learn why they feel they need more education in topics for which they have a limited scope in practice. For example, they may want to know what products they can or cannot apply or they may want more understanding about why certain dressings are used or how to stage pressure injuries. Involving PCAs and LPNnowcs in education that does not teach them skills outside their scope of practice but focuses on increasing awareness of some of the processes for wound care, dressings and treatment undertaken by the RNs and LPNwcs could be very beneficial by helping them gain more insight into the rationale behind preventative measures. As mentioned earlier, Howe (2008) found that a similar strategy not only empowered the certified and non-certified nursing assistants but also contributed to a decrease the incidence of pressure injuries. The appropriate level of knowledge may help them recognize issues to be brought to the attention of the RNs and LPNs, for example, recognizing that a dressing may need to be changed or when a heel suspension boot is required. It is worthwhile exploring education about wound care, dressings, and treatment for PCAs and LPNnowcs that is appropriate for their scope of practice. Such education can be limited to understanding how certain products such as hydrocolloid dressings or barrier creams protect the skin from friction and moisture but making sure they understand their practice would be limited to applying barrier creams versus hydrocolloid dressings. Such education may need to be very interactive in nature to address concerns and questions from PCAs about what practices are appropriate for them. Involving PCAs in this type of interaction and education may be helpful in promoting their engagement while empowering them within their scope of practice. Additionally, it may be beneficial to promote upskilling of LPNnowcs in wound care so that they are competent within their scope of practice. Having all LPNs competent in wound care could be beneficial to the entire nursing team by having this group more involved, engaged, and empowered.

Preferred method of education delivery. Of the choices provided for the participants to choose from, the majority selected `in-services at work' as the most preferred method of education delivery. The second most preferred method was `informal group sessions'. The least preferred method was `self-study through journals, handouts, newsletters, online'. This may suggest that staff would prefer to learn while at work versus independent learning outside of working hours. Staff also may not have easy access to journals or newsletters. Even though the majority of all participants indicated they preferred 'in-services at work' and ' informal group sessions' versus independent methods, this presents challenges with respect to having sufficient time during work hours to provide these methods of education. Providing time for in-services impacts staffing levels, potentially leaving units understaffed or incurring overtime while staff members are attending any educational sessions. However, holding education days with sessions on wound care would be beneficial for employers in LTC because it provides uninterrupted time for staff to learn and subsequently be more knowledgeable and skilled in practice. It would be beneficial to explore why self-study modalities are not preferred and to understand what factors may motivate independent learning. Regardless of method of educational delivery, when developing educational content, it is important to consider adult learning principles and to incorporate a delivery method that will encourage participation from staff. Failure to consider this could result in ineffective learning.

Learning needs summary. Some results to the questions related to learning needs were surprising while others were not. For example, even though PCAs do not provide wound care, they identified this topic more frequently than any other topic as a learning need. This example demonstrates that assumptions cannot be made about learning needs and reinforces the importance of completing a needs assessment before planning educational content. As well, to keep up with staff changeover or newly recommended practices and recent information a needs assessment should be completed every time education is developed. It is also crucial to identify any unique needs for each group while considering their scope of practice.

It was not surprising methods of education delivery such as in-services or informal group sessions were the most preferred because they occur at work and the onus is not on the participant to initiate or acquire the education on their personal time. However, incorporating education sessions during work time presents challenges, especially when considering how often staff may change over or ensuring routine updating. Obliging participants' preferred methods of delivery requires employer support while acknowledging the value of pressure injury prevention knowledge and skills.

The participants' identified learning needs suggest they were aware of the knowledge deficits. Without sufficient knowledge, it is difficult to practice to their full scope of practice resulting in a less efficient team and possibly less than optimal care. When each team member has good pressure injury knowledge, there is potential for each to work to their respective full scope of practice, thereby optimizing care, increasing the quality of care, and improving outcomes. This conclusion supports the logic model used as the framework for this study. Improving pressure injury care therefore requires support for education.

6.2 Policy Knowledge

As described in the logic model for this study, pressure injury policies and procedures are part of the foundation of the pathway to optimizing pressure injury prevention and management. However, the existence of policies without knowledge about them is ineffective and so they may not be applied in practice, possibly resulting in less than optimal care. As described in Chapter 3, at the time of this study, there were three EH policies that pertained to pressure injuries: 1) BSAOP, 2) PUPP), and 3) WMP. Each of the policies contained specific recommendations that are based on best practices in order to optimize preventative and management interventions. Policy knowledge was addressed by the fourth research question:

To determine the level of knowledge that the RNs and LPNwcs had in relation to any policies that were in place to guide their practice for the prevention and management of pressure injuries, they were asked to identify the relevant policies, when the Braden Risk Assessment should be done, and who could complete the assessment. The main themes that emerged from participant responses were 1) policy knowledge was poor, both of their existence and content and 2) there were no consistent differences in the effects of characteristics such as region of work, experience, or previous post-basic pressure injury education on knowledge. Each of these themes is discussed in the next sections.

Knowledge deficits related to policies. In response to the open-ended question asking to identify policies related to pressure injuries, participants could have identified three as discussed. If the responses did not specifically name a policy but instead identified content similar to a policy, the answer was accepted. Almost half of all the participants (38.9% of RNs and 50.0% of LPNwcs) did not identify any of Eastern Health's three policies related to pressure injuries. This suggests that only approximately half of the RNs and LPNwc who have responsibilities for care related to pressure injuries knew any of the policies that exist to guide their practice. This raises the question of how RNs and LPNwcs know what is expected of them, for example, whether they learn over time from colleagues or from orientation, or if they only seek out the information when needed. Policies are accessible on the Eastern Health Intranet and all staff have access to a computer at a nursing station. Such poor knowledge of existing policies may suggest that practices related to pressure injury prevention and management may not be based on best practice, may not be appropriate, and may not be consistent. These findings may warrant further investigation to determine the impact of the actual care given on the quality of care.

Even though RNs and LPNs are responsible for the completion of the Braden Risk Assessments at specified intervals, only 33.3% of RNs and 15.8% of LPNwcs knew there was a BSAOP outlining this practice. Given that this policy is not well known, it is not surprising that they also did not know all the intervals recommended for when to complete the risk assessment. Not one participant knew all expected times for completion of the risk assessment. The most identified time was 'on admission' and just over a third knew this. Fewer than 20% of RNs and fewer than 10% of LPNwcs knew both ‘on admission’ and ‘quarterly’. No RNs and approximately 16% of LPNwcs knew that a change in health status requires a Braden Risk Assessment. If a risk assessment is not completed at a change in health status, this suggests that proactive action is not taken and instead, a response to a decline in health status is responded to in a reactive manner, after a resident has developed skin integrity issues. The results to this question alone would suggest that if staff do not know about policy, then the Braden Risk Assessment would not be completed at the recommended times. As discussed in later sections, compliance to the BSAOP was in fact low. Without completing a risk assessments at recommended intervals, there is a danger that residents who are at risk will be missed and subsequently not receive the care or consultations required. At the worst, a resident could develop a preventable pressure injury.

Given that BSAOP knowledge was poor, it is not surprising that only approximately 40% of the RNs and 50% of the LPNwcs knew that both RNs and LPNs can complete the Braden Risk Assessment. Just over half the RNs and a third of the LPNwcs incorrectly responded that only an RN can do the assessment. This may explain why the RNs did the majority of risk assessments as discussed in a later section. It is important to address this knowledge gap about scope of practice since having LPNs complete the risk assessment can help in sharing the workload and may also contribute to a greater likelihood of completion of assessments at all intervals. It may also improve communication of level of risk for residents with additional healthcare team members contributing to this responsibility.

Knowledge about the PUPP was also poor. In contrast to knowledge about the BSAOP, more LPNwcs (25%) than RNs (10%) knew about the PUPP. This policy is specific to LTC and provides useful information regarding care plan interventions to minimize the risk of developing a pressure injury. It has specific advice about positioning and repositioning frequency which, interestingly, were not topics well known by the participants according to the results from the Pressure Ulcer Knowledge Test. Poor knowledge about the PUPP prompts the question concerning what actually occurs in practice to prevent pressure injuries if it is not based on policy and how do the nursing team members know what to do. Even though all nursing team members have a role in pressure injury prevention and management, the RNs are expected to develop care plans and provide leadership, however, these results show that very few RNs are even aware of the PUPP and its content suggesting that they may not provide policy driven guidance to other team members or they may not develop optimal care plans, again, leaving a resident at risk.

The WMP was the least known policy by both the RNs and LPNwcs and only one LPNwc identified this policy. The WMP outlines when and how to document on a wound, what type of wound care requires a physician or nurse practitioner order, and when re-evaluation is required. Also, it states that the RN or LPN function within their capacity of scope of practice. The lack of knowledge about the WMP suggests that RNs and LPNwcs may obtain advice about wound management from another source such as a wound care consultant or the Provincial Skin and Wound Care Manual. Without familiarity with the WMP, it is not clear what guides RNs or LPNwcs in their wound management and whether or not their practice is in accordance with the policy. Again, however, such a knowledge deficit creates a gap in practice suggesting that wound care management may be inadequate or inappropriate.

Influence of participant characteristics. Assessment of professional and LTC experience showed no patterns related to policy knowledge. This may indicate that no assumptions can be made about the influence of experience; that both very experienced and newer staff may have similar or different levels of knowledge, and consequently, education needs to target both groups.

Of all the participant characteristics assessed for any influence on policy knowledge, only region of work and previous post-basic pressure injury education were associated with differences in policy knowledge. For example, larger proportions of rural LPNwcs versus those from urban sites had knowledge about existing policies. As well, larger proportions of rural RNs and LPNwcs compared to those from urban sites gave correct answers about who can complete the Braden Risk Assessment. None of the differences found were statistically significant. It is not clear what the reasons for the differences are but perhaps there is more shared responsibility in the rural sites.

Similarly, larger proportions of LPNwcs who had post-basic pressure injury education gave partially correct answers to the question about when to complete the Braden Risk Assessment compared to those without this education, with a statistically significant difference ($p = .033$). Both the RNs and LPNwcs with post-basic pressure injury education had a higher correct response rate to the questions asking who can complete the Braden Risk Assessment and what policies exist, compared to those without this education, however, the difference was not statistically significant. The small sample sized and low power many have contributed to the lack of statistical significance found. These findings indicate that post-basic pressure injury education may positively impact knowledge about policies and related information, however, no differences were found with respect to timing of post-basic pressure injury education. This finding is more surprising as it would be expected that more recent education would have a more positive influence. But in this study, any post-basic pressure injury education regardless of when had a positive influence on knowledge. This suggests that any supplemental education is better than none.

6.3 Knowledge and Skills about Skin Assessments and Risk Assessments

Assessment skills make up the third component in the foundation of the logic model for optimizing pressure injury prevention and management. Nursing team members need to have the appropriate knowledge and skills to perform the skin and Braden Risk assessments and these were assessed in the fifth and sixth research questions.

As described in Chapter 3, to answer the fifth research question, the PCAs and LPNnowcs were asked how often they completed skin assessments in LTC and to whom they reported concerning findings (RN, LPN, or PCA). These questions were pertinent to the role functions of PCAs and LPNnowcs. As per the PUPP, an RN, LPN, or PCA can complete a skin assessment and it is to be done daily. However, PCAs and LPNnowc provide most of the basic personal care such as bathing and subsequently are in the position to detect any concerning skin integrity issues. Concerning findings can be reported to an RN or LPN. Several key findings emerged from the provided responses and they were: 1) the majority of the PCAs and LPNnowcs knew that skin assessments are supposed to be done daily, 2) the majority of PCAs and LPNnowcs answered that they would report concerning findings to an RN only. As well, with respect to participant characteristics, only region work had any influence on the results. These findings are discussed in the next sections.

Skin assessments. The results to the question about when to complete a skin assessment were encouraging. Approximately 90% of the PCAs and 95% of the LPNnowcs correctly stated that they complete skin assessments daily. Fewer than five percent of each group said weekly. This finding suggests that these two groups know that part of their daily care for residents involves a skin assessment. Even though this finding shows good knowledge about the frequency of skin assessment, it would be beneficial to explore what these groups understand to be a concerning finding and if and what action they would take to address the issue. For example, if they identified an area of non-blanchable erythema over a bony prominence, would they immediately start a repositioning schedule? Most of these participants said they only report concerning findings to the RN. Even though the RN is usually the team lead, some sites have an LPN as a team lead. It is beneficial that the nursing team members understand that the LPN can or may be a designated lead on a unit and that it is within his or her scope of practice to be a resource for the PCAs concerning pressure injury prevention. The LPN as well as an RN can guide PCAs, for example by giving advice about turning and positioning or to know when further consultation is needed such as with an occupational therapist for a pressure relief chair cushion.

There were no consistent patterns to show that experience or post-basic pressure injury education influenced the PCAs and LPNnowcs in their knowledge about when to complete daily skin assessments or to whom to report concerning findings. However, more urban PCAs and LPNnowcs compared to those from rural sites correctly identified 'daily' as the frequency of skin assessments in LTC. The difference was not statistically significant and even though there was a difference, results indicated that the majority of both groups correctly identified the answer. Furthermore, the small number of participants and low power limit the conclusions that can be drawn about the influence of region on knowledge. Perhaps revisiting this question with a larger group along with chart audits would help determine if region of work influences these groups in terms of knowledge about frequency of skin assessments and reporting concerning findings.

Braden Risk assessments. As described in Chapter 3, to answer this research question, 173 charts were reviewed from eight urban sites and 96 from nine rural sites for documentation over a period of at least six months from admission. Healthcare staff at several sites had received in-services about the BSAOP prior to the targeted admission time. Chart audit results were further assessed to determine if these in-services influenced risk assessment practices. The key findings from this retrospective chart review were: 1) overall adherence to the BSAOP was poor in terms of completion of the recommended frequencies and timelines with some significant differences by region, 2) BSAOP education had little influence on completion of risk assessments at any recommended intervals, instead adherence was greater at sites where no BSAOP education occurred, and 3) RNs completed most of the risk assessments, however, at rural sites where BSAOP education occurred, more LPNs completed the risk assessments. The key findings are discussed in the next sections.

Insufficient completion of Braden Risk assessments. The retrospective chart review first of all showed a concerning finding that 7.1% of residents had no risk assessments completed at all and only 6.2% had all seven expected assessments completed. Of the all the assessments and reassessments expected, for both the urban and rural sites, there was greatest adherence to the admission assessments with 76.6% completed. However, adherence to the reassessment intervals at the first four weeks was the poorest with fewer than 20% completed and just over half of all the first and second quarterly assessments were completed. As well, compared to urban sites, adherence to the schedule was statistically higher for the rural sites for the first 4 weekly and second quarterly reassessments ($p<.001$). Since a chart review revealed only the risk assessments and reassessments that were documented, it may be possible that some were completed but not documented; however there is no way to know this for certain. The results of the chart review reflect the findings of poor knowledge about the BSAOP. It is not surprising that adherence to the BSAOP is poor given that the RNs and LPNwcs showed a knowledge deficit concerning this policy. This finding was inconsistent with the study by Gallant et al. (2010) where there was a wide discrepancy between the high percentage of nurses (97%) who correctly answered the item about completing a risk assessment on admission and the actual practice them of completing the assessment (24%), demonstrating that knowledge may not necessarily translate into practice. The reason for lack of assessment was not investigated as part of this study; however if they do not know about the policy, this among other unexplored factors may influence the lack of completion or risk assessments.

The completed risk assessments and reassessments were further analyzed to determine whether or not they were completed at the right times and if not, were they early or late. Most of the completed admission assessments were done on time and the majority of the four weekly reassessments were completed within seven days of the expected date of completion. Even though the completed first four weekly reassessments were done close to the expected dates, overall, adherence to these intervals was low. There was more variability for the quarterly reassessments even though most were completed within two months of when expected and many were completed earlier than when expected. The first and second quarterly assessments were more likely to have occurred early at the urban sites versus rural sites with a statistically significant difference ($p=0.046$ and $p<0.05$, respectively). The first quarterly assessments were more likely to have been late at the rural sites versus the urban sites ($p=0.003$). It is not clear why there would be regional differences in adherence to the schedule for the quarterly assessments, however, a two month lapse before or after the expected date creates unpredictability in frequency, which may lead to confusion for staff when reviewing care plans. If the assessments are two months late, a resident's risk status may change and go undetected until it is too late, especially given that this study has shown that most of the RNs and LPNwcs do not know that a change in health status prompts a risk assessment.

There may be several reasons why there is greater adherence to the admission assessment compared to subsequent reassessments. For example, when a resident is admitted, it is more of a routine to complete any required assessments while gathering necessary information, however, as nursing team members become more familiar with a resident with time after admission, the same priority may not be given to completion of risk reassessments on time. Also, if there are no automatic reminders, this reassessment interval may more likely be completed when time permits versus when it is due. Again, poor adherence to the date of expected completion can mean that a care plan is not adjusted to reflect risk in a timely manner, placing a vulnerable resident at risk of developing a pressure injury. Education about policies needs to include information that explains the need for timely reassessments as recommended in the BSAOP. Routine audits can help determine if assessments and reassessments are done in a timely manner. It may also be worthwhile to work with RNs and LPNs to determine methods to help them adhere to a schedule.

Influence of BSAOP education on completion of risk assessments. Further analysis to determine if the numbers of completed risk assessments differed between sites where BSAOP education occurred and sites where it did not occur revealed a surprising finding. Except for the admission assessments, exposure to BSAOP education had little influence on the completion of subsequent reassessments. As well, at rural sites where the BSAOP education did not occur, the proportions of completed assessments was larger than at the rural sites where it did occur, however, there were no statistically significant differences. It is not clear why this occurred, however adherence may have already been better at some sites than others even before any BSAOP education was provided. It also may suggest the completion reassessments after admission at the rural sites may be influenced by other factors such sufficient staffing or access to other resources such as educators. This finding suggests that that even if staff education is provided on a policy, other factors may play a role in influencing compliance to the policy. It is important to have baseline information that includes data showing compliance to the BSAOP schedule and to complete a needs assessment prior to developing any educational programs to ensure that content fits the identified needs and targets knowledge and practice gaps. Baseline information can be useful in measuring the effectiveness of education, for example, by auditing charts for adherence to the BSAOP schedule at designated times after the education.

Completed risk assessments and reassessments by RNs versus LPNs. The chart review showed that overall the majority of all completed assessments and reassessments were done by RNs. This result is consistent with the policy knowledge question about the BSAOP which showed that approximately half of the RNs and LPNwcs answered that it is the RN who completes the Braden Risk Assessment, even though the policy states that an LPN can also complete it. However, at the rural sites, except for the admission assessments, LPNs completed up to 50% of the reassessments. Significantly more reassessments were completed by LPNs at rural sites where BSAOP education occurred compared to rural sites where it did not occur, suggesting that the BSAOP education may have had some influence on this aspect of the BSAOP. This finding is surprising given that the BSAOP education did not positively influence the numbers of reassessments completed after admission. If more LPNs completed the risk assessments at all intervals, there may be a greater likelihood of adherence to not only increasing the number of completed assessments but also the likelihood of doing them on time because the responsibility would be shared between these two groups of nursing team members. Completion of risk assessments by more LPNs also improves knowledge and communication among more team members which can contribute to more effective care planning and implementation. This responsibility can be a team effort instead the RN being the sole person with this function.

Poor adherence to the BSAOP is a concerning finding. The results from this chart review show that some residents in EH LTC facilities are not assessed at all or not often enough, placing the more vulnerable residents at risk of receiving inadequate preventative care and subsequently increasing the risk of developing a pressure injury. This also suggests that when skin integrity issues do actually occur in residents who have not been assessed, interventions are put in place as a reactive versus a proactive manner. However, if residents are assessed at the recommended times and care plans are implemented accordingly, skin integrity issues can be averted. The results to this chart review reinforce the need for effective education that includes policy information. Periodic chart and practice audits are also needed to determine if knowledge translates into practice. For risk assessments that were actually completed, it is also important to know the levels of risk present in LTC and if care planning was appropriate. This information also needs to be incorporated into educational planning. The next sections provide discussion from the chart audits about documented interventions and consults requested.

6.4 Application of Knowledge and Assessment Findings

Consistent with the logic model pathway for optimizing pressure injury prevention and management is the application of knowledge, policies and procedures, and assessment skills to practice. Appropriate policies and procedures, sufficient knowledge and assessment skills ensure that skin and Braden Risk assessments are completed as per policy. Findings from the assessments then should result in good care plans that prevent pressure injuries. The seventh research question addresses application of knowledge and assessment findings in practice.

As discussed in Chapter 3, the charts were also reviewed to determine if interventions were added to the plan of care that corresponded to the obtained Braden Scale score and subscores. The retrospective chart review revealed a lack of documentation to support that the appropriate interventions and interdisciplinary consults were not established for the majority of residents with high risk scores. These key findings are discussed in the following sections.

Lack of documentation supporting interventions and interdisciplinary consults for high risk scores. The chart review for both rural and urban sites showed that there was insufficient documentation to support that additional pressure injury prevention and management interventions were added to the plan of care for residents who had high risk scores. High risk scores comprised 8.1% of all the total risk scores obtained (11.5% at urban sites and 4.4% at rural sites). Only 20% of the reviewed charts with high risk scores contained documentation of additional interventions indicated for pressure injury prevention and management. Knowledge results from the Pressure Ulcer Knowledge Test for the RNs and LPNwcs showed that approximately half of both groups knew that a low Braden score is associated with increased risk of developing a pressure injury, so knowledge was poor but practice concerning high risk scores was worse. Gallant et al. (2010), however found that only 3% of charts showed that preventative interventions corresponded to the Braden scale scores, even though 86% of nurses correctly answered the item about the Braden scale scores. Again, it would be valuable to explore why high risk residents do not have appropriate interventions added to the plan of care. If the documentation was accurate, this is a concerning finding. As well, because the chart review also showed that many risk assessments were not completed as per policy, then the actual number of high risk residents may be greater than the 8.1% found in this study.

If, however, more interventions had actually been incorporated in practice but not documented, then lack of documentation reveals another issue. Documentation is important for several reasons; it ensures communication of care to all team members so that such care is implemented consistently. As well, given that development of a Stage 2 or higher pressure injury is considered a reportable occurrence in Eastern Health, such documentation from a legal perspective would allow transparency and support or show if appropriate measures were taken to prevent a pressure injury. If documentation was accurate, then residents who were at high risk for the development of a pressure injury were receiving inadequate pressure injury preventative care, placing them at risk for the development of a pressure injury and any related complications such as infection. This consequence can also incur more costly measures related to dressings and amount of time required at the bedside to manage such wounds. The lack of documentation supporting appropriate interventions on the residents' charts is not a surprising finding based on knowledge deficits found related to pressure injuries and related policies.

If a resident has a total score of less than 12 and a subscore of less than 2 on any of the Braden Risk Assessment components under mobility or nutrition (high risk for total score and for each component), then the BSAOP states that consultation with an Occupational Therapist (OT) and Physiotherapist (PT), or a Registered Dietitian (RD) (respectively) is required. There were 40 residents' charts from the urban sites and 17 from the rural sites that showed a total high risk score and a high risk score under the mobility category of which only 12.3% (15.0% at urban sites and 5.9% at rural sites) resulted in a PT consult request while 24.6% (27% at urban sites and 17.7% at rural sites) had an OT consult request. There were 22 residents' charts from the urban sites and 12 from the rural sites that showed a total high risk score and a high risk score under the nutrition category of which only 11.8% (18.2% at urban sites and 0.0% at rural sites) resulted in a RD consult request. The regional discrepancy may suggest less accessibility to PTs, OTs, and RDs as these professionals also service the Acute Care Programs in the rural areas of Eastern Health. Regardless, however, this is a concerning finding if the documentation was accurate. Even though Gallant et al. (2010) did not specifically identify interdisciplinary consults as an intervention or assess regional differences, their chart audits also showed that the percentage of documented interventions corresponding to risks involving nutrition and activity/mobility were less than desired (50% and 19%, respectively). If the documentation was not accurate and more consultation actually occurred, then again, lack of documentation is an issue. For this study, though, even if documentation did not show a request for the appropriate consult, if there was a note on the chart by the respective professional related to skin integrity, then the consult was considered requested.

Consults for the appropriate disciplines contribute to a comprehensive plan of care ensuring that resident needs related to optimizing intake and mobility are addressed. Without the appropriate consults, then residents who were already at risk continue to be exposed to the identified issues, compounding an existing problem. For example a dietitian can review dietary needs and make recommendations to optimize intake, such as including protein powder with meals, which can mitigate risk for skin integrity issues. An Occupational Therapist can make recommendations for the appropriate equipment such as pressure relief cushions or mattresses. Again, this chart review may underestimate the number of residents with high risk mobility and nutrition scores because many risk assessments were not completed. Subsequently, it is difficult to know how many actually needed consults and whether or not the consults occurred. The lack of documentation supporting sufficient interventions and consults is also consistent with any knowledge findings from this study. If staff do not have enough knowledge about pressure injury prevention, management and the related policies, then it is not surprising that documentation does not support sufficient related practices.

Strengths and Limitations

There were notable strengths in this descriptive-exploratory study. It examined a highly relevant and important issue that had not been previously explored in Eastern Health Long Term Care. With an increasingly aging population in the province of Newfoundland and Labrador, residents in Long Term Care facilities are increasingly complex with multiple comorbidities and potentially at risk for the development of a pressure injury. Additionally, in light of recently implemented model of care that utilizes higher numbers of unregulated staff and fewer licensed nursing professionals, it is crucial that that all nursing team members are highly skilled and knowledgeable about pressure injuries. The level of pressure injury knowledge among all nursing team members (RNs, LPNs, and PCAs) had not been previously formally assessed nor was documentation of their related practices. Best practice guidelines about pressure injury prevention and management are available in the literature to guide practice and these guidelines are reflected in EH pressure injury related policies. It was not known, however, if the nursing teams in EHLTC were aware of or implemented the recommendations contained in the policies. However this study has provided valuable information to EHLTC about nursing team members' knowledge and practice while contributing to the current literature. Little had been published about actual practice but it is clear from this study that practices, including assessments and documentation, need to be addressed, not just knowledge.

This study used a sample of 120 participants with proportional representation of each group of nursing team members. Even though it was not a large sample, each day the Pressure Ulcer Knowledge Questionnaire was completed, many of the team members working on that day voluntarily participated. It is unknown if those who volunteered knew more or were more confident about the topic of pressure injuries. If so, the knowledge results obtained may have overestimated knowledge of non-participating staff. The participants completed a knowledge test that had previously been tested for validity and reliability adding to the strength of this study. Additionally, urban and rural sites were chosen to ensure regional representation of staff. All LTC nursing homes are part of the larger Eastern Health Authority and operate under the same policies and hiring practices, therefore, the results can be generalized to all LTC sites within EH. As well, the practice assessment component of this study included 269 retrospective chart reviews from all of EHLTC facilities ensuring the results were reflective of all urban and rural sites. Any regional differences found provide a richer baseline of information that can ensure future improvement strategies consider such factors.

Even though existing studies were available about pressure injury knowledge and the effects of education, they mainly examined registered nurses and to a lesser extent, licensed practical nurses. Few, however, have been conducted in Canada and as well, very few included unregulated workers, consequently, little could be generalized from the available literature to Eastern Health LTC. The results from this study have provided a specific baseline of nursing knowledge and documented practices that will contribute to future educational programs and overall improvement initiatives that can address any shortcomings. This study contributes to the body of existing similar literature by highlighting that there are different learning needs and issues for different groups of workers according to their skill sets and responsibilities and so may help guide similar studies elsewhere with comparable populations and settings. Additionally, the framework developed for this study can be used to guide further research and action that can be taken to ensure needs assessments and interventions are comprehensive and not limited to knowledge.

This study also had limitations. The small sample size may have reduced the power to detect all significant differences based on characteristics that were assessed such as experience and previous post-basic pressure injury education, although some trends were found to warrant further exploration. Even though there may have been limitations due to the sample size, the focus of this study was to explore and describe pressure injury knowledge not to test a hypothesis.

Even though some minor wording changes were made to Pieper's Pressure Ulcer Knowledge Test to reflect any regional differences, contextual factors could still have influenced the participants' interpretation of some of the items and terminology, for example, understanding the benefits or limitations of heel protectors versus heel boots. As well, evolving knowledge may make some of the items debatable, for example, limited evidence supports a turning schedule every two hours; it may not be appropriate for some depending on the individual or the pressure relief surface being used. Overall, however, the majority of the items on Pieper's Pressure Ulcer Knowledge Test are relevant today and globally.

Another limitation was the use of retrospective chart reviews. Any lack of documentation or inconsistencies may have provided a distorted view of actual practices. Actual observation of practices related to pressure injury prevention and management may have more accurately captured actual practices, however, this was not considered feasible given the number of LTC facilities included. As well, if participants were aware of any investigators observing their practices, this may have influenced their actions. . Even if documentation did not accurately reflect actual practice, the findings still provided valuable insight into compliance to the BSAOP. Comparing sites by pressure injury prevalence and incidence and knowledge levels may have also added valuable data to this study to determine if knowledge levels influenced outcomes

Another possible limitation was that the audit form was developed for the purposes of this study and was not assessed for validity and reliability. The author of this study, however, was familiar with all forms of documentation systems in Eastern Health LTC facilities and the expected required documentation related to pressure injury interventions and care plans. The audit form was refined to ensure that it elicited the information required to answer the relevant research questions.

Discussion Conclusion

In conclusion, pressure injury knowledge and related policy knowledge among the RNs, LPNs, and PCAs in Eastern Health LTC was less than desirable. Even though some aspects were well known, other aspects were poorly known. There were few consistencies in the findings to show there was any definitive influence on knowledge related to factors such as experience, region, and post-basic pressure injury education. Chart reviews revealed a lack of documentation to support that adequate interventions and consults were in place for many high risk residents. The participants however, did show an awareness of their learning needs by identifying topics that reflected any deficits found in the results from the knowledge test. They also strongly indicated that their preference of education delivery was through inservices at work even though this method can be challenging to implement, giving rise to further investigation into how to best balance staff preferences with employer limitations.

Chart documentation revealed that practices were less than desirable; however, this was not surprising. Given that knowledge about pressure injury prevention and any related policies was deficient, then it could be predicted that actual practice may also be less than optimal. The findings from this study were consistent with many previous similar studies that also reported knowledge and practice gaps related to pressure injuries. This study has added to the literature, highlighting the issues with application of policies as well as expanding our knowledge about knowledge gaps in different groups of nursing staff.

This study revealed concerning findings that have implications for residents at risk for pressure injury development. The logic model developed for this study provides a pathway to optimizing pressure injury prevention and management which begins with having appropriate policies to guide staff as well as adequate staff knowledge and assessment skills. Without this foundation, the pathway is disrupted. If knowledge about pressure injuries and related policies is poor, the next step of completing risk assessments may not be completed as needed, then the appropriate care plans may not be implemented and ultimately, the development of a preventable pressure injury may occur. The linkages in the logic model pathway are dependent on strong communication among the nursing team which is achieved by strong and accurate documentation. Chart reviews showed that there was insufficient care plan documentation in place to reflect the needs determined from risk assessments. This gap in documentation erodes communication along the pathway to optimal pressure injury prevention and management. Without documentation in a care plan indicating the required interventions or consults, the involved team members have little structured guidance in providing the appropriate consistent care.

Even though the focus of this study was on knowledge and practices, it is important to acknowledge here that for either to be optimal and for best practices to be implemented at the organizational level, sufficient human and financial resources are necessary (RNAO, 2016). This study did not explore whether or not human and financial resources affected knowledge levels or practices and these may have been influencing factors. Appropriate levels of knowledge may be only one of several factors influencing practices and outcomes. Having sufficient resources may play a role in positively impacting outcomes. As the RNAO pointed out, studies have shown that incidence of pressure ulcers has been shown to be lower where there are lower turnover rates in nursing assistants and low nurse-to-patient ratios (Backhaus, Verbeek, van Rossum, Capezuti, & Hamers, 2014; Liu, Lee, Chia, Chi, & Yin, 2012; RNAO, 2016; Sullivan & Schoelles, 2013; Trinkoff et al., 2013).

This study identified gaps in knowledge and practice. Results can be used to guide actions to address these issues. Recommendations concerning education, practice, administration, and research are discussed in Chapter 7.

Chapter 7: Recommendations and Conclusion

Chapter 7 summarizes the recommendations based on the results presented in Chapters 4 and 5 and the discussion presented in Chapter 6. Recommendations for education, practice, administration, and research are discussed.

Recommendations for Education

Staff education. The results from the Pressure Injury Knowledge Test demonstrated that participants' knowledge about pressure injury prevention, management, and related policies were less than desirable. Certain items on the Pressure Injury Knowledge Test consistently yielded a low response rate for all the participant groups (RNs, LPNwcs, LPNnowcs, and PCAs). Topics not well known included the correct frequency for repositioning for persons bedfast or chairfast. Staging ability was also less than desirable, especially in the recognition and understanding of Stage II and Suspected Deep Tissue Injury stages. Knowledge and awareness of pressure injury related policies was also deficient. In addition, documentation showed that care plan interventions and consults were insufficient to meet the needs of those at risk. Based on the results from this study, education should cover the main deficits while including content on documentation to ensure sufficient communication among the nursing team members.

Overall, the RNs, LPNs, and PCAs need to improve their knowledge about pressure injury prevention and management, pressure injury staging, and policies related to pressure injuries. This can be achieved through education and skills training. Varying methods to deliver education need to be utilized so that sufficient support is sustainable while impact on staffing and budgets are minimized. Additionally, it is recommended to facilitate learning in the workplace but at the same time encourage and support staff to be accountable for independent professional development. For example, RNs can meet their continuing competence requirements by attending inservices about pressure injuries and via independent learning such as reading peer reviewed journal articles on the subject.

To develop an educational strategy, the Clinical Nurse Specialist can coordinate with the Clinical Educators. Meetings should be at least annually to address any needed updates or newly identified needs. Feedback should be sought from frontline staff to seek out any identified learning needs. The Clinical Educators are assigned to multiple sites in the EH region and set up education at their respective sites. Educational needs can be met in several ways. Certain topics can be covered in orientation for all nursing levels while aligning with their scope of practice. Topics recommended to be covered in orientation are all three pressure injury related polices (BSAOP, PUPP, and WMP), skin care and products, wound care and dressings, incontinence care, and documentation. Education on policies should be comprehensive and use case studies. Since the start of this study, more Clinical Educators have been hired and in consultation with the Clinical Nurse Specialist these topics have been put in orientation.

Since orientation only targets new hires, strategies are also needed to educate existing staff. It is recommended to provide unit to unit brief inservices on topics such as policies, documentation, pressure injury staging, pressure injury prevention interventions (positioning, mattresses, chair cushions, nutrition, skin care), pressure injury treatment (dressings, ointment), incontinence care and products as well as ongoing education about skin care products. The inservices can target all members of the nursing team, however, where needed, any scope of practice implications should be included. It is recommended to keep the inservices brief so that there is minimal impact on staffing levels while facilitating Manager support for staff attendance. Short inservices involving focused topics can help avoid overwhelming staff with excessive amounts of information while facilitating learning. Inservices should also be interactive while reflecting principles of adult learning. Even though staff acknowledged their learning needs, when presented information, it should not be only facts, but it should be meaningful and have relevance to their practice environments so that the content is able to be applied to practice. Inservices were also identified as the preferred choice of educational delivery. The inservices can be provided by the Clinical Educators and they can arrange to bring in product educators for topics related to skin care, incontinence care, dressings, and equipment, when feasible. It is recommended to provide the inservices on each identified topic at least yearly.

It is also recommended to have education days at least once a year with time allotted for pressure injury prevention and management. Again, this should include content on positioning and recommended frequencies, nutrition, risk assessments, skin and incontinence care, and products. Other topics can be included according to frontline staff feedback. In addition to ensuring appropriate topics are covered, any provided education should involve staff, for example, by going through case studies helping them to problem solve and apply the information to practice.

Other options that are recommended to be explored are supplemental educational resources that can be available via independent learning, for example, online modules. Even though this was not a preferred educational delivery method, it is beneficial to have resources available to staff as needed or for periods in between inservices. There may also be staff who would prefer independent learning. Given that pressure injury prevention is an ROP, it is also recommended that basic pressure injury prevention, management and risk assessment training be considered mandatory. Again, online modules may be a practical non-intrusive method to facilitate any mandatory education. Online modules can include certificates of completion for tracking purposes.

Meeting educational needs enhances pressure injury knowledge, policy knowledge and assessment skills and therefore, consistent with the logic model with this study, promotes a pathway to optimizing pressure injury prevention and management. More recommendations follow with respect to the broader educational strategy.

Clinical Nurse Specialist. The Clinical Nurse Specialist is in the position to collaborate with the Clinical Educators concerning education recommendations while seeking support from LTC administration to implement educational strategies. The results from this study provided helpful information to determine pressure injury knowledge deficits for RNs, LPNs, and PCAs. The Clinical Nurse Specialist can use such results to develop content for education and skills training. The Clinical Nurse Specialist can inform stakeholders of the findings and seek support for education for the nursing team members. Support will be needed to deliver education via inservices, education days, in orientation, and through available technologies. Support can also be sought to promote development of mandatory online modules. Online modules can be completed during slow periods at work and require less in terms of human and fiscal resources than inservices which would be a practical consideration in times of fiscal constraint. Given the additional responsibilities such as wound consults in the region, it is challenging for the Clinical Nurse Specialist to independently provide all needed education to all the sites, therefore, collaboration with the regional Clinical Educators is vital to develop and deliver needed pressure injury education while exploring available educational technologies.

Clinical Educators. The results from this study hold implications for the LTC Clinical Educators. Knowledge and practice deficiencies about pressure injury prevention and management were identified for RNs, LPNs, and PCAs, strongly demonstrating the need for education and training in this area. Clinical Educators are in a strategic position to incorporate pressure injury content in the broad educational planning with site managers. Clinical Educators also regularly meet and discuss educational needs for their respective sites. They are able to collaborate with the Clinical Nurse Specialist on appropriate pressure injury content and bring feedback from the nursing staff. As a team, they are in a position to ensure a standardized approach for pressure injury education. They are also in a position to ensure that pressure injury content remains included in orientation for newly hired nursing staff. It is recommended that the clinical educators maintain up-to-date knowledge about best practice related to pressure injury prevention and management so that it is a topic that it routinely taught to all nursing team members. Clinical educators should be able to provide education in a style that moves beyond didactic teaching so that problem solving and practice application are emphasized in formal and informal education.

Needs assessment. In a recent publication by the RNAO (2016) regarding assessment and management of pressure injuries for the interprofessional team, it was recommended to assess health-care professionals' knowledge, attitudes, and skills concerning the assessment and management of pressure injuries before and after any educational interventions. The purpose of this study was not to complete a needs assessment, however, the findings suggest it would be beneficial to do one now. The findings show that knowledge gaps exist and that they differ by groups in the nursing team. For example, as discussed earlier, all groups did not know content related to positioning and repositioning frequencies, however, RNs had a statistically significant higher median score than the LPNwcs on Wound Description content. As well, PCAs strongly identified a need to know more about wound care. The demographic profiles also revealed that even though almost half of the LPNs and over 75% of the RNs received post-basic pressure injury education, only 20% of the PCAs did. Such findings indicate that each group may have some unique learning needs while the PCAs may need to be considered more often in education as they provide most of the direct resident care. Completing a needs assessment helps avoid making assumptions about learning needs and therefore, education can be more meaningful and beneficial. Addressing specific needs enhances the efficiency and effectiveness of an educational strategy. An educational strategy also should be delivered using adult principles of learning while considering staff preferences and available resources. The Clinical Nurse Specialist should work with the Clinical Educators and Resident Care Managers to conduct a needs assessment. A needs assessment can also be valuable in determining if any regional differences exist, for example, if resources such as educators or interdisciplinary team members are less accessible in the rural areas. Findings can be built into educational planning and brought to the attention of stakeholders.

Method of educational delivery. As discussed, education is recommended to be delivered through several strategies. It is important to consider several options to ensure educational needs are met. All types of education are not needed to be delivered at the same time. Orientation would be ongoing as Human Resources hire new staff. To target current staff, unit to unit inservices can be used for specific topics as mentioned in brief sessions and can be provided once a year. Education days can be provided yearly. Online modules can be used as supplemental resources for ongoing requests for anyone who missed inservices. Staff can be required to complete any mandatory online modules once every five years and this can be coordinated by Clinical Educators and Resident Care Managers. Mandatory education topics should minimally cover Braden Risk Assessment and skin assessments. Consideration should be given for development for a core competency program for RNs, LPNs, and PCAs. The NPUAP (2013) provided an RN Competency Based Curriculum for pressure injury prevention that includes competencies such as understanding pressure injury incidence and prevalence and choosing appropriate support surfaces. Educational technologies can be explored as methods to deliver any education, for example site specific requests from the Clinical Nurse Specialist or for updates on skin care products. Even though participants preferred inservices at work, to enhance efficiency of education delivery across a large region, with ongoing staff changeover, it would be worthwhile to explore independent learning modalities as well as educational technologies. It is also recommended to liaise with the regional formal education centres concerning pressure injury prevention content, such as Memorial University School of Nursing, the Centre for Nursing Studies, College of the North Atlantic, and Eastern College. Different methods of educational delivery are discussed in the next sections.

***Inservices at work*.** The participants clearly identified their learning needs and their preferred method of education delivery. The identified learning needs reflected their knowledge deficits demonstrating that their perceived knowledge gaps were accurate. Overall, the RNs, LPNs, and PCAs identified ‘inservices at work’ as their most preferred method of education delivery. Based on these results, it may be preferable to try to provide education to the nursing team members at work. Provision of inservices at work can be challenging for several reasons. Managerial support may be limited due to impact on staffing levels on the units and the possibility of incurring overtime. If the Clinical Nurse Specialist delivers the education, there are multiple sites, requiring considerable travel with multiple visits and additional workload. Reliance on inservices as the only form of education would be difficult to sustain from a logistical standpoint. However, this method can still be utilized as part of a broader strategy. Since completion of this study, changes have occurred that can facilitate providing inservices at work.

Business communication technology. Even though inservices are typically provided in person, technology is now available in Eastern Health LTC sites that can help overcome challenges of multiple visits to multiple sites. For example, since completion of this study, Skype Business is being installed on the computers of the Clinical Educators, all management, the Clinical Nurse Specialists, at the nursing stations, and in boardrooms of the LTC sites. This technology shows the presenter as well as the presentation and allows for real-time communication. This method of communication can facilitate delivery of education to large or small groups at multiple sites so the presenter does not have to travel to those sites at different times. Delivering education in this manner can improve efficiency while accommodating the participants' preference. Unfortunately, this method of education delivery may also impact staffing levels as participants would not be able to work while listening. However, inservices on the unit also require staff attention. Business communication technology can certainly provide an alternative to inservices offered in person when it is impractical for an educator or presenter to be present.

Orientation. Since completion of this study, two additional clinical educators have been hired and now all LTC educators have received wound care education. Prior to this study, pressure injury prevention content had not been included in nursing orientation. However, it was recommended that because pressure injury prevention is a required organizational practice by Accreditation Canada, the topic should be covered in nursing orientation. Since the completion of this study, pressure injury prevention is being taught during orientation and includes education about all related policies. RNs and LPNs now also receive education about wound care that includes the Braden Risk assessment, pressure injury prevention, staging, and management. It is recommended to continue this practice. The RNAO (2016) summarized evidence that suggests there is insufficient training at the undergraduate level so that nursing graduates are competent in care related to pressure injuries. Such findings reinforce the importance of including pressure injury content during orientation not only for newly hired RNs, but also for LPNs, and PCAs.

Education days. The Clinical Nurse Specialist needs to work closely with the Clinical Educators to develop an overall educational strategy that includes education days to be held at least once a year and include all members of the nursing team. The education days need to include pressure injury prevention and management content and skill training.

Online modules. It is suggested to work with the Learning and Development program to explore the option of developing online learning modules. Even though this delivery method was not identified as one of the top three choices by the participants, it may be worthwhile piloting this method. Completion of online modules can be tracked by managers. There is also flexibility in using online modules, for example, staff members can complete them at their own convenience. Tests can be built in to the modules and certificates of completion can be printed. It is suggested that pressure injury prevention and management as well as Braden Risk and skin assessment modules be mandatory to ensure all nursing staff complete them at least every five years. A five year timeline would allow for updates according to best practice guidelines and policy updates. The modules can be developed by the Clinical Nurse Specialist and the Clinical Educators.

Basic education programs for RNs, LPNs, and PCAs. Even though knowledge of students in nursing and PCA programs was not the focus of this study, it can be beneficial to explore current pressure injury related curriculum. If there are knowledge deficits present for practicing RNs, LPNs, and PCAs, this issue may in part be related to lack of knowledge already present upon entry to practice but determining this requires further investigation. To ensure graduates from the nursing schools and PCA programs are sufficiently knowledgeable at entry into their roles, it is recommended that they receive pressure injury prevention and management training in their respective formal programs. The Clinical Nurse Specialist can liaise with the schools to review the current pressure injury prevention content and make recommendations as needed. Content should reflect best practices and cover risk assessments, skin assessments, pressure injury staging, and preventative interventions and can be reviewed every five years.

Recommendations for Practice

The results from this study showed that documentation did not support sufficient completion of Braden Risk assessments and interventions and consults for those identified to be at risk for the development of a pressure injury. Several recommendations are included here to improve not only practices but also supporting documentation. Consistent with the logic model pathway to optimizing pressure injury prevention and management, risk assessments followed by appropriate care plans are integral to positive outcomes. Recommendations to improve practices related to pressure injury care include: 1) mechanisms to improve completion of risk assessments and corresponding care plans, 2) chart audits with feedback, and 3) surveillance of pressure injuries. These recommendations are discussed in the next sections.

Mechanisms to improve completion of risk assessments and corresponding care plans. As described in Chapter 5, the chart reviews showed that many Braden Risk Assessments tended to not be completed, especially the first four weekly reassessments. Of the risk assessments that were completed, many were not completed at the right times. As well, even though both RNs and LPNs can complete the Braden Risk Assessments, most were done by RNs. Since completion of this study, there is an initiative by EHLTC to implement the Meditech electronic documentation system in all sites and this is ongoing, therefore, it may be timely to work with the documentation team members, such as the Resident Assessment/Minimum Data Set Coordinators, to explore methods to build in reminders electronically for completion of the risk assessments. In the Meditech and Client Server electronic forms of documentation, to improve care plans that reflect the risk assessments, it would be beneficial to explore the option of having appropriate interventions and interdisciplinary consults automatically triggered that reflect the obtained Braden score. Currently, interventions are selected and then added to the plan of care after the Braden score is obtained. Having a standardized care plan automatically triggered by the Braden score that corresponds to the risk can ensure appropriate interventions are in place. Having a plan of care triggered automatically by the corresponding Braden score facilitates the RN or LPN establishing the appropriate set of standardized interventions while improving consistency. For sites where documentation is still in paper format versus electronic, it is recommended to have Resident Care Managers assign resident charts to both the RNs and LPNs for completion of risk assessments at the right times and to ensure appropriate care plans are in place. Triggered care plans based on risk can be developed as bundles, incorporating multiple interventions. The care plans can include interventions for skin care such as moisturizing, using barriers, daily skin inspections, and incontinence management while addressing mobility issues with a turning and repositioning schedule and appropriate support surfaces. Appropriate interdisciplinary consults should also be automatically included. Studies support bundling of interventions to be effective strategies to improve pressure injury prevention and management (Niederhauser et al., 2012; Sullivan & Schoelles, 2013). Chart assignment can occur on a night shift to allow for more time for chart reviews and assignment can occur weekly.

Chart audits with feedback. To ensure adherence to the Braden Scale Adults Only Policy and Pressure Injury Prevention Policy, it is recommended to complete chart audits at routine intervals, for example twice a year or quarterly. Chart audit forms need to be developed so that they elicit the desired information. The chart audit forms used for this study can be utilized but can be modified according any feedback about its usability. Representatives from management and the Quality and Safety leads can work with the Clinical Nurse Specialist to determine appropriate persons to complete chart audits; such persons may include resident care managers or clinical educators. Findings from the chart audits can be presented to frontline teams to determine improvement strategies and solicit their feedback for suggestions to improve on identified issues. Findings from chart audits should be presented with recommendations for improvement strategies and needed support. Chart audits are a mechanism for reviewing practices and documentation. Without chart audits, it is difficult to know for sure if risk assessments are being completed or completed on time or if care plans are sufficient for the identified risk. From a legal perspective, chart audits are a mechanism to ensure the practices are reflected in documentation, allowing for transparency in care. Chart auditing can be perceived as a top-down approach, therefore, it is suggested to present audit findings to frontline staff in a way so that they are not perceived as negative or punitive. Staff should also be given positive feedback and recognized for positive findings. Improvements and excellent practice should be identified and brought back to the frontline. Systematic reviews by Niederhauser et al. (2012) and Sullivan and Schoelles (2013) support a bottom-up approach such as involvement of frontline staff at all levels of improvement initiatives. Failure to include them and poor communication were identified as barriers to successful implementation of pressure injury prevention initiatives.

Surveillance. At present, in EHLTC sites, prevalence and incidence of pressure injuries staged 2 or higher are measured through quarterly reporting to CIHI. This practice is recommended to continue as it provides a source of outcome measures that are comparable by site and by province against national benchmarks. This data is monitored by the Clinical Nurse Specialist and LTC administration and can aid as a tool to determine if educational and practice improvement strategies are effective. As well, it is recommended to liaise with the Quality and Safety leads about occurrence reports received on Stage 2 or higher pressure injuries. Occurrence reports provide details concerning the stage of pressure injury as well as the site location. Concerning reports can be followed up with site managers for a plan to address any issues accordingly.

Recommendations for education and practice require organizational support. Discussion is needed with administration to ensure priority is given to the issue of pressure injury prevention and management. Without administrative support and appropriate funding, it is difficult to implement any recommendations and therefore optimize pressure injury prevention and management. Even if frontline staff are included in any improvement strategies, implementation and success in sustaining such strategies would be very limited and challenging without administrative and organizational support and commitment. Support may be needed in the form of fiscal and human resources. Recommendations for administration are discussed next.

Recommendations for Administration

From an administrative perspective, findings from this study highlight the need to support region wide staff education concerning pressure injuries. The recommended initiatives require some funding but some very concrete suggestions are offered here. Even though fiscal support is needed, it is an investment that can contribute to the prevention of pressure injuries which are very costly. Investing in technology that facilitates online learning modules through the Learning and Development program is amenable to a sustainable long term plan. Investing in educational technologies provides alternatives to inservices and its associated impacts on staffing levels. To support Accreditation Canada's ROP for pressure injury prevention, administration can endorse mandatory education which would be reasonably manageable via online modules. The knowledge and practice deficits found in this study also demonstrate the need for administrative support for inservices and education days incorporating pressure injury content and skills training.

Administrative support can also be sought for reviewing electronic documentation systems for methods that incorporate automatic care plans triggered by Braden Scale scores and built in reminders to complete the Braden Risk Assessment. Support would also be needed to ensure appropriate personnel are delegated and are given time to complete chart audits for compliance to pressure injury related policies.

Recommendations for Research

This study has formally assessed the pressure injury knowledge and practices of nursing staff in EHLTC for the first time. It contributes more to the body of literature examining not only pressure injury knowledge but also corresponding practices. Including the assessment of practices makes knowledge findings more meaningful. This study can serve as the foundation of future research. For example, a before and after controlled study can be conducted to determine the effectiveness of an educational interventions, using the Pressure Ulcer Knowledge Test developed for this study. As the

RNAO (2016) suggested, it is also important to assess the knowledge translation process. Evaluating how practices and outcomes have changed in short-term and long-term periods after any educational intervention at can be valuable in determining if newly acquired knowledge is applied to practice.

While few statistically significant results were found to show that characteristics such as region of work, amount of experience, or previous post-basic pressure injury education influence knowledge, perhaps a similar study with a larger sample may provide more insight. It would also be worthwhile exploring the attitudes of nursing staff about pressure injury prevention and factors they perceive to be barriers to or facilitators of pressure injury knowledge and practice. Barriers and facilitators may be at the individual or organizational level or may be related to environmental factors. Champions and leadership support have been identified as facilitators, while negative staff attitudes and organizational and system level change may be barriers. The application of knowledge into practice is considered behavioral knowledge use. Understanding behavioral knowledge use can be valuable in determining factors that influence the application of knowledge into practice and can be assessed by observation and interviews (RNAO, 2012). This study and previous similar studies have shown that knowledge and practice gaps have persisted over time revealing the complexity of the issue; more research is needed to explore why this problem continues and to examine effective strategies. Also, the majority of studies evaluating the effectiveness of interventions used weak designs, e.g., lack of control groups, and small samples, and focused primarily on knowledge outcomes. Stronger designs are needed that include large non-convenience samples, control groups, and measurable practice outcomes such as pressure injury incidence.

Dissemination of Findings

The purpose of this study was to explore pressure injury knowledge and practices among nursing team members in EHLTC. The results showed the both knowledge and documented practices were less than optimal. These findings, however, provide clear insight to help address any knowledge and practice gaps. EHLTC stakeholders need to be informed of these findings related an important practice issue that concerns the ROP of pressure injury prevention. The results from this study will be presented to LTC stakeholders. The study may also be of interest to other similar provincial health authorities. Larger audiences can be reached by local presentations, conferences, and by journal publications.

Conclusion

The logic model developed for the framework of this study demonstrates that optimal pressure injury prevention and management begins with not only appropriate policies and procedure but sufficient knowledge and assessment skills. That lack of knowledge and assessment skills concerning pressure injuries can potentially compromise pressure injury prevention and management. The participants indicated an awareness of their knowledge deficits as well as their desire for education. The findings from this study can be used to develop education strategies and to endeavor to improve knowledge about pressure injuries, equipping nursing teams to improve practices. Education and training about pressure injuries are critical for the contribution to quality of care for LTC residents. It may be beneficial to work with staff to explore their receptiveness for differing learning modalities to expand on practical methods of learning. As well, it would be beneficial to work with staff to determine their motivation for professional development so that they may avail of independent learning.

This study had provided important information about pressure injury knowledge and practices in EHLTC that was not previously known. It shows clearly that deficits exist for all groups of the nursing team. This study yielded specific information to guide educational development. It also revealed that documentation does not support optimal pressure injury prevention practices. The findings from this study indicate that education and training are needed and should be delivered via diversified modalities. This study highlighted where practice gaps exist and so recommendations need to go beyond education ensuring specific measures can be implemented to address gaps. Education and training are needed but so are strategies to ensure assessments are done appropriately, and correct actions are taken based on those assessments. Administrative support is crucial for any of these recommendations to be realized.

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Appendix A

Braden Scale for Predicting Pressure Sore Risk Braden Scale

Braden Scale – For Predicting Pressure Sore Risk

Source: Barbara Braden and Nancy Bergstrom, copyright 1988. Reprinted with permission.

Chart #:

High Risk: Total Score = Less than or equal to 12 **Moderate Risk:** Total Score 13 or 14
Low Risk: Total Score 15 or 16 if under 75 years old **OR** 15 to18 if over 75 years old

RISK FACTOR	SCORE/DESCRIPTION				Date of Assessment 1	2	3	4
Sensory Perception Ability to respond meaningfully to pressure related discomfort	**1. Completely Limited** Unresponsive (does not moan, flinch or grasp) to painful stimuli, due to diminished level of consciousness or sedation, **OR** Limited ability to feel pain over most of body surface	**2. Very Limited** Responds only to painful stimuli. Cannot com-municate discomfort except by moaning or restlessness, **OR** Has sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3.Slightly Impaired** Responds to verbal com-mands but cannot always communicate discomfort or need to be turned, **OR** Has some sensory impair-ment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No Impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain ordiscomfort.				
Moisture Degree to which skin is exposed to moisture	**1. Constantly moist** Skin is kept moist almost constantly by perspiration, urine etc. Dampness is detected every time patient is moved or turned.	**2. Often moist** Skin is often but not always moist. Linen must be changed at least once a shift.	**3.Occasionally moist** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely moist** Skin is usually dry; linen only requires changing at regular intervals.				
Activity Degree of physical activity	**1. Bedfast** Confined to bed	**2. Chairfast** Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair orwheelchair.	**3.Walks occasionally** Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks frequently** Walks outside the room at least twice a day and inside room at least once every 2 hours during wakinghours.				
Mobility Ability to change and control body position	**1.Completely immobile** Does not make even slight changes in body or extremity position without assistance.	**2. Very limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly limited** Makes frequent though slight changes in body or extremity position independently.	**4. No limitations** Makes major and frequent changes in position without assistance.				
Nutrition Usual food intake pattern [1] NPO: nothing by mouth [2] IV: Intravenously [3] TPN: Total parenteral nutrition	**1. Very poor** Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, **OR** is NPO [1] and/or maintained on clear liquids or IV [2] for more than 5 days	**2. Probably inadequate** Rarely east a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement **OR** receives less than optimum amount of liquid diet or tube feeding	**3. Adequate** Eats over ½ of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered, **OR** is on a tube feeding or TPN [3] regimen, which probably meets most of nutritional needs	**4. Excellent** Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
Friction and Shear	**1. Problem** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	**2. Potential problem** Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3.No apparent problem** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.					
TOTAL SCORE	**Total score of 12 or less represents HIGH RISK**							

Assess-ment	Date	Signature/Status	Assess-ment	Date	Signature/Status
1			3		
2			4		

Complete Braden Scale on **ALL** adult inpatients within 12-24 hours of admission or transfer to another unit.
Exclusions: Psychiatric short stay and Obstetrical patients.

Frequency after admission: Medical/Surgical areas: Mon-Wed-Fri Critical Care areas: daily
Long Term Care/Mental Health Program: weekly for 1 month and then monthly

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Appendix B

Skills Mix Model of Care: Responsibilities and Structure

RNs

Proportion**:** 14-20%

Responsibilities: RN is in charge and responsible for resident care and staff supervision

- Coordinator of care
- Care planning
- Assessment
- Planning
- Implementation
- Evaluation
- Documentation
- Care and management of unstable residents
- Advanced foot care
- Physician rounds
- Admission screening
- Resident care meetings
- Team conferences
- Resident assignment
- Venipuncture
- Intravenous therapy
- Safe medication practice
- Other duties

LPNs

Proportion: 40-53%

Responsibilities: Practitioner and leader

- Health assessment
- Medication administration
- Catheterization, colostomy care, wound care, tube feedings, oxygen therapy/suction, foot care
- Provide resident care related to activities of daily living
- Direct resident care such as glucose checks, vital signs, weights

- Documentation
- Safe medication practice
- Appointments (shared with ward clerk)

PCAs

Proportion: 33-40%

Responsibilities: Provide resident care

- Activities of daily living
- Basic nail and foot care
- Vital signs
- Colostomy care
- Weights
- Documentation
- Escort duty
- Other related duties

Appendix C

Staging Definitions

Stage 1 pressure injuries are observed as an area of intact skin non- blanchable erythema of intact skin that may present differently on darker skin. Blanchable erythema or changes in temperature, firmness or sensation may precede the non-blanchable erythema. (NPUAP, 2016).

Stage 2 pressure injuries are defined as partial thickness skin loss of the dermis. They may present as a shallow open area containing a red or pink wound bed without any slough, eschar, or granulation tissue. Stage 2 pressure injuries may alternatively be observed as an intact or open serum-filled blister. Adversed microclimate and shear over the pelvis and the heel may be the cause. Stage 2 is not used to describe non pressure injury related wounds such as skin tears, tape burns, or excoriation (NPUAP, 2016).

Stage 3 pressure injuries involve full thickness skin loss. It may be possible to see subcutaneous tissue and adipose tissue, however, bone, tendon, or muscle are not exposed. Granulation tissue and epibole may often be seen. Tunneling and undermining may be present as well as slough and/or eschar. The presence of slough does not obscure the depth of the pressure injury (NPUAP, 2016).

Stage 4 pressure injuries involve full thickness tissue loss. Bone, tendon, ligament, cartilage, or muscle is exposed or palpable. Portions of the wound bed may be covered in slough or necrotic tissue. Epibole, undermining and tunneling are frequently present (NPUAP, 2016).

D**eep tissue injury: persistent non-blanchable deep, red, maroon or purple discolouration,** is characterized by a localized intact area that is purple or maroon in colour or may be a blood filled blister as a result of intense and/or prolonged pressure and shear forces at the bone-muscle interface. Pain and temperature change may be present before the skin colour changes are present. Discolouration may present differently in dark skin (NPUAP, 2016)

Unstageable Pressure Injury: If the presence of slough or eschar covers the wound bed of a full thickness pressure injury, then it cannot be accurately staged and is termed **unstageable.** Dry, adherent, stable eschar (without erythema or fluctuance) on a heel or an ischemic limb should not be removed (NPUAP, 2016).

Appendix D

Literature Summary Table:

Studies Examining Pressure Injury Knowledge

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
Aydin & Karadağ, 2010	Design: Descriptive cross-sectional survey Sample: Nurses of varying levels of educational preparation (*n*=237) • Licensed practical nursing (*n*=83) • Associate degree (*n*=58) • Bachelor's degree (*n*=93) • Master of science in nursing (*n*=3) Setting: Three hospitals within the borders of Ankara, Turkey Objective: To assess knowledge levels and practices related to prevention and management of deep tissue injury and stage I pressure injuries Participants completed a	Mean scores (range) (maximum possible score =100 points): • Licensed practical nurses: 45.98 (20.83 to 70.84) • Associate degree nurses: 48.13 (20.83 to 75.00) • Bachelor's and Master's degree: 51.77 (25.00 to 75.00) Nurses with more education had higher scores, statistically significant relationship between mean scores and level of nursing education ($p<.004$) Nurses with experience with patients who had a pressure injury had higher scores than those who did not have this clinical experience (not statistically significant)	Study design[b]: weak Study quality[c]: medium Strengths: The questionnaires were completed on-site in the presence of the investigator to prevent contamination of results that may have occurred with interaction among participants. Sample size was large with 87.1% response rate from the target population. The instrument was reviewed by two experts, piloted, revised, reviewed by another expert, and then piloted again. Limitations:

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
	questionnaire comprised of two sections: a) demographics and b) 8 case studies, each with 3 multiple choice questions	Nurses who had training about deep tissue injury and stage I pressure injuries scored higher than those without the training (not statistically significant) The item about identifying a stage I pressure injury was answered correctly by the majority of participants The correct response rate to the item about identifying a deep tissue injury stage was low Items with the lowest correct response rate were about avoiding massage of areas with tissue injury and offloading heels of immobile patients.	Convenience, non-randomized sample. Generalizability limited to nurses in the study setting. Comment: The nurse participants worked in areas with patients at risk for pressure injuries but knowledge about deep tissue injury and stage I pressure injuries was less than desirable.
Ayello, Baranoski, & Salati, 2005	Design: Descriptive cross-sectional survey Sample: Nurses of varying levels of educational preparation (*n*=692) • BSN/BS (*n*=254) • Associate degree (*n*=125) • LPN/LVN (*n*=95) • RN diploma (*n*=87) • MSN/MS (*n*=80) • Student nurses (*n*=14)	10 true/false knowledge items: • Average of 87% of responses to 9 out of 10 items were consistent with best practice recommendations • On one item: 56% of responses were incorrect about the purpose of the Braden Risk Assessment tool (48% of acute care nurses; 37% of long-term/subacute nurses)	Study design: Weak Study quality: Low Strengths: Large sample from several work settings and areas within 9 countries. Limitations: It is not clear how data were

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
	• Doctorate (*n*=2) Setting: Various work settings from 48 states, 5 Canadian provinces, and 7 other countries • Hospital (>61%) • Long term or subacute care facility (20%) • Home health or community care (10%) Objective: To determine nurses' knowledge and practices related to the care and prevention of wounds and whether best practice wound care interventions are implemented Participants completed a 23 item survey about wound care knowledge and practices. • 10 true/false knowledge items • 5 self-assessment items • 6 policy/setting practice items • 2 regulation items	6 policy/setting practice items: • On 4 out of 5 best practice items, over 65% were aware of setting practices/policies that were consistent with best practice • On 1 out of 5 best practice items, only 35% knew the best practice gold standard for obtaining a wound culture specimen Minor surgical debridement regulation: • 29% of respondents did not know the regulation in scope of practice regarding minor surgical debridement in their state Overall nurses demonstrated a good knowledge of wound care and practices. Knowledge increased with age and years of experience. Younger, less experienced nurses need more education about wound care. Only 20% of long-term /subacute care nurses felt they had enough wound care	collected and how each participant's responses may have been influenced. No information was provided about whether or not the survey items were reviewed by experts, piloted or tested for validity and reliability. Comment: The responses to some items are compared to best practice recommendations revealing any gaps or strengths.

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
		education from the basic nursing programs. Nurses in long term /subacute care settings were less likely to complete daily skin assessments (number and percentage not provided).	
Chianca et al., 2010	Design: Descriptive cross-sectional survey Sample: Baccalaureate Nurses (*n*=106) Setting: all units in a university hospital, Belo Horizonte, Minas Gerais, Brazil Objective: To evaluate Brazilian nurses' knowledge of pressure injury prevention, assessment, and staging. Participants completed an adapted Portuguese version of Pieper's Pressure Injury Knowledge Test; comprising 41 true/false/don't know items (8 assessment & staging items and 33 risk and prevention items).	Total mean score (SD), out of 41: 26.07 (4.93) • Risk and prevention (33 items): 21.5 (3.97) • Assessment and staging (8 items):4.59 (1.62) Only14 (42.4%) of all items were correctly answered by >90% of the participants. Examples of items with the lowest percentage of correct items were about the frequency of repositioning when in a chair for those that can shift weight (8.49%) and those who cannot (21.69%), repositioning frequency when in bed (17.92%), massage of bony prominences	Study design: weak Study quality: medium Strengths: Even though a convenience sample was used, 75% of the targeted population participated. The adapted version of Pieper's Pressure Injury Knowledge Test was tested for content validity. The coefficient alpha for the total score of all nurses was .83. Participants completed the test in the presence of a researcher or research assistant, minimizing opportunities for discussion or

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
		((30.18%), the definition of Stage II (33.96%), and donut devices (36.79%). More experienced nurses scored significantly lower than less experienced nurses (*p*=.033).	research of the answers. Limitations: The use of a small convenience sample limits generalizability beyond the study setting. Comments: Knowledge does not necessarily reflect practices; assessment of other factors such as prevalence, incidence, practice skills, and chart audits can help determine if there are knowledge to practice gaps. Overall, the results in this study showed less than desirable knowledge about pressure injuries.
Gallant et al., 2010	Design: Descriptive correlational study Sample: Nurses (*n*=256) Patients (chart audits) (*n*=235) Setting: university hospital centre (cardiology, surgery, haematology, medicine, nephrology, orthopaedics,	Nurses' mean score out of 45: 33.98 *SD and range not reported Mean scores (SD) on knowledge test by hospital unit: • Cardiology: 33.7 (3.1) • Surgery: 33.7 (3.2) • Haematology: 32.7 (3.2)	Study design: weak Study quality: medium Strengths: Despite use of a convenience sample for the knowledge test, there was a 41% response rate

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	and intensive care) in Quebec, Canada Objective: to explore if there was a relationship between nurses' knowledge about pressure injuries, nurses' characteristics, and their preventative practices. Nurse participants completed an adapted version of Pieper's Pressure Injury Knowledge Test comprised of 45 yes/no/don't know items. 256 patient charts were randomly selected for auditing of the following: 1) Was the Braden Scale Risk Assessment completed within 24 hours of admission as per hospital protocol? 2) Was there follow up according to the risk assessment score? 3) Were practices applied as per the risk factors identified by the Braden scale?	• Medicine & nephrology: 35.4 (2.7) • Orthopaedics: 32.7 (3.1) • Intensive care: 33.6 (3.4) Nurses who worked on medicine and nephrology scored significantly higher than those working on the other units (p=.0011). For nurses who had previous continuous education related to pressure injuries (session >7 hours, one hour session provided by the university hospital, or other training), only the training session >7 hours was significantly related to higher mean scores (p=.0037). *breakdown of each mean score not provided Nurses who perceived their level of pressure injury knowledge as 'sufficient and more' score significantly higher than those who answered 'clearly insufficient' or 'insufficient' (p<.0001). Pressure injury prevention practices that were carried out by nurses' as determined from chart audits were	from eligible participants. Over 30% of targeted admitted patients had charts audited and these were randomly selected. The selected charts were from the units where the nurse participants worked. The knowledge test was previously tested for validity and reliability. Limitations: It was not reported if the participants were monitored by anyone when completing the test, so it is not known if they were able to discuss or research their answers. If documentation was poor, chart documentation of practices may not reflect what actually occurs in practice, therefore, chart audit results may not be accurate. Statistical differences between

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		compared to the correct response rate to the test question concerning the specific practice. Knowledge was greater than the corresponding action in practice, revealing a gap between knowledge and practice. Tests for significant differences were not performed. Examples included: • 94% correct response rate to the item about completion of the initial risk assessment versus 24% of completion in practice • 86% correct response rate to the item about the Braden risk score interpretation versus 1% of corresponding interventions in practice • 84% correct response rate to the item about use of therapeutic surfaces versus 57% corresponding interventions in practice	knowledge scores and the corresponding practices were not assessed. Comments: If documentation was accurate, the chart audits provided additional valuable information to determine if knowledge was reflected in documented practices. For this study, even though knowledge concerning certain preventative measures was strong, the corresponding documented practices were weak suggesting a gap between knowledge and practice. Additional research to explore other factors that negatively impact the translation of knowledge into practice would be beneficial.

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
Gunningberg et al., 2013	Design: Descriptive comparative study Sample: Registered nurses (*n*=196) Assistant nurses (*n*=97) Student nurses (*n*=122) Total (*n*=415) Setting: surgical, orthopaedic, medical, and surgical units from three hospitals in Sweden Objective: to describe and compare pressure injury prevention knowledge of Swedish RNs, Assistant Nurses (ANs), and student nurses (SNs) and to explore related practices. Participants completed a two part Pressure Injury Knowledge Assessment Tool (PUKAT) comprised of: 1) 26 multiple choice themed questions • 6 aetiology and development	Mean Scores (SD) Total: • RNs: 59.3% (11.9) • ANs: 55.4% (12.7) • SNs: 61.0% (11.8) RN versus AN (p=.028); SN versus AN (p=.002) Total mean scores were below or borderline with score (≥60%) set to indicate sufficient knowledge. Aetiology themed items: • RNs: 64.4% (20.9) • ANs: 55.7% (18.8) • SNs: 66.4% (20.9) RN versus AN (p=.002); SN versus AN (p<.001) Nutrition themed items (highest scores): • RNs: 81.1% (39.2) • ANs: 76.3% (42.8) • SNs: 91.8% (27.5) SN versus AN (p=.007); SN versus RN (p=.039)	Study design: weak Study quality: medium Strengths: The investigators used the PUKAT which had previously established psychometric properties in Belgium and the Netherlands (Cronbach's alpha =0.77). A convenience sample was used, however the response rate was 72%. Limitations: Even though participants were instructed to complete the test individually and not to use reference materials, the participants were not monitored, therefore it is not known if they obliged the instruction. Use of a convenience sample from Swedish hospitals limits generalizability beyond these

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	items • 5 classification and observation items • 2 risk assessment items • 1 nutrition item • 12 pressure and shearing items A mean score of ≥60% indicated satisfactory knowledge. 2) Five multiple choice questions about pressure injury behaviors in practice (for RNs and ANs).	Lowest scores on 'Reduction in the amount of pressure and shear' themed items (no significant difference between groups): • RNs: 47.6% (17.6) • ANs: 45.8% (18.0) • SNs: 48.8% (18.3) Self-reported behaviors: • RNs (13.8%) and ANs (8.2%) reported that they often could not mobilize patients as necessary • Approximately 20% of RNs and ANs reported their patients did not need pressure reducing mattresses • RNs (7%) and ANs (4-6%) reported that they often could not provide pressure reducing mattresses or cushions for patients at risk There were no significant differences between RNs and ANs in percentages of self-reported behaviors.	settings. The authors reported that some participants found response options difficult to understand and suggested it may have been related to differences in contexts (Belgium and the Netherlands vs Sweden). Comments: The investigators did not analyse data by obtained demographic characteristics, i.e., previous wound care education, work experience, hospital unit, for any relationship with test scores. Further research to explore factors that may have influenced higher scores for nursing students may be valuable, e.g., recent exposure to up-to-date education.

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
Miyazaki, Caliri, & dos Santos, 2010	Design: Descriptive, cross sectional survey Sample: Varying levels of nursing team members (*n*= 386) • Nursing auxiliaries/technicians (*n*=250) • Baccalaureate nurses (*n*= 136) Setting: university hospital (inner city tertiary hospital in São Paulo State, Brazil) Objective: to describe and analyze knowledge of nursing team members about pressure injury assessment, classification, and prevention. Participants completed a modified, adapted Brazilian version Pieper's Pressure Injury Knowledge Test consisting of 41 true/false items (8 pressure injury assessment and classification items, 33 prevention items). A score of 90% was expected to demonstrate sufficient knowledge.	Mean score(SD): • nursing auxiliaries/technicians: 73.6% (9.8) • Baccalaureate nurses: 79.4% (8.3) Statistically significant difference between groups ($p < .05$) Nursing auxiliaries/technicians' percentage of correct answers decreased with time since professional education and with time working in hospital ($p < .009$), but there was no correlation found for baccalaureate nurses. Examples of items with the lowest percentage of correct responses for both groups were about donut devices (35.2%), use of massage (39.6%), head of bed positioning (27.7%), chair repositioning frequency (28%), and side lying positioning (37.3%). Examples of items with the highest percentage of correct responses for both groups were about effects of education (98.7%), keeping skin clean and dry (98.2%), risk for chair and bed bound	Study design: weak Study quality: low Strengths: The majority of the target population participated. The original and adapted versions of Pieper's Pressure Injury Knowledge Test were previously tested for validity and reliability. Appropriate statistics were used for analyses. Limitations: Use of a convenience sample from one hospital limits generalizability beyond that group and setting. Participants were given a copy of the test to complete individually so they may have discussed or researched the answers.

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
		patients (98.7%), macerated skin (93.3%), and bony prominences (94.6%). Overall mean scores for both groups demonstrated less than desirable knowledge about pressure injuries.	Comment: Other factors were not assessed to determine if practices reflected knowledge scores, i.e., pressure injury prevalence and incidence, chart audits, observation of practices. The knowledge test scores were consistent with results from similar previous studies including. Testing nursing auxiliaries/technicians' pressure injury knowledge is valuable information to add to the existing literature given their breadth of direct day to day care of the patients.
Pieper & Mott, 1995	Design: Cross-sectional survey Sample:Registered nurses of varying levels of education (*n*=228) • Diploma: (*n*=24) • Associate degree: (*n*=103) • Baccalaureate degree: (*n*=93)	Total mean score (SD): 71.7% (4.5) Subscores: mean (SD) • Risk and prevention: 70.6% (3.2) • Pressure injury staging: 78.6% (1.1) • Wound description: 70% (1.5)	Study design: weak Study quality: low Strengths: Content validity was established by four enterostomal therapy

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
	• Masters' degree: (*n=8)* Settings: acute and critical care units fromone urban teaching hospital and one suburban community hospital, US Objective: to examine nurses' knowledge about pressure injury risk and prevention, staging, and wound description. Nurses completed the Pressure Injury Knowledge Test (47 item true/false/don't know) comprised of three categories: 1) risk and prevention, 2) pressure injury staging, and 3) wound description.	17 items were answered correctly by 90% or more of the nurses Nurses who attended a lecture on pressure injuries within last year had significantly higher scores than those who had not (p= .03) None of the test scores were significantly correlated with years of nursing employment or nurses' age or educational level. Examples of items with the lowest percentages of correct responses were about frequency of shifting weight in a chair (4%), repositioning frequency in a chair (19%), massage of bony prominences (25%), donut devices (35%), Stage II definition (38%), and Braden risk score interpretation (44%). Examples of items with the highest percentages of correct responses were about heel blisters (97%), Stage IV definition (96%), skin is the largest organ (94%), and blanching of the skin (94%).	nurses Limitations: A non-random convenience sample was use, limiting generalizability to the setting. It is not clear if an investigator was present when participants completed to test, therefore, they may have discussed or researched their answers. Pressure injury knowledge was not compared with pressure injury outcomes (incidence, prevalence) Pressure injury knowledge test was newly developed with a focus on risk and prevention of pressure injuries versus pressure injury staging and wound description. It may be beneficial to modify the test using more content about wounds and staging.

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
Pieper & Mattern, 1997	Design: Cross-sectional survey Sample: critical care nurses (*n*=75) drawn from a larger study sample (Pieper & Mott, 1995) Settings: two acute care teaching hospitals(urban and suburban), US Objective: to assess levels of critical care nurses' knowledge about pressure injury prevention, staging and description. Participants completed the Pieper's Pressure Injury Knowledge Test (47 item true/false/don't know test) comprised of three categories: 1) risk and prevention, 2) pressure injury staging, and 3) wound description.	Total mean score (SD): 71.3% (4.5) Subscores: mean (SD) • Risk and prevention: 71% (3.1) • Pressure injury staging:75.7 (1.2) • Wound description: 68.6% (1.5) The scores indicated less than desirable knowledge about pressure injuries. None of the scores differed significantly by level of nursing education, years of nursing experience, or by reading the Agency for Health Care Policy and Research guidelines about pressure injury prevention Scores were not affected by time since last reading an article about pressure injuries Participants who listened to a lecture about pressure injuries within a year had significantly higher wound subscores (p=.03). Those who listened to a lecture on pressure injuries four or more years ago had the lowest scores (statistical	Study design: weak Study quality: low Strengths: Validity of Pieper's Pressure Injury Knowledge Test was previously established. Reliability was established during data analysis. The coefficient alpha values for the critical care nurses were: • Total score: .91 • Risk and prevention: .88 • Staging: .62 • Wound description: .73 Limitations: A small non-random convenience sample was used, limiting any generalizability beyond this study. Participants weren't monitored when completing the test; therefore they may have discussed or researched their

Author/Date	Methods and Sample/ Location	Key Results	Comments Strengths/Limitations[a]
		significance not reported). Examples of items with the lowest percentages of correct responses were about: massage of bony prominences (25%), donut devices (29%), Stage III definition (32%), interpretation of the Braden score (48%), eschar (49%), head of the bed positioning (51%), and side lying position (51%). Examples of items with the highest percentages of correct responses were about: heel blisters (99%), Stage IV definition (95%), skin is the largest organ (93%), blanching definition (92%).	answers. Other factors were not assessed to determine if practices reflect knowledge, i.e., pressure injury prevalence and incidence, documentation, and observed practices.

Note. [a]Strengths/Limitations=study quality and design critically appraised as per Public Health Agency of Canada's Infection Prevention and Control Guidelines Critical Appraisal Tool Kit (2014). [b]Study design= rated as either strong, moderate, or weak; descriptive designs such as uncontrolled before and after or cross-sectional are rated as weak designs. [c]Study quality= rated as either high, medium, or low according to established criteria used to assess research question clarity and relevance, sample selection, data collection sources and methods, data collection instruments, ethics, and statistics.

Appendix E

Literature Summary Table:

Studies Examining the Effects of Pressure Injury Education

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
Altun & Zencirci, 2011	Design: Uncontrolled before and after descriptive study Sample: Hospital nurses (*n*=28) Setting: Ankara, Turkey private hospital (general surgery; orthopedics; ear, nose, and throat; urology; and spinal surgery) Objective: to determine if participation in an interactive lecture-based workshop about management of pressure injuries led to improved knowledge Participants completed a 21 item multiple-choice test before and after the workshop	Mean Score (out of 21) (SD) Pre Workshop: 11.1 (2.1) Post Workshop: 14.6 (0.9) Statistically significant mean score improvement from pre to post workshop (p<.001)	Study design: weak Study quality: medium Strengths: Participants did not know that they would complete the multiple choice test before and after the workshop, therefore, opportunities for participants to discuss or research test answers were minimized. Even though the sample was small, they represented 60% of the targeted population. Limitations: Generalizability limited to the study setting. Details are not provided about

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
			test content validity, data collection, or ethics. Details about the workshop content were not provided. The sample was small, convenient, and self-selected and may not have represented the target population. Knowledge retention was only tested immediately after the workshop with no further follow up testing to determine if knowledge improvement was sustained over time. Comment: Knowledge about pressure injury management improved after an educational workshop, with a statistically significant difference in mean pre and post test scores,

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
Briggs, 2006	Design: Uncontrolled before and after descriptive study Sample: Registered Nurses (*n*=52) Setting: Adult nursing clinical settings (medical wards, surgical wards, care of elderly, community, oncology, intensive treatment units), United Kingdom Objective: To determine the effect of an educational intervention on the level of pressure injury staging accuracy by RNs. Before and after completion of the European Pressure Injury Advisory Panel education program, RNs were tested on their pressure injury staging skill. They were pressure injuries shown 20 photographs of differing stages and incontinence lesions to identify.	Score Range out of 20 Pretest/Posttest: (Percentage of participants) Score Range 16-20 • Pre: 1.9%; Post: 7.7% Score Range 11-15 • Pre: 15.3% ; Post: 55.7% Score Range 6-10 • Pre: 44.2%; Post: 34.6% Results suggest that despite improvement from pretest to posttest, overall pressure injury staging ability was less than desirable. Only 25% of the participants had received any prior training or education regarding pressure injuries since their formal nursing education program.	Study design: weak Study quality: low Strengths: The instrument used to test staging ability was developed for the European Pressure Injury Advisory Panel and been validated by experts and clinicians with a high degree of inter-rater reliability. The posttest item order was changed from the pretest order, which may have decreased participants memorizing the test. Response rate of 41% was achieved. Limitations: No statistical analyses were conducted to determine if there were any statistically significant differences between pre and posttest scores or if there were

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
			any associations with participant demographic variables, e.g., age, experience. However, sample size may have been insufficient for statistical significance to be detected. A small convenience sample was used, limiting generalizability. The author does not report whether or not the investigator was present when participants completed the tests, thus other influences on improvements in scores could not be eliminated, e.g., discussing responses. No control group was used for comparison purposes. The author does not provide item by item responses, therefore, it is not known if participants recognized some stages of pressure injuries better

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
			than others. Comment: The author selected participants from settings where pressure injury assessments were part of their daily work. The findings from this study suggest that their staging in practice may be inaccurate.
Forseth, 2010	Design: Uncontrolled before and after descriptive study Sample: Registered Nurses (*n*=3) Licensed Practical Nurses (*n*=4) Setting: A rural 10-bed community critical-access hospital, Montana, US Objective: To examine nurses' pressure injury knowledge before and after an educational intervention. Before and after the educational intervention, participants completed Pieper's Pressure Injury Knowledge	Mean Score (out of 100) (Range) LPNs: • Pre education: 79 (72 to 89) • Post education: 86.5 (76 to 98) RNs: • Pre education: 83 (81 to 85) • Post education: 87.7 (85 to 91) The mean score improved, however, it was not statistically significant. No statistical significance was found in	Study design: weak Study quality: low Strengths: The instrument used to test knowledge (Pieper's Pressure Injury Knowledge Test) was previously tested for validity and reliability. Limitations: Small convenience sample used, limiting generalizability. Statistical significance in

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
	Test, containing 46 true/false/don't know items.	the following differences: Nurses with >20 years of experience scored lower (79) on the pretest than those with <20 years of experience (82). Nurses who knew about Clinical Guidelines for management of pressure injury management scored lower (79) on the pretest than those who didn't (83). Nurses who read an article about pressure injuries in the last year scored higher (81.5) on the pretest than those who did not (76). RNs scored higher than LPNs pre and posttest (83 vs. 79 and 88 vs. 86.5, respectively). On the pretest, the lowest correct response rates were to the items about shifting weight every 15 minutes for chairbound persons, heel protectors, repositioning every two hours when in bed, Stage II definition, and the correct elevation level for the head of the bed.	differences couldn't be determined because sample size was too small. It's not clear if the investigator was present at the time the participants completed the pre and posttest, therefore, their responses on the test may have been influenced by discussion or an opportunity to research the answers. No further follow up testing was done to determine if any effectiveness of education was sustained. No control group was used for comparison purposes. Details were not provided regarding how participants scored on each item or subcategory.

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
			Comment: Even though no statistical significance could be determined, scores were higher if participants had recent exposure to pressure injury information.
Kwong, 2011	Study Design: Uncontrolled before and after descriptive study Sample: Non-licensed care providers (*n*=41) Nurses (*n*=11) Setting: a Hong Kong nursing home Objective: To evaluate a pressure injury prevention program, its feasibility for implementation, and its impact on staff knowledge and skills, and pressure injury occurrence. After training, the program was implemented for 12 weeks. Participants completed a modified	Knowledge Scores: Mean (SD) (out of 30) • T0: 21.05 (2.66) • T1: 25.46 (1.95) • T 2: 23.59 (2.78) Mean scores increased significantly from pre-training (T0) to immediately after (T1) and from T0 to 6 weeks later (T2) (p<.001). The mean scores then decreased significantly from T1 to T2 (p<.001). Skills scores: Mean (SD) • T0: 17.0 (4.47) • T1: 21.26 (3.57) • T2: 22.06 (2.46)	Study design: weak Study quality: medium Strengths: The authors modified the Pieper's Pressure Injury Knowledge Test by translating it to Chinese. Content was validated by three wound care specialists (CVI=0.92). Cronbach's alpha was 0.91 for internal consistency. The skills test was developed by the author and validated by three geriatric care nurses (CVI=0.93) and internal consistency was

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
	version of Pieper's Pressure Injury Knowledge Test consisting of a 30 true/false items before the training (T0), immediately after (T1) and again six weeks later (T2). A skills checklist was used to assess pressure injury interventions (turning, positioning, transfers and lifting skills). Observation of skills occurred prior to the program and again six weeks later. Pressure injury prevalence and incidence were measured using forms that included data about the number, location, and stage of pressure injuries. Prevalence was recorded by two nurses one day before the program training, one day before the implementation of the program protocol, at the sixth week, and again at the end of the program implementation. During the program implementation	Mean skills scores increased significantly from T0 to T1 and from T0 to T2 (*p*<.001). Pressure injury prevalence: • Start of training: 9% • Start of protocol implementation: 4% • 6 week post implementation: 3.3% • 12 week post implementation: 2.5% Pressure injury incidence: • From start of training to start of protocol implementation (6 weeks): 2.5% • From the start of protocol implementation to 6 weeks later: (2.4%) • From 6 weeks post protocol implementation to end of protocol: (0.8%) Focus group findings: • Improved motivation of non-licensed care provides to prevent pressure injuries	demonstrated (Cronbach's alpha =0.84). Interrater agreement between two research assistants was 95%. Inter-rater reliability of pressure injury staging on the prevalence and incidence forms yielded agreement rates of 100%. Research assistants received training on the instruments and were present for all data collection. Even though the sample size was small, over 90% of the targeted population participated. Limitations: A small convenience sample limits generalizability to the study setting. No control group was used. No details were provided about the results on the knowledge and

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
	period, nurses recorded new pressure injuries on the incidence forms. At the end of the program, two focus groups were held; one with the non-licensed care providers (*n*=6) and one with the nurses (*n*=6).	• Improved recognition of Stage I pressure injuries by non-licensed care providers • Increased communication and cooperation between nurses and non-licensed care providers • Nurses reported that even though conducting a risk assessment every two week was comprehensive and systematic method, it increased workload and they suggested to decrease the frequency	skills tests, therefore, specific weakness or strengths related to pressure injury knowledge are not known. Comment: This study included non-licensed care professionals who work with nurses and comprised a large part of the team who provide direct personal care to the nursing home residents. Information on this group is valuable as they are in a position to detect early signs of skin breakdown and to ensure appropriate preventative care is provided.
Sinclair & et., 2004	Study Design: Uncontrolled before and after descriptive study Sample: Registered Nurses (*n*=595) Licensed Practical Nurses (*n*=59) Setting: Three acute care hospitals	Mean Scores (SD) (possible range of scores was -53 to +53) • RNs Pretest: 22.41 (6.38) Posttest #1: 36.83 (5.27) Posttest #2: 31.89 (6.44) • LPNs	Study design: weak Study quality: low Strengths: The instrument had previously been tested for validity and

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
	with a bed capacity of 1,760 in one Canadian health region Objective: To assess pressure injury knowledge of RNs and LPNs before an educational intervention (series of 8 workshops), then immediately after and again three months post intervention. Participants completed a modified version of Pieper's Pressure Injury Knowledge Test consisting of 53 true/false/don't know items before the intervention, immediately after, then three months post intervention.	Pretest: 18.51 (5.77) Posttest #1: 32.55 (6.71) Posttest #2: 29.85 (7.10) *All participants did not complete post 1 and post 2 tests. Pre, post 1 and post 2 scores were not significantly different for the total group. For the RNs (*n*=165) and LPNs (*n*=19) who completed all 3 tests, there was a significant within subjects effect (*P*<.000). Posthoc pairwise comparisons collapsed over RNs and LPNs showed mean scores were significantly higher from pre to post 1 and post 2. However, mean scores decreased significantly from post 1 to post 2. (*P*< .005). The lowest correct response rates for both the RNs and LPNs were to the items about the correct frequency of repositioning a chairbound person, the interpretation of the Braden risk score, and the frequency of the Braden Risk	reliability. The modified version was further tested by four ET nurses and one project team member for content, scope, and accuracy to establish face and content validity. Cronbach's alpha for the revised test was .86. Participants' results from the first workshop series were analyzed separately from those who participated in a later series in case the second group was influenced by discussions with or clinical practice changes by the first group. Limitations: Convenience sample representing less than 20% of the target population. The workshop was delivered in

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
		Assessment.	and 8-part series, therefore participants had time to discuss and research answers to the test questions in between each part. The posttest at three month was mailed out for participants to complete and send back, so participant could have discussed or researched the answers. No control group was used for comparison. Comment: Lower mean scores at three months post intervention may suggest efforts to sustain knowledge over time are needed.

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
Thomas, 2012	Design: Uncontrolled before and after descriptive study Sample: RNs and LPNs (*n*=10) Setting: A 340- bed long term care facility in northeastern New Jersey, US Objective: To assess nursing knowledge and documentation related to pressure injuries following a pressure injury educational program. Effects of the program were measured using a pre and posttest consisting of 15 multiple choice and true/false items. To determine effect on practices related to pressure injuries, retrospective chart reviews were conducted using a wound documentation audit tool at three points (baseline, four weeks, and eight weeks)	Mean Scores (SD) (total possible score of 15 x100): Pretest: 63.2 (17.23) Posttest #1: 80.2 (8.53) Posttest #2: 92.3 (6.13) Effect size analysis showed improvement of over one standard deviation at from pretest to posttest # and over two standard deviations at posttest#2. Wound assessment documentation frequency increased from pretest to posttest #1 and posttest #2: Mean % (SD): Anatomical wound location: • Baseline: 71.0% (12.3) • Four weeks: 81.3% (10.2) • Eight weeks: 90.6% (8.9) Use of offloading devices: • Baseline: 7.7% (13.2) • Four weeks: 34.6% (13.0) • Eight weeks: 44.5% (13.9)	Study deign: weak Study quality: low Strengths: Participants were not aware that charts were audited for the wound documentation at either study point. Therefore, concerns about chart auditing would not be a factor associated with any changes in documentation practices. The tool (Pressure Injury Scale for Healing) used as the framework to assess nursing documentation of wounds had demonstrated content validity ($p < .01$) and correlational validity ($p < .05$). The participants completed the tests in the presences of the investigator minimizing opportunities to discuss or

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
		Healing progress: • Baseline: 10.2% (12.1) • Four weeks: 30.4% (9.4) • Eight weeks: 39.1% (9.4) Wound Size: • Baseline: 59.5% (20.9) • Four weeks 70.7% (15.8) • Eight weeks 82.7% (11.4) Reported improvements in wound characteristics from baseline to eight weeks: • Size: >23% • Exudate: >26% • Tissue type: >20%	research the answers. Limitations: Small convenience sample limiting generalizability. Sample size too small for any statistically significant differences to be detected. No control group was used to compare knowledge and documentation of practices. The author pointed out that the study should have also included nurses' aides because they are directly involved in the daily care of skin integrity of the patients. Comment: Chart audits without the participants' awareness helped to gauge effectiveness of the education and the transfer of

Author/Date	Methods and Sample/ Location	Key Results	Strengths/Limitations[a] Comments
			improved knowledge in practice. Prior to the intervention the pressure injury prevalence rate was reported as 8.2%, however, the rate was not reported at any other study points. Pressure injury prevalence and incidence rates may have also been a useful outcome measures to determine effectiveness of the educational intervention.

Note. [a]Strengths/Limitations=study quality and design critically appraised as per Public Health Agency of Canada's Infection Prevention and Control Guidelines Critical Appraisal Tool Kit (2014). [b]Study design= rated as either strong, moderate, or weak; descriptive designs such as uncontrolled before and after or cross-sectional are rated as weak designs. [c]Study quality= rated as either high, medium, or low according to established criteria used to assess research question clarity and relevance, sample selection, data collection sources and methods, data collection instruments, ethics, and statistics.

Appendix F

Email and Print Correspondence to Resident Care Managers

Insert date here

Re: An Exploration of Knowledge and Practices Related to Pressure Ulcers –Study at your sites

Dear Resident Care Managers (Insert Resident Care Manager Name here),

I am a Master's of Nursing student at Memorial University School of Nursing, and I am writing to let you know that I will be conducting a research study at your sites in November. The study purpose is to explore the knowledge and practices among RNs, LPNs and PCAs regarding pressure ulcers. The results of this assessment will be used to develop education that addresses the identified learning needs regarding pressure ulcers. Ultimately, the developed education program regarding pressure ulcer prevention and management will be part of a larger strategy to support the Required Organization Practice of Pressure Ulcer Prevention.

I am writing to ask for your support for the study by allowing staff enough time during a shift to participate. I would also like your help in reminding staff about the upcoming study dates and times**.** The evaluation will involve completion of a knowledge questionnaire by the RNs, LPNs, and PCAs. This questionnaire is not expected to take any more than 20 minutes to complete. Participation will be voluntary. Snacks and beverages will be provided.

The dates are yet to be arranged, but I will be at your sites at pre-arranged times for approximately two to three hours per 12 hour shift for 2-4 shifts depending on the response of potential candidates. I will book a room at your site for the purpose of questionnaire administration. I will be availing of the paging system to call for volunteer participants.

I will have flyers posted approximately one week in advance around your site to inform of the study and to elicit interest from potential participants.

Prior to commencing the study, I will be set up a meeting time (*by teleconference for rural sites*) in late October with the managers at *insert site here* to further discuss details of the study and to answer any concerns and questions. I will send you the details concerning meeting times and dates in the near future. If you are unable to attend a meeting, I will be available by phone, email, or in person to arrange additional meetings. If you have any suggestions as to times and dates that you feel would be suitable for the purposes of this study, that information would be appreciated.

Meanwhile, I can be contacted at any time if you have any comments, concerns, or questions.

I look forward to discussing this study with you.

Regards,

Alicia Hennebury

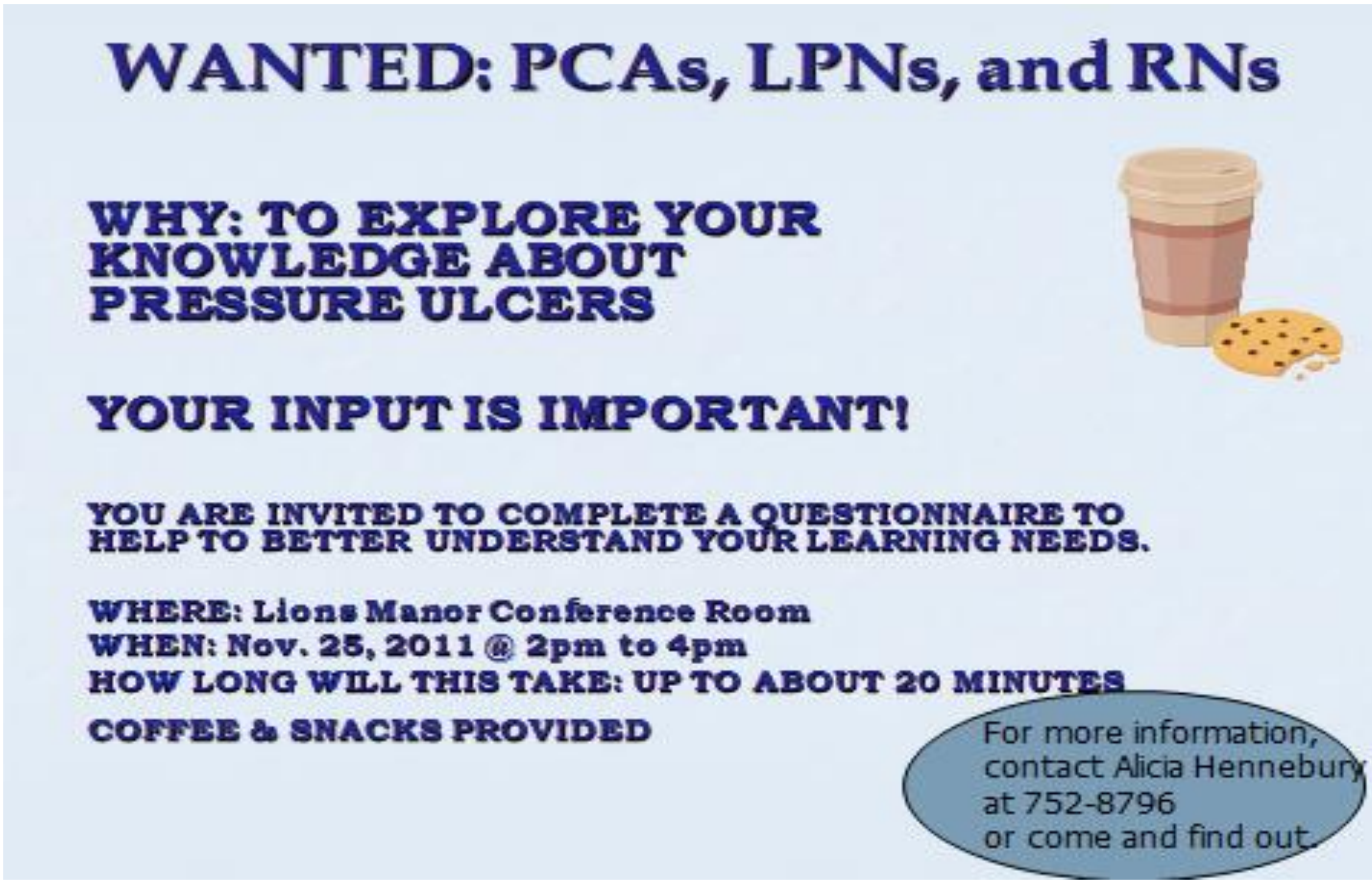
Clinical Nurse Specialist

Long Term Care, Eastern Health

752-8796

Appendix G

Sample Study Recruitment Flyer



Appendix H

Script of Paging Announcement to Volunteer Participants

Any PCAs, LPNs, or RNs interested in participating in the study to explore knowledge about pressure ulcers can go to Room *insert room # and time here.* Snacks and beverages will be provided.

Appendix I

Participant Information Letter

Why is this study an important research study?
In Canada, pressure ulcer prevalence was estimated at 30% in long term care (Houghton & Woodbury, 2004). Accreditation Canada has recognized pressure ulcers as a serious concern in long term care and as a result, in 2009, pressure injury prevention was identified as a required organizational practice in the long term care sector. Prevalence and incidence rates of pressure ulcers are used to measure quality of care across health care settings. Complications of pressure ulcers include infection, septicemia, hospitalization, surgery, and death. Treatment of pressure ulcers substantially increases healthcare costs and nursing time. The need for adequate knowledge and skills among nursing staff to prevent and manage pressure ulcers, is well documented. However, equally well documented is the fact that serious deficiencies in this area exist in all levels of nursing staff. Currently, knowledge and practices related to pressure injuries among nursing staff in Eastern Health Long Term Care has not been formally assessed. In order to develop an understanding of your learning needs, research is needed in this area. The purpose of this research project is to explore the knowledge and practices related to pressure ulcer prevention and management among nursing staff in Eastern Health Long Term Care. The results from this study can be used to develop education that will address any learning needs identified. A tailored education program can enhance the knowledge and skills among nursing staff and improve quality of care.

What is involved in participating?
If you chose to participate, you will be asked if you are an RN, LPN, or PCA. If you are an LPN, you will be asked if any wound care education was completed in either your basic education program or from a post-basic wound care education module.

If you are an RN or an LPN who has stated that you have completed wound care education, you will be asked to complete a questionnaire. Demographic information will also be collected. This questionnaire is expected to take approximately 20 minutes to complete.

If you are a PCA or an LPN who has stated that you have not received any wound care education, you will be asked to complete a questionnaire and to provide demographic information. The questionnaire is expected to take approximately 10 minutes to complete. You will be asked not to discuss the questionnaire questions with other participants while completing the questionnaire and with potential participants after you have finished.

After you have completed the questionnaire, snacks and beverages will be available.

After this letter has been read, you will be provided an opportunity to ask the researcher any questions you may have about the study.

What about privacy and confidentiality?

The questionnaire will not include your name or any identifying information. Your results will be anonymous and confidential. You will be asked to generate a code in writing on the questionnaire. Only you will know your code. This code will only be used later for non-study purposes, should you chose to repeat the questionnaire after an education session. This code can then be matched to your original questionnaire to measure the effect of the education. Again, your name or any identifying information will not be known. The data from the results of your questionnaire will only be accessible by the researcher. Results will be reported as a summary of all questionnaire results and not linked to a specific person.

Every effort to protect your privacy will be made.

Has this study been approved by an ethics committee?

Yes. This study has been approved by the Health Research Ethics Authority.

Please note that participation is voluntary; there will be no repercussions if you choose not to stay and participate.
If you choose to stay and participate, this means you agree to:

- **Complete the all sections of the questionnaire**
- **Not discuss the contents of the questionnaire with other participants or potential participants**
- **Return all parts of the questionnaire to the researcher at the end of the session**

If you have questions, do not hesitate to ask the researcher conducting this study before proceeding.

If you agree, thank you for participating!

If you do not agree, thank you for your interest.

Alicia Hennebury BN RN

Master's of Nursing Student

Memorial University of Newfoundland and Labrador

Phone: 752-8796

Email: alicia.hennebury@easternhealth.ca

Appendix J

Participant Consent Form

Consent to Take Part in Research *:July 2011*

TITLE: Pressure Ulcer Prevention and Management: An Exploration of Knowledge and Practices

INVESTIGATOR: Alicia Hennebury
Master's of Nursing Student
Memorial University of Newfoundland and Labrador
752-8796

You have been invited to take part in a research study. Taking part in this study is voluntary. It is up to you to decide whether to be in the study or not. You can decide not to take part in the study. If you decide to take part, you are free to leave at any time.

Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. This consent form explains the study.

Please read this carefully. Take as much time as you like. If you like, take it home to think about for a while. Mark anything you do not understand, or want explained better. After you have read it, please ask questions about anything that is not clear.

The researcher will:

- discuss the study with you
- answer your questions
- keep confidential any information which could identify you personally
- be available during the study to deal with problems and answer questions

1. **Introduction/Background**:

Pressure ulcers are a serious problem in Long Term Care settings. Pressure ulcers can cause severe complications in the person affected. Gaps in knowledge and practice in nursing staff regarding pressure ulcers have been identified. To date, pressure injury related knowledge and practices of nursing staff in Eastern Health Long Term Care have not been formally evaluated. The results of this study will provide a better understanding of knowledge levels and therefore your learning needs and can lend support to the development of a tailored education program for nursing staff in Eastern Health Long Term Care sites.

Version date: Subject's Initials: ______

:July 2011

2. Purpose of study:

The purpose of this study is to explore knowledge and practices of RNs, LPNs, and PCAs working in Eastern Health Long Term Care related to pressure ulcers.

3. Description of the study procedures:

You will be invited during your working hours to complete a pressure injury knowledge questionnaire. This is a written questionnaire composed of three parts. Instructions will be provided on the test. Participation requires only one session. You will generate your own identification code in case you would like to complete the questionnaire at a later date after receiving pressure injury education for non-study purposes. You will be the only person who will know this identification code. The researcher will not know the name associated with the identification code.

4. Length of time:

There are two versions of this questionnaire. The questionnaire for RNs and LPNs who have completed education in wound care may take approximately 20 minutes. The questionnaire for PCAs and LPNs who have not completed education in wound care may take approximately 10 minutes.

5. Possible risks and discomforts:

I know of no risks or discomforts to you should you agree to participate in the study. The questionnaire will take approximately 10 to 20 minutes of your time and will be offered at a time that will be determined to be as convenient as possible for you.

6. Benefits:

It is not known whether or not this study will benefit you personally, although, the results can contribute to the development of a pressure injury education program that will be provided to you as an Eastern Health nursing staff member in Long Term Care. It is hoped that your learning needs regarding pressure injuries will be addressed in the educational program. Your participation in this study may also stimulate your curiosity to learn more about pressure ulcers. Improving knowledge and practice about pressure ulcers may improve future resident care and outcomes.

Version date: Subject's Initials: ___

7. Liability statement:

Signing this form gives us your consent to be in this study. It tells us that you understand the information about the research study. When you sign this form, you do not give up your legal rights. Researchers or agencies involved in this research study still have their legal and professional responsibilities.

8. What about my privacy and confidentiality?

Protecting your privacy is an important part of this study. Every effort to protect your privacy will be made. However it cannot be guaranteed. Only a code will be used on your questionnaire and the researcher will not be able to match the code with your identity.

When you sign this consent form you give us permission to

- Collect information from you

<u>Use of your study information</u>
The research team will collect and use only the information they need for this research study.

This information will include your

- *Position title*
- *Number of years in your position*
- *Number of years experience in your nursing designation*

Your information will be kept secure by the researcher in Newfoundland and Labrador. It will not be shared with others without your permission. Your name will not appear in any report or article published as a result of this study.

Information collected for this study will kept for five years.

Information collected and used by the research team will be stored in the principle investigator's office in a locked file cabinet or on a password protected computer. Alicia Hennebury is the person responsible for keeping it secure.

9. Questions or problems:

If you have any questions about taking part in this study, you can meet with the investigator who is in charge of the study at this institution. That person is: Alicia Hennebury at 752-8796.

Principal Investigator's Name and Phone Number

Alicia Hennebury
752-8796

OR YOU CAN TALK TO SOMEONE WHO IS NOT INVOLVED WITH THE STUDY AT ALL, BUT CAN ADVISE YOU ON YOUR RIGHTS AS A PARTICIPANT IN A RESEARCH STUDY. THIS PERSON CAN BE REACHED THROUGH:
ETHICS OFFICE
HEALTH RESEARCH ETHICS AUTHORITY
709-777-6974 OR BY EMAIL AT INFO@HREA.CA

After signing this consent you will be given a copy.

Appendix K

Pressure Ulcer Knowledge Questionnaire A

For RNs and LPNs who have completed education wound care

Three Sections to be Completed

Pressure Ulcer Knowledge Questionnaire
Section 1: Demographic Profile

An identifier code will be assigned to your test but will ensure anonymity. Your code will be determined by your month of birth, the first initial of your mother's maiden name, and your day of birth. Please fill in the information in the space provided:

Month of birth/First initial of mother's maiden name/day of birth
__ __/__/__ __

Circle the appropriate answer in the following questions:

Your position:
a) RN
b) LPN
c) PCA

Years experience in Long Term Care:
a) Less than 5 years
b) Between 5 to 10 years
c) Greater than 10 years

Years experience in your profession:
d) Less than 5 years
e) Between 5 to 10 years
f) Greater than 10 years

Have you had any pressure ulcer education outside of your basic training?
a) Yes
b) No
If yes, how long ago:
i) Within the last 6 months up to 1 year ago
ii) 1 to 3 years ago
iii) Greater than 3 years ago

If you have received and pressure ulcer education outside of your basic training, what type:

a) self initiated on the Internet
b) print material such as nursing journals, newsletters
c) in-service at work
d) formal education program outside of work
e) work related conference
f) other, e.g. Conference

Pressure Ulcer Knowledge Assessment Questionnaire A
Section 2:

Please answer the following questions:

1. Identify your **three** most preferred methods of education delivery from the choices below. Rank them in order of preference with **1 being most preferred, 2 being second choice** and **3 being third choice**. Place the number of rank preference in a space provided after the identified choice.

Education Delivery Method	Rank
a) In-services offered at work	_____
b) Individualized one on one education	_____
c) Self-paced learning module-paper	_____
d) Online self-paced learning module	_____
e) Informal group sessions	_____
f) Organization-offered conferences	_____
g) Self study through journals, handouts, newsletters, online	_____
h) Other-name type_____________	_____

2. Regarding the topic of pressure ulcers, what would you like to learn about?

3. When should the Braden Risk Assessment Scale be done on residents in Long Term Care?

4. Who (RN, LPN, or PCA) can complete the Braden Risk Assessment?

____

5. What are the policies in Long Term Care related to pressure ulcer prevention and risk assessment?You have been provided with two pictures of pressure injuries:

A and B.

i) Circle the answer that best identifies the stage of the pressure ulcer in Picture A:

a) Stage I
b) Stage II
c) Stage III
d) Stage IV
e) Deep tissue injury
f) Unstageable

ii) Circle the answer that best identifies the stage of the pressure ulcer in Picture B:

a) Stage I
b) Stage II
c) Stage III
d) Stage IV
e) Deep Tissue Injury
f) Unstageable

Pressure Ulcer Knowledge Questionnaire A
Section 3:

For each question, check the box for True, False, or Don't Know.

	True	**False**	**Don't Know**
1. Stage I pressure ulcers are defined as intact skin with nonblanchable erythema in lightly pigmented persons.			
2. Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness.			
3. All residents in Long Term Care at risk for pressure ulcers should have a systematic skin inspection at least daily.			
4. Hot water and soap may dry the skin and increase the risk for pressure ulcers.			

	True	False	Don't Know
5. It is important to massage bony prominences.			
6. A Stage III pressure ulcer is a partial thickness skin loss involving the epidermis and/or dermis.			
7. All residents should be assessed on admission to a Long Term Care facility for risk of pressure ulcer development.			
8. Creams, transparent dressings (e.g., Tegaderm, Opsite), and hydrocolloid dressings (e.g., DuoDerm, Comfeel) do not protect against the effects of friction.			
9. A Stage IV pressure ulcer is a full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structure.			
10. An adequate dietary intake of protein and calories should be maintained during illness.			
11. Persons confined to bed should be repositioned every 3 hours.			
12. A turning schedule should be written and placed at the bedside.			
13. Heel protectors relieve pressure on the heels.			
14. Donut devices/ring cushions help to prevent pressure ulcers.			
15. In a side lying position, a person should be at a 30 degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority.			
16. The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions.			
17. A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair.			
18. Persons who can be taught should shift their weight every 30 minutes while sitting in a chair.			
19. Chair-bound persons should be fitted for a chair cushion.			
20. Stage II pressure ulcers are a full thickness skin loss.			
21. The epidermis should remain clean and dry.			
22. The prevalence of pressure ulcers is so high that Accreditation Canada has identified Pressure Ulcer Prevention as a Required Organizational Practice.			
23. A low-humidity environment may predispose a person to pressure ulcers.			

	True	False	Don't Know
24. To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture.			
25. Rehabilitation should be instituted if consistent with the patient's overall goals of therapy.			
26. Slough is yellow or creamy necrotic tissue on a wound bed.			
27. Eschar is good for wound healing.			
28. Bony prominences should not have direct contact with one another.			
29. Every person assessed to be at risk for developing pressure injuries should be placed on a pressure-redistribution bed surface.			
30. Undermining is the destruction that occurs under the skin.			
31. Eschar is healthy tissue.			
32. Blanching refers to whiteness when pressure is applied to a reddened area.			
33. A pressure redistribution surface reduces tissue interface pressure below capillary closing pressure.			
34. Skin macerated from moisture tears more easily.			
35. Pressure ulcers are sterile wounds.			
36. A pressure ulcer scar will break down faster than unwounded skin.			
37. A blister on the heel is nothing to worry about.			
38. A good way to decrease pressure on the heels is to elevate them off the bed.			
39. All care given to prevent or treat pressure ulcers must be documented.			
40. Devices that suspend the heels protect the heels from pressure.			
41. Shear is the force that occurs when the skin sticks to a surface and the body slides.			
42. Friction may occur when moving a person up in bed.			
43. A low Braden score is associated with increased pressure ulcer risk.			
44. The skin is the largest organ of the body.			
45. Stage II pressure ulcers may be extremely painful due to exposure of nerve endings.			

	True	False	Don't Know
46. For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals.			
47. Educational programs may reduce the incidence of pressure ulcers.			

Appendix L

Pressure Ulcer Knowledge Questionnaire B

For PCAs and LPNs who have not completed education in wound care

Pressure Ulcer Knowledge Questionnaire
Three Sections to be Completed

Section 1: Demographic Profile

An identifier code will be assigned to your test but will ensure anonymity. Your code will be determined by your month of birth, the first initial of your mother's maiden name, and your day of birth. Please fill in the information in the space provided:

Month of birth/First initial of mother's maiden name/day of birth
__ __/__/__ __

Circle the appropriate answer in the following questions:

Your position:

d) RN
e) LPN
f) PCA

Years experience in Long Term Care:

g) Less than 5 years
h) Between 5 to 10 years
i) Greater than 10 years

Years experience in your profession:

j) Less than 5 years
k) Between 5 to 10 years
l) Greater than 10 years

Have you had any pressure ulcer education outside of your basic training?
a) Yes
b) No
If yes, how long ago:

iv) Within the last 6 months up to 1 year ago
v) 1 to 3 years ago
vi) Greater than 3 years ago

If you have received and pressure ulcer education outside of your basic training, what type:

g) self initiated on the Internet
h) print material such as nursing journals, newsletters
i) in-service at work
j) formal education program outside of work
k) work related conference
l) other, e.g. Conference

Pressure Ulcer Knowledge Questionnaire B
Section 2:

Please complete the following questions.

1. Identify your **three** most preferred methods of education delivery from the choices below. Rank them in order of preference with **1 being most preferred, 2 being second choice** and **3 being third choice**. Place the number of rank preference in a space provided after the identified choice.

Education Delivery Method	Rank
a) In-services offered at work	_____
b) Individualized one on one education	_____
c) Self-paced learning module-paper	_____
d) Online self-paced learning module	_____
e) Informal group sessions	_____
f) Organization-offered conferences	_____
g) Self study through journals, handouts, newsletters, online	_____
h) Other-name type_____________	_____

2. Regarding the topic of pressure ulcers, what would you like to learn about?

3. How often do you complete skin assessments on residents in Long Term Care?
   a) weekly
   b) monthly

c) daily
d) every three days
e) other ___________

4. To whom (RN, LPN, or PCA) do you report any concerning findings from a skin assessment?

____

Pressure Ulcer Knowledge Questionnaire B
Section 3:

For each question, check the box for True, False, or Don't Know.

	True	**False**	**Don't Know**
1. Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness.			
2. All residents at risk for pressure ulcers should have a systematic skin inspection at least daily.			
3. Hot water and soap may dry the skin and increase the risk for pressure ulcers.			
4. It is important to massage bony prominences.			
5. An adequate dietary intake of protein and calories should be maintained during illness.			
6. Persons confined to bed should be repositioned every 3 hours.			
7. A turning schedule should be written and placed at the bedside.			
8. In a side lying position, a person should be at a 30 degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority.			
9. The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions.			
10. A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair.			
11. Persons who can be taught should shift their weight every 30 minutes while sitting in a chair.			
12. Chair-bound persons should be fitted for a chair cushion.			

	True	False	Don't Know
13. The skin should remain clean and dry.			
14. To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture.			
15. Bony prominences should not have direct contact with one another.			
16. Skin macerated from moisture tears more easily.			
17. A blister on the heel is nothing to worry about.			
18. A good way to decrease pressure on the heels is to elevate them off the bed.			
19. All care given to prevent or treat pressure ulcers must be documented.			
20. Devices that keep the heels off the mattress protect the heels from pressure.			
21. Shear is the force that occurs when the skin sticks to a surface and the body slides.			
22. Friction may occur when moving a person up in bed.			
23. The skin is the largest organ of the body.			
24. For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals.			

Appendix M

List of Eastern Health Long Term Care Sites

Urban Sites

Site
Agnes Pratt, St. John's
Caribou Memorial Veterans' Pavilion, St. John's
Dr. Walter Templeman Hospital, Bell Island
Glenbrook Lodge, St. John's
Hoyles-Escasoni Complex , St. John's
Masonic Park, St. John's
St. Luke's, St. John's
St. Pat's Mercy Home, St. John's
Total

Rural Sites

Site
Bonavista Health Centre, Protective Care Unit, Bonavista
Blue Crest Nursing Home, Grand Bank
Golden Heights Manor, Bonavista
Harbour Lodge, Carbonear
Interfaith Nursing Home, Carbonear
Lion's Manor, Placentia
O'Mahoney Manor, Clarenville
Pentecostal Home, Clarke's Beach
US Memorial, St. Lawrence
Total

Appendix N

Pressure Ulcer Risk Assessment Audit Tool (Revised Feb. 26, 2012)

Research Code: **Date of Data Collection:**

Site: **Date of Admission:**

Was Braden Risk Assessment Completed	Yes	No	Date	Total Score	Braden subcategory score Moisture (M); Sensory Perception (SP); Activity (A); Mobility (Mb); Nutrition (N); Friction/shear (FS)	Actual Additional Interventions added to Standard the Plan of Care	Consults Requested (PT, OT, CNS, RD)	Completed by RN or LPN
On Admission					M= SP= A= Mb= N= FS=			
At Week 1					M= SP= A= Mb= N= FS=			
At Week 2					M= SP= A= Mb= N= FS=			
At Week 3					M= SP= A= Mb= N= FS=			
At Week 4					M= SP= A= Mb= N= FS=			
At 3 Months					M= SP= A= Mb= N= FS=			
At 6 Months					M= SP= A= Mb= N= FS=			
Other Time: When and Why:					M= SP= A= Mb= N= FS=			

Score of 2 or less identifies a need in corresponding category

M: Moisture **Mb: Mobility**

SP: Sensory Perception **N: Nutrition**

A: Activity **FS: Friction and Shear**

Consults requested at other times (related to skin integrity)	Type of consult	Date	Reason

Braden scale warranted at other times due to significant change in health status but not completed	Date (s)	Why

Criteria: s/s of respiratory or gastrointestinal illness for the duration of at least 1 week.

Number of times reassessments completed	
Admission assessment completed within 48 hours of admission	

Appendix O

Braden Audit Tool from the Newfoundland and Labrador Provincial Skin and Wound Care Manual

Braden Audit Tool

	1	2	3	4	5	6	7	8	9	10
Braden Score-										
Was the Braden assessment completed within the required timeframe on admission?										
Was the Braden Score reassessed appropriately for the practice area?										
Do the interventions in the care plan reflect the recommended guidelines based on the score?										
Is there skin breakdown, stage II or greater pressure ulcer.										
Were appropriate consults made if a score is less than 18? • OT • PT • Dietician										
If the score is less than 18, what support surfaces are used? eg. Mattress/chair cushion										
What support surfaces have been recommended?										

Appendix P

Letter to the Directors of LTC, Eastern Health

———————

Regional Director
Long Term Care Program
Eastern Health
146 Elizabeth Ave.
St. John's, NL, A1B 1S5

Alicia Hennebury
Clinical Nurse Specialist
Hoyles Escasoni Complex
10 Escasoni Pl..
St. John's, NL, A1A3R6

cc. ---------------------

November 5, 2011

Dear ---------------------:

I am a Master's of Nursing student at Memorial University School of Nursing, I am writing to update you and to provide information regarding a research study that I am planning to conduct in Eastern Health Long Term Care. The proposed study has been approved by the Health Research Ethics Authority and the Research Proposal Committee for Eastern Health.

This study is intended to explore the knowledge and practices of RNs, LPNs, and PCAs related to pressure ulcer prevention and management. The results will be used to develop education that addresses the identified knowledge and practice gaps regarding pressure ulcer care. Ultimately, the developed education program regarding pressure ulcer prevention and management will be part of a larger strategy to support the Required Organizational Practice of Pressure Ulcer Prevention.

The study is anticipated to take place over the months of November, December, 2011, January, February, and March, 2012.

The title of the study is: Pressure Ulcer Prevention and Management: An Exploration of Knowledge and Practice.

The study is comprised of two components: 1) a knowledge assessment and 2) a practice assessment.

For the knowledge assessment, the sites selected are: Hoyles-Escasoni, Agnes Pratt, Lion's Manor, and Blue Crest Nursing Home. A minimum of 100 RNs, LPNs, and PCAs will be recruited to complete a knowledge questionnaire. This questionnaire is not expected to take any more than 20 minutes to complete. Prior to completion of the questionnaire, an information sheet regarding the study will be read to the participants, they will then be given an opportunity to ask any questions, after which they will be asked to read and sign a consent form. They will be given copies of the information sheet and consent forms. Participation will be voluntary. Snacks and beverages will be provided.

The Resident Care Managers will be informed of the details regarding the knowledge assessment component of this study by email and print correspondence. As well, meeting times will be set up with the Resident Care Managers to further discuss study details and to answer any questions or concerns. Support will be sought from the Resident Care Managers in terms of reminding staff that they can volunteer to participate and enabling them to leave the unit for a short time to participate in the study.

The knowledge assessment component will take place in November, December, and January, 2011, but may extend to February or March depending on participant response. The dates are yet to be arranged, but I will be at these sites at pre-arranged times for approximately two to three hours per 12 hour shift for 2-4 shifts depending on the response of potential candidates. I will book a room at the selected sites for the purpose of questionnaire administration.

I will have flyers posted approximately one week in advance around each site to inform of the study and to elicit interest from potential participants. On the days planned for questionnaire administration, I will be availing of the paging system to call for volunteer participants.

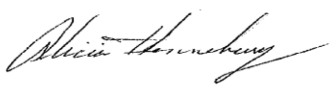
For the practice assessment, all 17 Eastern Health Long Term Care Facilities will be targeted. Retrospective chart reviews will be conducted to evaluate Braden Scale Risk assessment related practices. Upon approval for access to admissions and discharge data, two random sample sets will be obtained from all admissions into Eastern Health Long Term Care that occurred between September 1, 2010 and April 30, 2011. Samples will be selected to represent both urban and rural admissions. A Pressure Ulcer Risk Assessment Audit Tool that I have developed will be used for the purposes of the chart reviews. The chart review will cover six months of documentation from the time of admission. Chart reviews are planned to be conducted over the months of November, December, 2011, January, and possibly February and March, 2012.

I am very much looking forward to conducting this study and I believe it will yield valuable information that can provide a deeper understanding of knowledge and practices of nursing staff regarding pressure ulcer care. Such an understanding can enhance educational strategies to improve knowledge and practices of our staff and thereby improve outcomes for the residents in our Long Term Care Nursing Homes.

The results from this study will be shared with you and all stakeholders for Eastern Health Long Term Care.

Please let me know if you would like to discuss this study further. I can be available for a meeting by phone or in person.

I appreciate your support that you have provided for this endeavor so far and look forward to sharing the findings with you.
Sincerely,



Alicia Hennebury
Master's of Nursing Student
School of Nursing, Memorial University

Appendix Q

Letter of Request for Data Access to Director of IMAT

Alicia Hennebury
Hoyles-Escasoni Complex
10 Escasoni Pl.,
St. John's, NL
A1A 3R6

Director
Information Management and Technology
Eastern Health
760 Topsail Rd.,
Mount Pearl, NL
A1N 3J5

November 5, 2011

Dear ------------------:

I am a Master's of Nursing student at Memorial University School of Nursing and I am writing to request access to health records as part of the ethical protocol for the purposes of a research study that I would like to conduct in Eastern Health Long Term Care. The proposed study is submitted for approval by the Health Research Ethics Authority and will be followed up with an application for approval from the Research Proposal Committee for Eastern Health.

The study is anticipated to take place over the months of November, December, 2011, January, February, and March, 2012.

The title of the study is: Pressure Ulcer Prevention and Management: An Exploration of Knowledge and Practice.

A component of this study is comprised of an assessment of nursing staff practices which is planned to be evaluated by way of retrospective chart reviews. The information sought from the chart will include pressure injury risk assessments on admission, subsequent reassessments, and any related care plan interventions added as well as relevant documentation.

All 17 Eastern Health Long Term Care Facilities will be targeted. Approval will be required for access to admissions and discharge data for the period between September 1, 2010 and April 30, 2011 into Eastern Health Long Term Care sites. I will then require access to the charts of the eligible admissions that will be randomly selected. Documentation over a period of 6 months from admission will be reviewed so that a sufficient amount of data can be captured. It is anticipated that a sample of 241 charts will be required for review. Chart reviews are planned to be conducted over the months of November, December, 2011, January, and February, 2012.

I look forward to your approval and support.
Sincerely,

Alicia Hennebury
Master's of Nursing Student
School of Nursing, Memorial University