REDUCING HOSPITAL-ACQUIRED PRESSURE ULCERS BY 40%: INTRODUCING A SKIN BUNDLE PROJECT

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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ABSTRACT

Hospital-acquired pressure ulcers (HAPUs) are a major healthcare issue that lead to significant patient suffering as well as exorbitant health care expense. The Centers for Medicare and Medicaid Services (CMS) identify HAPUs as *Never Events*, or events that should not occur while in the hospital, and as such, no longer provide reimbursement for care related to HAPUs. In 2013, there were 26 HAPUs on the spinal cord injury (SCI) unit at a 219-bed urban hospital.

The goal of this Doctor of Nursing Practice project was to decrease HAPUs by 40% over 12 months on the SCI unit through the introduction of a skin bundle. The quality improvement (QI) skin bundle involved providing nursing education, new skin care products, a revised Braden Risk Assessment Scale, and a root cause analysis HAPU tool. HAPU data was abstracted from the electronic health record and verified by the wound nurse. Appropriate measures of central tendency were calculated to describe the sample and report the results.

The results showed that HAPUs decreased by 65.4% over the 12 month period of the project. By using a multimodal approach (a skin care bundle), nurses have the opportunity to mitigate the occurrence of this Never Event. Strategies to sustain the gains achieved include continued monitoring by staff, feedback from the administration, and peer review to ensure accurate documentation.
# TABLE OF CONTENTS

ABSTRACT ................................................................................................................... iii

LIST OF TABLES ......................................................................................................... vi

LIST OF FIGURES ....................................................................................................... vii

ACKNOWLEDGMENTS ............................................................................................. viii

BACKGROUND ........................................................................................................... 1

  Problem Statement ................................................................................................. 1
  Significance of Study ............................................................................................. 3
  Purpose Statement ................................................................................................. 4

REVIEW OF LITERATURE ........................................................................................ 5

  Discovery of Two New PU Categories ................................................................. 6
  PUs are Dangerous in Vulnerable Populations ...................................................... 6
  Pathophysiology of PUs ......................................................................................... 7
  Nursing Education ................................................................................................. 8
  Theoretical Framework ......................................................................................... 10

METHODS .................................................................................................................... 15

  Setting ................................................................................................................... 16
  Sample .................................................................................................................. 16
  Skin Bundle Interventions ..................................................................................... 16
  Analysis ................................................................................................................ 21
  Results .................................................................................................................. 21

DISCUSSION ................................................................................................................ 26

REFERENCES .............................................................................................................. 30
APPENDIX A: STAFF ASSESSMENT SURVEY .................................................... 34
APPENDIX B: SAFETY SKIN CROSS ............................................................... 38
APPENDIX C: SKIN CARE PRODUCTS ............................................................ 39
APPENDIX D: FISHBONE DIAGRAM HAPU RCA ......................................... 40
APPENDIX E: TABLES OF EVIDENCE FOR PROPOSAL ............................... 41
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Braden Scale Risk Assessment</td>
<td>10</td>
</tr>
<tr>
<td>2. Demographics of Patients on the Pilot Unit</td>
<td>22</td>
</tr>
<tr>
<td>3. Hospital-acquired Pressure Ulcers Within the Pilot Unit</td>
<td>23</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plan-Do-Study-Act model for QI skin bundle project</td>
<td>14</td>
</tr>
<tr>
<td>2.</td>
<td>Number of hospital-acquired pressure ulcers by quarter</td>
<td>24</td>
</tr>
<tr>
<td>3.</td>
<td>Health insurance plans on pilot unit in total</td>
<td>25</td>
</tr>
<tr>
<td>4.</td>
<td>Race/ethnicity of patients on pilot unit in total</td>
<td>25</td>
</tr>
</tbody>
</table>
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To my husband Cesar and three children—Matthew, Katherine, and Lauren, thank you all for your support and love throughout this DNP program, without your understanding and patience this degree would not have been possible. I love each of you so very much!
DEDICATION

I dedicate this project to my parents who have provided encouragement, love, support, and guidance throughout my life. Without these fundamentals I would not be the person I am today. To my father, I believe you are watching over me each day and smiling. To my mom, you are the strength and center of our family, thank you for always encouraging me and simply asking “how I am doing each and every day.” Thank you from the bottom of my heart, I love you both!
BACKGROUND

Statement of the Problem

Hospital-acquired pressure ulcers (HAPUs) are a major healthcare issue that leads to enormous patient suffering as well as exorbitant healthcare expense. The Centers for Medicare and Medicaid Services (CMS) identifies pressure ulcers (PUs) as Never Events: an event that a patient should not incur while in the hospital and no longer provides reimbursement for care related to these events (Armour-Burton, Fields, Outlaw, & Deleon, 2013). If certain PUs occur while a patient is in the hospital (e.g., Stage III, Stage IV, or unstageable), the hospital must notify the California Department of Public Health (CDPH) within a specific timeframe; the implications may include a state surveyor visit, a state citation and/or fines. In line with the author’s clinical experience, the literature suggests that the spinal injury population is one of the highest risk populations for PUs (Ploumis et al., 2011). Rates of PUs and HAPUs have increased over the last three years in the acute care setting where this author practices as Nursing Director. Therefore, the focus of this project will be to improve PU incidence by implementing a skin bundle quality improvement (QI) project based on evidence-based practice (EBP) guidelines on a 21-bed spinal cord injury unit at a southern California public hospital.

PUs have been an important issue in healthcare for many years and often lead to infection, sepsis, and other serious complications (National Pressure Ulcer Advisory Panel [NPUAP], 2013). PUs are also referred to as bed sores, pressure sores, and bed wounds (NPUAP, 2013). In 2008, the National Pressure Ulcer Advisory Panel published new guidelines on the staging and identification of PUs. They identified new indicators of PUs as unstageable and suspected deep tissue injury (sDTI) (NPUAP, 2013).
The NPUAP provides guidelines for the staging of PUs (stages I-IV, unstageable, and sDTI) and precisely defines each stage:

_Suspected deep tissue injury_ is defined as a purple or maroon localized area of discolored intact skin or a blood-filled blister due to damage to the underlying soft tissue from pressure and/or shear. The tissue may be painful, firm, mushy, boggy, warm, or cool as compared to adjacent skin areas (NPUAP, 2013). The wound may also include a thin blister over a dark wound bed and may evolve to be covered by thin eschar. Evolution of the wound may be rapid, exposing additional layers of tissue damage, even with optimal treatment.

A Stage I PU is intact skin with non-blanchable redness of a localized area, usually over a bony prominence. The exception is darkly pigmented skin that may appear different in color when compared to surrounding skin. The area may be painful, firm, soft, warm, or cool as compared with adjacent tissue (NPUAP, 2013).

A Stage II PU is a partial thickness loss of the dermis presenting as a shallow, open ulcer with a red-pink wound bed without slough. It may also present as an intact or open/ruptured serum-filled or serosanguinous-filled blister or as a shiny or dry shallow ulcer without slough or bruising (NPUAP, 2013).

A Stage III PU is full thickness tissue loss. Subcutaneous fat may be visible but neither bone, tendon, nor muscle are exposed. Slough may be present but does not obscure the depth of tissue loss. It may include undermining and tunneling. The depth of a Stage III PU varies by anatomical location (NPUAP, 2013).

The Stage IV PU is full thickness tissue loss with exposed bone, tendon, or muscle. Slough or eschar may be present on some parts of the wound bed and often
includes undermining and tunneling. The depth of a Stage IV PU varies by anatomical location (NPUAP, 2013).

Lastly, the Unstageable PU is full thickness tissue loss involving the subcutaneous tissue that is covered by slough (yellow, tan, gray, green, or brown) and/or eschar (tan, brown, or black). This PU is challenging for hospitals, as nurses are accustomed to staging PUs by using the Stages I-IV. The NPUAP recognizes all PUs stages as subjective. When staging a PU, the healthcare provider must critically evaluate the wound to determine the etiology and the depth of tissue damage. An incorrectly staged PU could result in the mistaken assumption that it had become worse during the patient’s hospital stay.

**Significance of Study**

There is a definite need to decrease the incidence of HAPUs at the author’s hospital. Data from the hospital’s patient safety reporting system for the spinal cord injury unit (SCI) reported 17 HAPUs in the first three quarters of 2013. This is an increase from 2012 and a high number of cases in comparison to other similar sized facilities.

The financial impact of these *Never Events* is great, with an associated treatment cost ranging from $2,000-$40,000 per PU, depending on the stage of the PU (NPUAP, 2013). Reconstructive surgery costs are estimated at $25,000 per patient (Ploumis et al., 2011). These costs alone, without the cost of human suffering, demonstrate the importance of preventing PUs as well as the importance of cost-effective, preventative practices (Ostadabbas et al., 2012). The scope of the problem is significant on multiple
levels. Estimates indicate that one to three million people in the United States develop PUs each year (Kruger, Pires, Ngann, Sterling, & Rubayi, 2013).

The Joint Commission on Patient Safety estimates that more than 2.5 million patients in acute care facilities suffer from PUs, and that 60,000 die from PU-related complications each year (Kruger et al., 2013). Furthermore, the CMS penalty, withholding reimbursement for Hospital Acquired Conditions (HAC), means that the author’s institution cannot afford to continue to see PUs at this rate.

Over the last three years, attempts to decrease the incidence of HAPUs have focused on nurse education. However, education has not decreased HAPUs as, in fact, the rate increased in 2013 compared to 2012. A more systematic approach to preventing HAPUs is therefore warranted.

**Statement of Purpose**

The purpose of this QI project is to decrease the incidence of HAPUs by 40% over 12 months through the introduction of a skin bundle project to the SCI unit.
REVIEW OF LITERATURE

PUs have been a healthcare issue for many years (Niederhauser et al., 2012). The first step for the pilot team was to review the literature. Ovid MEDLINE, Ovid CINAHL, and PubMed were searched using key terms such as: PUs, risk assessment, spinal cord injury, quality improvement, preventing PUs, decubitus ulcer, and reducing incidence of PUs. The included articles were published in English from January 2008 to January 2015. To be included, the article needed to describe a program to prevent PUs, discuss PU interventions, or describe the impact of PUs in a healthcare setting. Twenty-two articles were identified using comprehensive PU prevention programs. Additional articles were reviewed including SCI patients, stroke patients, and other studies specific to the QI of PUs.

For the purposes of this proposal, a discussion of the literature and its application to this project will be reviewed. The sections will include: cost of PU, discovery of two new PU categories, PUs in vulnerable populations, pathophysiology of PUs, nursing education, skin safety cross, skin care products, and the Braden Pressure Ulcer Risk Assessment Tool.

Cost of PUs

In acute care facilities, more than 2.5 million patients develop PUs each year, with 60,000 dying annually due to associated complications. PU-related hospitalizations increased by 80% from 1993 to 2006 (Sendelbach, Zink, & Peterson, 2011). Treatment costs vary according to severity but may range between $2,000 and $86,000 per PU, while associated treatments (i.e., PU dressings) require an increase of up to 50% more direct nursing time (Sendelbach et al., 2011). In 2006, the cost for adult patients
hospitalized with a PU diagnosis totaled $11 billion. The cost of PU management has thus become a nationwide healthcare priority (Sendelbach et al., 2011).

**Discovery of Two New PU Categories**

The literature introduced two new staging categories. In 2008, the NPUAP identified additional PU related terms: Unstageable and sDTI. The NPUAP (2013) classifies PUs as ranging from Stage I-Stage IV, Unstageable, and sDTI. The literature supports the value of these two additional PU categories as they relate to the incidence of HAPUs (Sendelbach et al., 2011). For example, Unstageable and sDTI PUs are not necessarily easy to identify. Healthcare providers are required to identify all PUs within twenty-four hours of a patient’s admission into the hospital. The dynamics are complex and present challenges for healthcare providers in terms of correctly identifying and treating wounds to prevent further deterioration (Niederhauser et al., 2012).

**PUs are Dangerous in Vulnerable Populations**

According to the literature, PUs and their treatment represent one of the most challenging clinical problems faced by patients who are elderly, neurologically impaired, chronically hospitalized, or have chronic SCI. PUs introduce a costly cycle of recurrent hospitalizations, surgeries, clinic visits, and home healthcare needs (Ploumis et al., 2011). PUs can be life-threatening in end-stage cases, for example as a potential source of severe sepsis (Catania et al., 2007; Niederhauser et al., 2012). Patients with SCI, which is coupled with chronic comorbidities and a lack of protective sensory perception, represent a particularly vulnerable population in terms of developing PUs and are at high risk of recurrent PUs.
The incidence of PUs in the SCI population is 25–66%. It has also been reported that patients with higher-level SCI are more susceptible than those with lower-level lesions (Kruger et al., 2013). The lack of protective sensation, variations in home care, access to pressure-relieving equipment, and common comorbidities (e.g., diabetes, anemia, malnutrition) contribute to the high risk of developing PUs among this population (Kruger et al., 2013). Professionals caring for such high-risk patients need to periodically review PU physiology and clinical management guidelines (Armour-Burton et al., 2013).

Pathophysiology of PUs

The known pathophysiology of PUs can be traced to early investigators from the nineteenth and twentieth century who focused on pressure as the primary cause of PUs (Kruger et al., 2013). Experimental research by pioneers such as Paget, Charcot, Landis, Groth, and Kosiak led to our current understanding of the physiology of skin microcirculation and the pathophysiology of pressure-induced tissue ischemia and ulceration. In the early nineteenth century, Paget and Charcot described the effect of external pressure on the circulation of the skin and ensuing necrosis, as well as the clinical features of PU development following paralysis (Kruger et al., 2013). In the 1930s, Landis discovered pressure mapping. Using an experimental microinjection model of human skin, he discovered that the average venous capillary pressure was 6 mmHg and that the arteriolar limb pressure was 32 mmHg (Kruger et al., 2013).

During the 1940s, Groth noted that larger muscles better withstood pressure, that destruction of tissue from an external force was evident at the base of a wound overlying a bony prominence, and that generalized sepsis could result from local infection at the
site of pressure (Kruger et al., 2013). Kosiak’s experiments with canines demonstrated that higher pressures for short periods of time were just as injurious to tissue as lower pressures applied over longer periods of time, and that both led to tissue ischemia, necrosis, and ulceration (Kruger et al., 2013). Several other researchers independently contributed to these findings and were among the first to describe how muscle was more susceptible to pressure than skin and that friction can be synergistic with pressure in tissue destruction. Our modern understanding of the definition, etiology, and risk factors for PUs has been an affirmation of the findings of these early skin and pressure research pioneers (Kruger et al., 2013).

**Nursing Education**

The literature identifies the importance of ongoing education, continuity of care, consistent interventions, and adequate leadership in decreasing PU incidence (Catania et al., 2007; Armour-Burton et al., 2013).

**Skin Safety Cross**

The Institution of Healthcare Improvement (IHI, 2014) developed a visual tool used to improve HAPU rates. The tool has proved successful in hospitals by decreasing their HAPU rates. The tool is a constant staff reminder of current HAPUs and PUs rates.

**Skin Care Products**

The Wound, Ostomy, and Continence Nurses Society recommends the use of appropriate skin care products to reduce HAPUs (Leijon, Bergh, & Terstappen, 2013). In one study, there was evidence to support keeping the number of products to a minimum and avoiding similar or duplicate products (e.g., skin protectant, moisture barrier, skin cleanser, skin moisturizer) in order to minimize the misuse of products and encourage the
correct products to be used (Armour-Burton et al., 2013). The literature recommends the use of a skin care product poster or algorithm as a staff reference.

**Braden Scale Risk Assessment**

The Braden Pressure Ulcer Risk Assessment Tool was developed in 1984 by Barbara Braden and Nancy Bergstrom. The results of testing its reliability and validity in various clinical settings were published in 1987 (Braden, 2012).

The Braden Scale has been adopted internationally and has proven to be a reliable and valid tool in identifying the risk of PU development. In 1998, both Bergstrom and Braden agreed that the new critical cutoff score would be 18 in order to decrease the likelihood of a false negative risk score, which may be attributed to other risk factors not measured in the Braden Risk Score (Bergstrom et al., 1998). Further research by Lyder et al. (1999) demonstrated the new Braden score cutoff to be valid in other populations besides Caucasians.

In recent reflections, Braden (2012) recommends using the scores of each subscale to assess specific risk factors known to contribute to PU development and to implement specific interventions for each subscale risk score, regardless of whether the total risk score falls below 18. Ayello and Braden (2002) also recommend that each facility develop preventive intervention protocols specific to their patient population prior to the implementation of the Braden Risk Assessment. Recommended risk scores are provided in Table 1 below (Braden, 2012).
Table 1

*Braden Scale Risk Assessment*

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<tr>
<td>At Risk:</td>
<td>15 to 18</td>
</tr>
<tr>
<td>Moderate Risk:</td>
<td>13 to 14</td>
</tr>
<tr>
<td>High Risk:</td>
<td>10 to 12</td>
</tr>
<tr>
<td>Very High Risk:</td>
<td>9 or below</td>
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Braden also recommends that if a patient has an existing PU or a history of PUs, the patient should automatically be placed in the high risk group due to the increased risk of developing a PU (Maklebust, 2005). In addition, the Guidelines for the Prevention and Management of Pressure Ulcers, published by the Wound, Ostomy and Continence Nurses (WOCN, 2010), recommend that any patient who has diastolic blood pressure less than 60, fever, or low albumin/prealbumin should be “upgraded” to the higher PU risk level (The Joint Commission, 2012).

**Theoretical Framework**

**Lewin’s Change Theory**

Lewin’s Change Theory and the Plan-Do-Study-Act (PDSA) model will be used to facilitate this QI skin bundle project. For the purposes of this proposal, a discussion of Lewin’s theory and its application to the project will be provided first. Then, the Plan-Do-Study-Act model of QI proposed by the Institute of Health Improvement (Deming, 2000) will be explained. Finally, how the PDSA model will guide the implementation and evaluation of this QI skin bundle project will be explained.
Lewin’s Change Theory (Kritsoni, 2005) will facilitate the implementation of interventions to promote behavioral changes in nursing staff. The Change Theory has three major concepts: driving forces, restraining forces, and equilibrium. Driving forces are those that push in a direction that causes change to occur. They facilitate change because they push the patient in the desired direction. They cause a shift in the equilibrium towards change. Restraining forces are those forces that counter the driving forces (Kritsoni, 2005). They cause a shift in the equilibrium that opposes change. Equilibrium is a state of being where driving forces equal restraining forces, and thus no change occurs. It can be raised or lowered by changes that occur between the driving forces and restraining forces (Kritsoni, 2005). There are three stages in this nursing theory: unfreezing, change, and refreezing.

Unfreezing is a process that involves finding a method of encouraging people to let go of an old pattern of behavior that may not be working well. Unfreezing is necessary to overcome the strains of individual resistance and group conformity. There are two steps that lead to unfreezing (Kritsoni, 2005). The first step is to increase the driving forces that direct behavior away from the existing situation or status quo. The driving force in my institution is the high rate of HAPUs in the pilot unit. The second step is to decrease the restraining forces that negatively affect the movement from the existing equilibrium. The restraining forces will be identified as the staff working in the pilot unit in addition to the barriers which will be identified through staff knowledge assessment. For this project, the plan is to address both driving forces and restraining forces so as to promote the implementation of this project.
The change stage (also referred to as "moving to a new level" or "movement") involves changing thoughts, feelings, behaviors, or all three, to a more liberating or more productive functioning (Kritsoni, 2005). During this stage, visible changes occur. In this project, the change stage will include the education program and implementing other pilot interventions (e.g., new skin care products).

The refreezing stage establishes the change as the new habit, so that it becomes the "standard operating procedure". Without this final stage, it would be easy for the staff to go back to old habits. New changes are integrated and stabilized by rewarding the outcomes of the changed behavior (a decrease in HAPUs). The planned rewards will include positive feedback, encouragement, and constructive criticism. According to Kritsoni (2005), these steps are very important in the process of making change stick. The pilot leaders will ensure these steps occur.

**Plan-Do-Study-Act (PDSA) Model**

In addition to Lewin’s Theory of Change (Kritsoni, 2005), the Plan-Do-Study-Act (PDSA) model was used to plan and implement this QI skin bundle project (Deming, 2000). The PDSA model is a simple yet powerful tool for accelerating quality improvement (IHI, 2012). The PDSA model has two parts: three fundamental questions, which can be addressed in any order, and the PDSA cycle to test changes in real work settings (IHI, 2012). The three questions are: 1) What are we trying to accomplish? 2) How will we know if the change is an improvement? and 3) What changes can we make that will result in improvement? (Deming, 2000). The second part of the PDSA model is the actual P-plan, D-do, S-study, and A-act cycle shown in Figure 1.
Two agencies that support the use of the PDSA cycle for quality improvement are the IHI, an agency that specializes in Healthcare Improvement, and the Agency for Healthcare Research and Quality (AHRQ, 2014). The IHI works to accelerate improvement by building the will for change, cultivating promising concepts for improving patient care, and helping healthcare systems to put those ideas into action.

The AHRQ is the nation's leading federal agency for research on healthcare quality, costs, outcomes, and patient safety. It is the health services research arm of the U.S. Department of Health and Human Services (HHS). The IHI strongly supports and encourages the use of the PDSA cycle for small tests of change in a healthcare setting (IHI, 2012).

The PDSA cycle provides a means to test a change—by planning it, trying it, observing the results, and acting on what is learned. This is the scientific method used for action-oriented learning (Deming, 2000). The steps in the PDSA Model are presented in Figure 1 and briefly described below.

**PDSA-Plan.** In the *Plan* phase, the QI skin bundle project’s implementation plan was identified. This includes identifying the items that will be measured.

**PDSA-Do.** The second phase of the PDSA is the *Do* phase. In this phase, the interventions and/or changes take place. For example, this may include implementing new processes, education, devices, or interventions. In addition, data collection was completed during this phase.

**PDSA-Study.** In the third phase, the data collection occurred. The data related to the practice change was evaluated. This phase is important in determining the actions in the next phase.
PDSA-Act. The last phase in the PDSA cycle is Act. In this phase, the author determined what actions should be taken as a result of this pilot project.

Figure 1. The Plan-Do-Study-Act (PDSA) model for this QI skin bundle project.
METHODS

This QI project evaluated the effectiveness of a skin bundle in decreasing the incidence of HAPUs on a SCI unit. Institutional Review Board (IRB) approvals were obtained from both the hospital and the University, and the data was extracted from the Patient Safety Intelligence System by the author. Existing data from all patients who were discharged from the SCI pilot unit between 2013 and 2014 was included. The Patient Safety Intelligence System captures all skin impairments, including PUs. Each of the pilot unit PU entries was validated by the wound nurse for accuracy of staging and etiology. Validation by the wound nurse was important for the purposes of this project, as reports in this system are often not accurate. In addition, the data was compared to existing PU diagnosis data in the medical records for consistency and accuracy.

The data was entered into an Excel spreadsheet and analyzed in Excel, while the Statistical Analysis System for Windows, version 9.3, (SAS Institute Inc., Cary, N.C.) was used to run the statistical analyses for this project. The date of onset was defined as the time when the HAPU occurrence was identified and recorded. The HAPU data was secured in a locked cabinet in the author’s office at the hospital. Only the author and the wound nurse had access to this data. Descriptive statistics were calculated to describe the sample and report the results.

This project estimated the frequency of development of new cases over a period of time. A longitudinal design was used to compare HAPU data over 12 months and retrospective data from the previous year to estimate incidence. The author had knowledge of the incidence rate prior to the interventions.
Setting

The setting for the project was a public hospital with 219 beds in southern California. The patients in this hospital receive a mixture of medical-surgical services and rehabilitation services. There are four rehabilitation units: stroke, brain injury, spinal cord injury, and pediatrics services. In addition, there are several units dedicated to acute services such as ICU, DOU, pressure ulcer management, ortho-diabetes, acute stroke, and medical-surgical services. The QI skin bundle project was initiated in a 21-bed SCI medical-surgical unit.

Sample

A convenience sample was used to obtain the sample. The sample consisted of patients from the SCI unit: 98 patients discharged in 2013 and 76 patients discharged in 2014. These patients vary by level of SCI and their length of stay. Some injuries were secondary from accidents such as motor vehicle, motorcycle, surfing, skiing, diving, gunshot wound, or falls. All patients were paraplegics or tetraplegics from SCI. Higher levels of injury correlate with an increased risk of developing a PU (Ploumis et al., 2011).

Skin Bundle Interventions

The practical application of this skin bundle included interventions developed by all members of the interdisciplinary team. The bundle had four main components: 1) a targeted nursing education program based on a needs assessment survey (Appendix A), 2) implementation of Skin Safety Cross (Appendix B), 3) new skin care products (Appendix C), and 4) modified Braden Scale Risk Assessment (Figure 1).
Nursing Education

The staff surveys were reviewed. Seven of the 20 questions revealed staff knowledge gaps. These were chosen to be the focus of the staff PU educational programs. The survey results were presented to the staff to show the variation in PU-related knowledge. The staff were informed of the plan to provide education and support to improve the unit’s current HAPU rate. A 10-step education program was created that included lectures, handouts, reference tools, and self-study modules on topics related to PUs and skin care. Continuing education hours (necessary for licensure/certification renewal) were provided to motivate the staff to complete the education program, and the staff were given two weeks to complete each module. Evidence-based practices to reduce PUs were included in the education program.

Skin Safety Cross

The Skin Safety Cross tool was implemented in the pilot unit (Appendix B). Prior to implementation, staff provided feedback that was used to modify the tool specifically for the SCI patient population. The tool was then implemented to provide a daily snapshot of HAPU and PU rates in order to heighten staff awareness.

Skin Care Products

In reviewing the staff survey assessment results, the team leaders identified a need to update the skin care products in the SCI unit. The QI skin bundle project introduced new skin care products, provided education, and included a skin care product algorithm to simplify the skin care products for staff (Appendix C).
Braden Scale Risk Assessment Changes

The review of current practice identified a need to update the Braden Scale Risk Assessment Tool (Table 1). This required several education components such as the Braden assessment risk score, Braden subscales, specialty surfaces, documentation, and specific interventions. The team leaders determined this education must include all licensed staff throughout the hospital since it was a change in current practice. Implementation of the new Braden tool was planned and conducted. The skin care policy was revised to reflect practice changes.

Root Cause Analysis HAPU Tool

The author and the wound nurse adopted a root cause analysis (RCA) tool, also known as a fishbone diagram (Appendix D), to be completed when a reportable HAPU occurred in the hospital. This would assist the hospital in better understanding the potential risks of HAPUs. The wound nurse completed a RCA for reportable HAPUs. The Joint Commission and AHRQ support the use of an RCA to identify processes and/or similarities between HAPUs for necessary improvements (The Joint Commission, 2012). The HAPU was discussed at interdisciplinary team meetings with representatives from medicine, nursing, PT, OT, quality improvement and risk management.

Evidence-Based Practice Implementation

To implement the QI project, the author identified the pilot team leaders. They were a group of experts who would determine and develop the skin bundle. The pilot team leaders consisted of an APN team leader, a wound care nurse, a nurse educator from the pilot unit and an APN educator from another unit. Their work included identifying current PU prevention practices in the pilot unit, a PU review of the literature for best
practice recommendations, and a review of policies and procedures regarding PUs from other hospitals.

The team identified the AHRQ-Preventing Pressure Ulcers in Hospitals, a toolkit for improving quality of care (AHRQ, 2012). Next, a survey was developed from this toolkit to assess the knowledge of the nursing staff with regard to PU prevention (Appendix A). The survey questions were reviewed by two PU experts, the chief physician of the pressure management service, and the nurse manager of the SCI unit to establish the face validity of the survey items (AHRQ, 2012). The survey was given to all the pilot unit staff to complete.

The team leaders attended staff meetings on the SCI unit regularly, allowing them to hear of any challenges and update staff on the progress of the QI skin bundle. The pilot unit staff participated in a needs assessment survey (Appendix A). The staff were encouraged to use the secure suggestion box created in the nurses’ documentation room to provide feedback and offer suggestions.

The team leaders appointed interdisciplinary (ID) champions to participate in the skin bundle project. The team leaders and ID champions met monthly with the staff to help them embrace the ongoing changes. The staff assisted in identifying what was needed to encourage successful implementation of the skin bundle project. To encourage “ownership” of this project, the staff were asked to name the QI project and make key decisions related to its implementation. The project was named the PUPPI project, which stands for Pressure Ulcer Prevention Protocols and Interventions. The team leaders began to work on educational materials and were assigned weekly tasks. The tasks included the creation and implementation of the education program, the implementation of the Skin
Safety Cross, modification of the Braden Risk Assessment Tool, facilitating changes to the medical record documentation, policy changes, introduction of new skin care products, coordinating and attending the weekly team leaders meeting, and monthly PUPPI champion meetings.

During this PUPPI project, the team created a skin resource board, located in the nurses’ documentation room, as a resource. It was updated monthly, at a minimum, with a “PUPPI Tip of the Month” to share information with all staff. The communication board was labeled “All About Skin”. The PUPPI project adopted a Lego theme to focus and embrace teamwork.

The ID team decided on a “see something, say something” campaign, and all staff received buttons to wear for PUPPI project awareness as well as to encourage staff to act and not hesitate to say something if they saw an issue related to HAPU.

Every month, the team leaders, ID champions, and staff discussed additional ideas and barriers to HAPU prevention. The ID champions, who are experts from their departments (Nursing, PT, OT, Dietary, Medicine, IT, Products Procurement, and Quality Improvement), consistently participated in the project and monthly meetings. The team came up with ideas at each meeting and members were divided into small teams to work on the assigned tasks. All members actively participated in the meetings to ensure the goals were achieved within the established timeframe. Meetings included trained coaches who structured the meetings in a question format rather than as a typical team meeting. This method allowed brainstorming as well as the sharing of open ideas and solutions. It was a great way to engage everyone at the meeting and make it fun.
Analysis

The incidence of HAPUs was measured to evaluate the effectiveness of this QI project. The author worked closely with IT and the wound nurse to create a report that would reflect PUs and HAPUs per patient on discharge from the pilot unit and each hospital unit. Measuring incidence data from the medical record and comparing it to the Patient Safety Intelligence System (verified by the wound nurse) allowed the author and hospital to compare validated HAPUs in the pilot unit. Currently, the HAPUs were not cross compared to the medical record; however, during this project, all data was cross compared with the medical record upon discharge. The percentage change was calculated to describe the difference in HAPUs from 2013 to 2014.

Descriptive statistics were used to describe sample characteristics and the incidence of HAPUs. Included in the sample were patient’s gender, type of spinal cord injury, and age (Table 2).

Results

The purpose of this project was to determine whether introducing a skin bundle, focused on staff education and other changes, would decrease HAPUs in the SCI unit. HAPUs in fact decreased from 26 in 2013 to 9 in 2014, which was an overall decrease of 65.4%. Suspected Deep Tissue Injuries also decreased from 15 to 6, representing a decrease of 60% (Table 3). None of the baseline characteristics of the patient population (gender, ethnicity, medical coverage, level of injury, etc.) changed significantly from 2013 to 2014 (data not shown).
Table 2

*Demographics of Patients on Pilot Unit as measured in 2014*

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>n = 76</td>
<td></td>
</tr>
<tr>
<td>Paraplegics</td>
<td>50</td>
<td>65.8%</td>
</tr>
<tr>
<td>Tetraplegics</td>
<td>20</td>
<td>26.3%</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>7.9%</td>
</tr>
<tr>
<td>Patient’s Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>66</td>
<td>86.4%</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>13.6%</td>
</tr>
<tr>
<td>Patient’s Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-29</td>
<td>6</td>
<td>7.9%</td>
</tr>
<tr>
<td>30-39</td>
<td>18</td>
<td>23.7%</td>
</tr>
<tr>
<td>40-49</td>
<td>24</td>
<td>31.6%</td>
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<tr>
<td>50-59</td>
<td>22</td>
<td>28.9%</td>
</tr>
<tr>
<td>60+</td>
<td>6</td>
<td>7.9%</td>
</tr>
</tbody>
</table>
Table 3

Hospital-Acquired Pressure Ulcers (HAPUs) within the Pilot Unit (2013 and 2014)

<table>
<thead>
<tr>
<th>HAPU</th>
<th>2013 n = 26</th>
<th></th>
<th>2014 n = 9</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage I</td>
<td>3</td>
<td>11.5</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Stage II</td>
<td>6</td>
<td>23.1</td>
<td>2</td>
<td>22.2</td>
</tr>
<tr>
<td>Stage III</td>
<td>2</td>
<td>7.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>sDTI</td>
<td>15</td>
<td>57.7</td>
<td>6</td>
<td>66.7</td>
</tr>
<tr>
<td>Location</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ankle</td>
<td>1</td>
<td>3.8</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Coccyx</td>
<td>2</td>
<td>7.7</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Foot</td>
<td>4</td>
<td>15.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Forearm</td>
<td>1</td>
<td>3.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Heel</td>
<td>8</td>
<td>30.8</td>
<td>5</td>
<td>55.6</td>
</tr>
<tr>
<td>Ischium</td>
<td>2</td>
<td>7.7</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Leg</td>
<td>1</td>
<td>3.8</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Sacrococcyx</td>
<td>1</td>
<td>3.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sacrum</td>
<td>2</td>
<td>7.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Thoracolumbar</td>
<td>1</td>
<td>3.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Toe</td>
<td>3</td>
<td>11.5</td>
<td>1</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Note. Most common Stage and Location are in boldface. Data source: Patient Safety Intelligence System and verified by the wound nurse. Data included all discharges from 2013 and 2014 on pilot unit. sDTI = Suspected Deep-Tissue Injury.
The rates of HAPUs varied by quarter. Figure 2 shows the trends of HAPUs by quarter in 2013 and 2014. No factors that may help to explain this variance were identified by the author. However, the HAPU rates were decreased by 65% in 2014.

Figure 2. The number of HAPUs by quarter.

There were no significant findings between 2013 and 2014 in comparing health care plans of patients. Almost 50% are covered by Medicare (Figure 3). The author also compared race/ethnicity of patient discharged between 2013 and 2014 shown in Figure 4, there were no significant findings that may contribute to the project results.
Figure 3. Health insurance plans on pilot unit.

Figure 4. Race/Ethnicity of patients on pilot unit.
DISCUSSION AND CONCLUSION

The purpose of this QI project was to evaluate the effectiveness of the skin bundle in reducing the incidence of HAPUs. The results of the project showed there was a 65% reduction in HAPUs in the pilot unit. The project interventions were successful in raising staff awareness and ownership of each patient’s PUs.

This HAPU reduction represents a potential cost saving of $34,000 to $680,000 in the treatment of a PU. During the project, the team identified that the largest number of HAPUs were occurring on the heels and not the sacrum as previously presumed. The team addressed the heel protectors as a potential cause of HAPUs and made such investigation a priority. The team was successful in reducing heel HAPUs in 2014 by 60%.

The author found it interesting that the stages of HAPUs decreased in 2014 when compared to 2013. When reviewing the data, there were no significant differences in patient demographics, including the length of stay. This leads the author to conclude that the key effective differences were the interventions and awareness of the QI project.

The successes were achieved by dedicated team leaders and ID team members who were engaged and present at the monthly meetings to support this project. Our project was successful because the staff were aware of the project’s goal to reduce HAPUs across the unit and they were engaged. It was clear to the staff that all HAPUs and PUs would be reviewed during this pilot project and this included the PU documentation and Braden assessments. The nurses were engaged in the project and wanted to improve their HAPU rates, thus they accomplished the goal. The author found
it invaluable to have staff and ID participation in this project as it contributes to the project’s success.

The 10-step education program continues in the pilot unit. Not all 10 steps were implemented during this project phase. Once the implementation is complete, the team leaders will modify the tools/education as needed and then identify the next hospital area in which to implement the QI project.

The QI project was able to reduce HAPUs and so the next step is to ensure sustainability. The literature shows that few studies commented on the long-term sustainability of the intervention, and there was little in the literature to suggest how improvements could be maintained (Niederhauser et al., 2012). However, it does suggest that continuous monitoring of PU rates, the presence of a wound nurse or unit champions, and continued formal and informal education seem to be some of the elements that could positively influence the maintenance of positive outcomes (Neiderhauser et al., 2012). In addition, the literature strongly supports the use of ID teams that work together to redesign clinical delivery processes as an effective and efficient addition to any organization.

Two strategies have been identified that are intended to sustain the skin bundle project. First, it is important to continue to monitor and provide monthly feedback to staff regarding the HAPU rates. The second strategy is to utilize the ID team to conduct monthly peer review PU documentation audits to ensure consistency among healthcare providers. Both strategies will help to ensure the QI project results continue.

In planning to implement this QI project across the hospital, the education modules will be simplified. The original modules were created for the pilot unit nurses
who primarily cared for high risk SCI and post flap surgery patients. In moving this QI project outside the pilot unit, the educational materials will be modified to focus on more general aspects of PU prevention.

The prevention of PUs is complicated and a multifaceted, interdisciplinary, collaborative approach is required to mitigate this devastating complication. The skin bundle interventions created by the team were the key to the success of this project. Our work demonstrates that evidence-based approaches to prevention and a dedicated team both reduce the number of reportable HAPUs in a population at high risk of this preventable problem. The plan for future work includes sustaining the improvement and spreading the project to each of the patient care areas. Regardless of the healthcare setting, it is important that all healthcare providers (e.g., nurses, physicians, therapists) be consistent when staging PUs. Our goal is to provide education to the ID teams throughout the hospital in order to engage all healthcare team members.

As health technology transforms documentation into electronic health records, the consistency of PU documentation across all patients units and healthcare systems will be viewable, and eventually publicly reported. Now more than ever, ID team members need to be knowledgeable about regulations and trends in various healthcare settings. The team leaders emphasized throughout the education the importance of determining whether a PU was present on admission or was hospital-acquired. The staff compliance and understanding of this concept showed improvement, as evidenced by the project’s outcome.

The PDSA cycle was a valuable tool that allowed the team to test a small change over a one or two week period. This allowed many ideas to be tested; some were
supported while others were not. The literature supports the use of the PDSA in QI projects, and in this skin project it facilitated feedback from staff and the modification of tools. The PDSA will be valuable in spreading the changes to every hospital unit.
REFERENCES


APPENDIX A

STAFF ASSESSMENT SURVEY

SCI Pressure Ulcer Management Survey

1. Applying your clinical knowledge, identify which patient(s) have the greatest risk for pressure ulcer development?
   a. Diabetic, ambulatory, high income
   b. Spinal cord injury, smoker, spasms
   c. Multiple tattoos, incontinence, Caucasian
   d. High blood pressure, perspiration, 25 years old

Answer the next three questions as they apply to the 3 North Pressure Ulcer Management Service

2. What is the most common site?
   a. Heels
   b. Sacral
   c. Ischial
   d. Occiput

3. What is the most common stage of pressure ulcer’s developing in the Pressure Ulcer Management service patient’s this year?
   a. sDT1
   b. Stage 1
   c. Stage 2
   d. Mucosal
   e. Unstageable

4. What is the most common reason(s)?
   a. Dry skin
   b. Recent surgery
   c. Pressure and Friction/Shear
   d. Spinal cord injury and low blood pressure
   e. All of the above

5. Using the Braden Scale for Predicting Pressure Sore Risk, you identified that your patient is at highest risk for skin breakdown due to friction and shear. What is an appropriate intervention you can recommend to prevent this type of breakdown?
   a. Lift patient, do not drag
   b. Apply a diaper while in bed
   c. Keep head of bed at 45 degrees
   d. Apply sufficient Aquaphor ointment to ensure patient slides easily
6. A paraplegic patient is admitted from LAC-USC with a Stage 3 pressure ulcer to the sacrum. The patient’s wife tells you he developed the wound because he experienced multi-organ failure, sepsis, resuscitation, and required the head of the bed to be 45 degrees at all times while on a Rite Hite Clinitron bed. What steps should the RN initiate on admission?
   a. Complete a PSN, Report to State, Apply a wound vac
   b. Take a picture of the wound and endorse to the next shift
   c. Call the Wound Care Nurse to initiate care plan, complete a PSN, and discuss with MD
   d. Skin inspection, risk assessment, inform MD, complete a PSN, initiate a care plan, specialty bed, initiate consults

7. The correct procedure for checking an air mattress/cushion every shift is:
   a. Push down and if it feels soft it is okay.
   b. Ask the patient if it feels like they have enough air underneath them.
   c. The air mattress should be OK once it is blown up and does not need to be checked.
   d. Do a hand check by placing palm up and feeling for a cushion of air under the heaviest of areas of the body.

8. At minimum, how often should you, the RN, assess and document skin condition?
   a. Daily
   b. Once a shift
   c. Upon admission and discharge.
   d. Upon admission and discharge, every shift, and as patient condition warrants

9. When should you, the NA, look at your patient’s skin to look for signs of redness, dryness or skin discoloration?
   a. During bathing
   b. During cleaning
   c. During changing
   d. During dressing
   e. All of the above

10. What should you report to your patient’s RN every shift?
    a. Skin tears
    b. Open sores
    c. Discoloration of skin, such as red, blue, or purple
    d. All of the above

11. Mr. Montoya is a diabetic ambulatory patient who was admitted to your unit yesterday evening. He is status post day 5 from a left below knee amputation (BKA), is depressed, has frequent diarrhea, and insists on wearing a diaper in bed. He has been refusing to turn often because of pain in his back. As the RN, what would be the best plan of care to prevent pressure ulcers?
a. **Educate patient on skin care management**
   b. Turn patient every 2 hours despite patients’ objection, it is the policy.
   c. Pad bed with five layers of linen and underpads to protect bony prominences
   d. Listen to the patient’s request and do not turn them, wait until Kardex to inform MD.

12. You admitted a SCI patient who is a 65 year old female on Friday evening from Harbor UCLA with a right knee immobilizer. The discharging Orthopedic doctor wrote an order “Do not remove, keep on at all times”. The admitting doctor wrote orders to follow previous order. As an RN, what would be the best action?
   a. Do not touch or remove the immobilizer
   b. Remove immobilizer with no precautions. The skin must be inspected.
   c. Have patient remove the device herself for your skin inspection. The MD’s order did not tell the patient what she can or cannot do.
   d. **Inspect skin around and underneath immobilizer at least every shift and place hands under straps to palpate for any texture changes. Assess for pain under device and advocate for Ortho consult ASAP.**

13. You are cleaning a patient who has frequent liquid stool. After wiping their buttocks you see a shallow wound about the size of a pencil eraser on the patient’s tailbone that has 95% pinkish-red bumpy tissue and 5% moist yellow tissue in the wound bed. What type of wound is this most likely to be?
   a. Excoriation
   b. Fungal wound
   c. Stage 2 pressure ulcer
   d. **Stage 3 pressure ulcer**
   e. Incontinence Associated Dermatitis

14. A paraplegic patient has a small brown-colored scab over his left ankle. He tells you, “I have had this wound for about 3 years now and it always scabs over and then reopens.” What would be the most appropriate wound dressing for this patient?
   a. Leave open to air
   b. Must apply whatever the doctor orders.
   c. **Apply a moist dressing to soften the scab.**
   d. Use a small scissor and carefully trim off the scab. Then apply Bacitracin ointment and Xeroform gauze.

15. At the beginning of your shift on 3 North, you are aware of which of your patients have pressure ulcers and the stages of their ulcers?
   a. Rarely
   b. Never
   c. **Always**
   d. Occasionally
   e. Most of the time
16. You have a 250 pound patient who must be positioned 30 degrees or higher due to aspiration precautions. Patient’s skin is often moist with perspiration and he has some blanchable red patches in the groin and perineal area. The patient is able to reposition self, but only with verbal reminders. Patient ambulates with PT. Which would be the most appropriate sleeping surface?
   a. NP100
   b. Volkner
   c. Clinitron
   d. Envision

17. The best way to provide pressure relief for a patient in bed is to alternate their position every 2 hours, onto their back, right hip, and left hip.
   a. True
   b. False

18. You have a patient who has an order for TED hose after surgery. TED stockings should be removed and skin inspected. You will:
   a. Attempt to do, but can only do it if time allows.
   b. **Ensure TED hose is removed at least once during your shift.**
   c. Not remove, patients skin will not breakdown from TED hose.
   d. Should not remove TED hose, they are there to prevent blood clots.
   e. Will only do if patient is requesting or patient complains of pain in this area.

19. A patient with a wound is scheduled to be discharged home with a home health nurse, who will be performing dressing changes once discharged. What is the likelihood that you will teach the patient and family how to perform the wound dressing prior to discharge?
   a. Will only provide a paper handout with dressing instructions.
   b. Will not educate patient, home health nurse will perform dressing changes.
   c. **Will ensure patient and family can provide return demonstration and understanding.**
   d. Likely to educate, but it is not a priority for family and patient to return demonstration and understanding.

20. What are some reasons why you cannot provide timely pressure ulcer prevention care to your patient’s as you anticipated or would like to throughout your working shift? What are some possible solutions to the reasons you described?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
APPENDIX B

SAFETY SKIN CROSS

<table>
<thead>
<tr>
<th>SAFETY CALENDAR</th>
<th>MONTH: December 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UNIT:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital acquired:</td>
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</tr>
<tr>
<td>Admitted with:</td>
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</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>29   30   31</td>
<td></td>
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</table>
## APPENDIX C

### SKIN CARE PRODUCTS

<table>
<thead>
<tr>
<th>SKIN TYPE</th>
<th>Step 1: Non-rinse Cleanser</th>
<th>Step 2: Moisturizer</th>
<th>Step 3: Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRY SKIN</strong></td>
<td>Pat dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MOIST SKIN</strong></td>
<td></td>
<td>Pat dry</td>
<td></td>
</tr>
<tr>
<td><strong>OPEN/CONSTANTLY MOIST SKIN</strong></td>
<td></td>
<td></td>
<td>Gently remove with non-rinse cleanser</td>
</tr>
</tbody>
</table>
APPENDIX D

FISHBONE DIAGRAM HAPU RCA
(Adopted from IHI, 2013)
## APPENDIX E

### TABLE OF EVIDENCE FOR PROPOSAL

**Summary of Studies Including Hospital-Acquired Pressure Ulcers**

<table>
<thead>
<tr>
<th>Purpose, (Author(s), Year)</th>
<th>Sample and Setting</th>
<th>Measurements and Operational Definitions</th>
<th>Results or Findings</th>
<th>Conclusions, Limitations, and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate a Multidisciplinary Skin Project to reduce the prevalence of HAPUs. (Armour-Burton, Fields, Outlaw, &amp; Deleon, 2013)</td>
<td>Included 85 nurses working in So. California Hospital with 41 beds. Participation and implementation from summer 2005 to summer 2006. Most common diagnoses were pulmonary, cardiac, and renal disease.</td>
<td>Introduced several interventions that included: wound liaison nurse, three-part staff education guided by a skin education manual, and algorithm for pressure ulcer management to evaluate effectiveness.</td>
<td>Prevalence of HAPUs decreased consistently to 0% from 18.92%. Prevention and multidisciplinary approaches were effective in reducing the occurrence of HAPUs. It is more costly to treat a PU than to prevent one.</td>
<td>Nurses who do not receive education and tools for assessing and documenting PUs have an increased chance of not identifying a PU or the risk of developing a PU. Nurse demographics were not mentioned to compare job tenure, age, and gender.</td>
</tr>
<tr>
<td>To evaluate the difference between SCI pts. admitted to model SCI trauma centers versus non-SCI trauma centers to determine any differences in medical stability and LOS. (Ploumis et al., 2011)</td>
<td>209 SCI pts. admitted to IRF between 2005-2007. Included pts. from a model SCI trauma center (n = 78) and a non-SCI acute hospital (n = 131); gender and level of injury were not mentioned. Settings included regional SCI Center and a University hospital both located in Delaware, Philadelphia.</td>
<td>Observations included chart review of pressure ulcer documentation and nursing care provided. Acute care LOS, IRF LOS and total LOS were compared between pts. transferred to IRF from the SCI center and from non-SCI centers to determine any significance in outcomes.</td>
<td>SCI pts. admitted to IRF from the SCI trauma center had significantly shorter acute care LOS (P = 0.01). More patients from non-SCI centers (n = 44, 34%) than SCI centers (n = 24, 12%) had PUs. The percentage of patients with stage III and stage VI (6% SCI, 11% non-SCI) was not significantly different (P&gt;0.05).</td>
<td>Neurological findings were a significant factor, which could increase pts. LOS at either medical setting. Patient demographics were not identified.</td>
</tr>
<tr>
<td>Purpose, (Author(s), Year)</td>
<td>Design and Key Variables</td>
<td>Sample and Setting</td>
<td>Measurements and Operational Definitions</td>
<td>Results or Findings</td>
</tr>
<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>To evaluate methods for establishing a PU prevalence and prevention program in a long-term care setting. (Moore &amp; Cowman, 2011)</td>
<td>Cross-sectional survey design.</td>
<td>1100 residents of long-term care settings in rural and urban centers located in the Republic of Ireland from 2007 through 2008.</td>
<td>Data collected from nursing notes and skin inspection of pts. All PUs were staged using the EPUAP grading system.</td>
<td>PUs were found in 100 pts. (9%). 83% of the PUs were located in the sacrum or heel. 33% were classified as stage II; however, 24% were classified as the most severe PU stage IV. Braden scale calculations identified that 77% of the study participants were not at risk or were at low risk of PUs developing. Individual components of the Braden scale identified that 53.5% were either completely immobile or had very limited mobility.</td>
</tr>
<tr>
<td>To evaluate the effectiveness of a skin and wound assessment</td>
<td>Exploratory. study DV: HAPUs. IDVs: Multiple interventions to Evaluation of two units including: 14-bed Neuroscience ICU and 18 beds in a New York University hospital. Sample</td>
<td>In establishing best practices for reducing HAPUs, the hospital implemented a SWAT team of expert skin and</td>
<td>Number of HAPUs in 2008 in the Neuroscience ICU was 23; in 2009, the number was reduced to 12 (reduction of 48%); in</td>
<td>Validated the value of educating and motivating the RNs and NAs to make a difference in reducing HAPUs. This should be</td>
</tr>
<tr>
<td>Purpose, (Author(s), Year)</td>
<td>Design and Key Variables</td>
<td>Sample and Setting</td>
<td>Measurements and Operational Definitions</td>
<td>Results or Findings</td>
</tr>
<tr>
<td>---------------------------</td>
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<td>team in reducing HAPUs. (McGuinness et al., 2013).</td>
<td>reduce HAPUs.</td>
<td>not stated.</td>
<td>wound nurses.</td>
<td>2010 it was 10 (reduction of 57%); and, finally in 2011, it was only 9 (reduction of 61%).</td>
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| Evaluate the effectiveness of resource-efficient planning for PU prevention. (Ostadabbas et al., 2012) | Exploratory study. DV: PU incidence. IDVs: Pressure mapping mat, PUs, nursing staffing, air mattresses, and patient position when lying or sitting. | Acute long-term care, for profit, located in Texas. N = 35 pts. | Collection and review of pressure mapping data from a commercial pressure mat assembled on a hospital bed. Documentation and observation occurred daily while pts. were in bed and in wheelchairs. Reviewed PU incidence data from previous year as a baseline to measure results. | Researchers formulated a solution for measuring nursing effort, which including an optimal position schedule to avoid PUs. The pressure position table was adjusted for each pt. with data collected using a commercial pressure mat, which proved beneficial for the pts. The computerized program identified optimal and suboptimal positions for pts. | Confirmed the effects of constant pressure on skin over bony prominences as a major predictor in developing PUs. Further information needed to identify length of time required to fully or partially recover from the initial pressure exposure. Study identified the need for further similar studies. |

<p>| To identify | Cross-sectional N = 168 stroke pts., aged | Data collection used the | Significant predicting | Findings suggest that |  |</p>
<table>
<thead>
<tr>
<th>Purpose, (Author(s), Year)</th>
<th>Design and Key Variables</th>
<th>Sample and Setting</th>
<th>Measurements and Operational Definitions</th>
<th>Results or Findings</th>
<th>Conclusions, Limitations, and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>various predictive factors of PUs in older stroke patients. (Suttupong &amp; Sindhu, 2011)</td>
<td>survey design. DV: PUs. IDVs: Stroke diagnosis, age 60 and older, sufficient cognitive (mini-mental state examination &gt;24,) and verbal skills to be able to complete study instruments.</td>
<td>between 60-93 years old, living in a long-term care facility or in the community, in three districts of metropolitan Thailand. Data collected from September 2010 to January 2011.</td>
<td>following tools: validated Braden skin assessment tool, neurological scale, social support questionnaire, and geriatric depression scale.</td>
<td>factors for PUs identified were activity, moisture, nutrition, friction and shearing, and depression. Eighty patients developed PUs, which was significant (47.6% of sample). PUs continue to be a serious problem, physiological factors and depression were found to be significant predicting factors for developing PUs. The incidence of PUs was 28.9% in community and 27% in long-term care units. PUs are associated with increased mortality rates, longer lengths of hospital stay and direct cost of patient care.</td>
<td>healthcare providers assess activity, moisture, nutrition, friction, and shearing, as well as psychological assessment for depression. However, this information is not consistently incorporated in pts. care plans and education to reduce PUs. Researchers found that skin assessment and specific interventions decreases PU development.</td>
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<td>Evaluate the effectiveness of treatment in ICUs compared with general hospital wards in reducing PU incidence. (Lahmann, Kottner,</td>
<td>Cross sectional study. DV: PU incidence. IDVs: Prevention interventions, bed surface, repositioning of pts., risk level, N = 32,400 pts. PU surveys collected from 256 German hospitals. Data collected from 2002-2009.</td>
<td>Modified interventions and provided education to evaluate the incidence of PUs over time. Identified differences in PU staging between hospital wards and ICU, pts. characteristics, individual pt. risk factors.</td>
<td>Pts. treated in ICU have a greater risk of developing PUs compared to pts. treated in hospital wards. Findings showed a reduction in PUs occurred during the survey period, which validated the effectiveness of interventions in reducing PUs.</td>
<td>Study identified the delay between the genesis of PUs and the moment they become clinically visible. Authors identified the need for further studies. The authors identified that the results of this study are not directly linked to the</td>
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<td>Dassen, &amp; Tanner, 2011)</td>
<td>and multiple diagnosis.</td>
<td></td>
<td>and the application of preventive interventions were expressed by prevalence odds ratios with 95% confidence intervals.</td>
<td>PU incidence.</td>
<td>quality of care in these clinical specialties.</td>
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<td>All predictors were included in a logistic regression model to assess the probability of developing a ward-acquired stage 1-4 PU.</td>
<td>Overall, hospitals that address surface, repositioning, immobility, shear forces, age, and gender, confirmed that the institutional factor of ICU vs. hospital wards was no longer a high-risk factor for the development of PU.</td>
<td>Data related to the origin of PU wounds was unknown for 25% of hospital wards and 15% ICUs.</td>
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| Evaluate the effectiveness of a QI initiative to decrease rates of costly PUs by introducing various interventions. (Catania et al., 2007) | Retrospective chart audits. QI initiative: PU Prevention Protocol Interventions (PUPPI). DV: HAPUs. IDVs: Nurse education, skin assessment and nutrition status, providing skincare, documentation, staff motivation, and PU awareness. | N = 700+ pts. participated from 5 inpatient nursing units at a State University Cancer hospital in Columbus, Ohio. Data collected from 2003-2005. | Data sources and measures included prevalence data, incidence data, and NDNQI data. Retrospective chart audits of pts. pre- and post-PUPPI initiatives. | After PUPPI implementation, nurses were more proactive than reactive regarding skin care issues. PU incidence was reduced by more than 50% across the nursing units. Post implementation documentation compliance showed skin assessments were 90%, validated through chart review. The HAPU rates decreased from 11.36% to 2%, which remained below the NDNQI’s benchmarks. | Authors identified the challenge of consistent ongoing support and education for the nurses by the Clinical Nurse Specialist. Improvements in communication and critical thinking have a significant impact on improved pt. quality of care and outcomes. No demographic tables describing pts. were included in this study. |

**Note.** AC = Acute Care; CMS = Centers for Medicare and Medicaid Services; HAPUs = Hospital-Acquired Pressure Ulcers; ICU = Intensive Care Unit; IRF = Inpatient Rehabilitation Facility; IRB = Institutional Review Board; LOS = Length of Stay; RN = Registered Nurse; R = Rehabilitation; NA = Nursing Attendant; NDNQI = National Database Nursing Quality Indicators; NPUAP = National Pressure Ulcer Advisory Panel; PCU = Progressive Care Unit; Pts. = Patient’s; PUs = Pressure Ulcers; PUP = Pressure Ulcer Prevalence; QOC = Quality of Care.