Hospital-Acquired Pressure Injury (HAPI) Preventative Bundle (HAPIPB):

A Quality Improvement (QI) Project

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Abstract

For years it is common knowledge that pressure injuries are preventable. Hospital-acquired pressure injuries/pressure ulcers (HAPI/HAPU) are not only costly for the hospital but detrimental to patient quality of life. A quality improvement project was created to implement a HAPI Preventative Bundle (HAPIPB) to address financial concerns and elevate the patient experience. In the intensive care unit, three recorded cases of HAPI before the commence of the project a baseline data. Review of literature presented the European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel HAPIPB and implemented in the unit.

The bundle included: Risk and Skin Assessment, Reposition, Microclimate Control, Nutrition, Support Surfaces. The staff was educated on the HAPIPB and audits were performed to check effectiveness. The project is carried out over three months. Data were coded into a Statistical Package for the Social Sciences (SPSS) and Data analysis was performed. The results supported a decrease in the number of HAPI more than 100% hitting ground zero during the implementation of the project and post-implementation. The data presented opportunities for improvement and the project illustrated the impact of HAPIPB on the prevention of HAPIs in the intensive care unit.

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Background

Exceptional healthcare outcomes begin with quality nursing care that commences with the integration, and translation of the latest research transformed into evidence-based practice (EBP) guidelines in the clinical practice arenas (Brown, 2018). The complexity of the healthcare system requires a method on how to adapt to the changing environment (Clancy, 2009). EBP is a process that utilized the latest research or known as best practices or gold standards, to utilize as a way of clinical pathways to guide the critical decision on the care of individuals, patients, and/or populations (Plsek & Greenhalgh, 2001). It is an approach to improve the quality of nursing care towards equitable outcomes that are scientifically-based and precise (Hughes, 2008). The streamline of EBP into the healthcare setting allows for new methods of clinical pathways to promote growth in the healthcare system (Ishfaq et al., 2016).

Clinicians are essential to practice to their highest of knowledge for clinicians to work to the best of their knowledge and ability in ensuring that the patient is receiving and being advised about the best available treatment and practices hence quality decisions (Melnyk et al., 2016). There might be a vast amount of evidence-based practices, but most of them are not being implemented in clinical practice without the help of doctorly prepared nurses.

The patient that developed preventable HAPI or HAPU (Hospital-Acquired Pressure Ulcer) is at greater risk for infections and complications, increase length of stay, and potential undergoing surgical interventions (Spector et al., 2016). In the advent of 2010, the Centers for Medicare and Medicaid Services (CMS) changed its policy in regards to reimbursement for the cost associated with hospital-acquired pressure ulcers or now known as HAPI (Padula et al., 2016). The CMS acknowledged that HAPI is a preventable event hence declared nonpayment and deny reimbursement for any HAPI-related treatment costs (Padula, et al., 2015). Upon

evaluation of University Health Systems Academic Medical Centers or now known as Vizient Healthcare in the United States, there have been 10,386 HAPI cases from 2008 to 2012 (Padula, et al, 2015).

The National Database of Nursing Quality Indicators (NDNQI) had estimated that the average HAPI costs about $38,700 about $3.8 billion effects on the US economy (Swafford et al, 2016). Currently one of the University Health Systems Academic Medical Centers presented an increasing rate of HAPI on the healthcare system. The health system has outdated best practices on preventing HAPI and does not have a prevention bundle in comparison to other clinical indicators. To address this concern and continue to improve care outcomes, and potentially reduce HAPI rates; in response to this call to action, is the implementation of a HAPI Preventative Bundle (HAPIPB).

Problem Statement

A 700+ licensed bed level one academic medical center part of the Vizient Healthcare University Health Systems has had increases HAPI cases which is costly to the organization (Frank et al., 2017). In response to this trend, the development of a HAPIPB will be integrated into the health system to reduce the incidents of HAPI cases. Upon evaluation of the project site and various interviews from stakeholders: nursing administration. The nursing staff had changed significantly for the last few years as the organization faced a surge of top to down retirements; and, hired a large amount of novice to the expert nursing staff at various levels.

With the onboarding process, new systems, new cultures, and constant change revealed a gap in knowledge and best practices. The integration of HAPIPB into the health system reduces the incidents and prevalence of HAPI cases, and to fill in knowledge gaps to novice and expert

nursing staff. This is in support of the nursing leadership's financial stewardship initiatives to not only assist with elevating quality nursing care but maximizing reimbursement (Coyer, 2015).

Purpose Statement

The purpose of the EBP HAPIPB is to investigate the reduction of pressure injury incidence and prevalence in the adult critical care or intensive care patient population environment and address any clinical knowledge gaps.

Project Question

Does a HAPIPB assist in reducing HAPI rates in the adult critical care and/or intensive care patient population of a level one academic trauma medical center within a 5-week timeframe?

Objectives

In the timeframe of the DNP Project, the following objectives will be met:

1. HAPI data set will be extracted from the Incident Reporting (IR) solutions within the last month as preliminary data benchmark for HAPI rates; in addition, a validated chart audit tool questionnaire of nursing activities will be utilized to gain preliminary and post-intervention data.
2. Develop real-time coaching to introduce HAPIPB to clinicians within five weeks timeframe.
3. Data from IR solutions will be evaluated after the real-time coaching/implementation of the intervention; in addition, raw data will be analyzed for correlation points to determine the effectiveness of the HAPIPB; current cases 27 hospital-wide from the last eight quarters, the pilot unit/department developed three cases which are the highest of 27 total cases. The target is to reduce HAPI cases by one and compare the hospital to the national benchmark.

Literature Review: Significance of Evidence to Profession

The cost of care related to HAPI continues to increase annually and the estimated cost of care is about $50,000 to $150,000 per pressure injury (Kirkland-Walsh et al., 2015). In addition to the cost of care, the in-hospital mortality rate associated with HAPI increase by 11.2% (Rondinelli et al., 2018). Preventing HAPI has been a major focus on many healthcare delivery systems because CMS does not reimburse for the associated with the preventable event. Also, the quality of care suffers and prolongs hospital admission. In a large academic trauma one medical center based on trends, HAPI cases are rising and account for 27 cases in the last are eight quarters. These cases are equivalent to about $1,350,000 to $4,050,000 cost of hospitalization that is not reimbursed. Therefore, HAPIPB as a quality improvement project is introduced to assist with the efforts to reduce the HAPI cases hospital-wide.

Review Coverage and Justification

Through the various review of literature databases including EBSCO, CINAHL, PUBMED, and Google Scholar found several pieces of literature. Exclusion criteria included non-peer review articles, articles published before 2015, and single-author articles. Inclusion criteria include studies from a specific timeline from 2015 to 2020, peer-reviewed, and multi authors research articles. Initial search terms used in a setting of text phase within the content of the article ‘hospital-acquired pressure ulcer’ yield 17,000 related articles, changed term ‘ulcer’ to ‘injury’ yield 17,100 related articles.

The second strategy modifying the setting of the text phase to search within the title yield 37 related articles for HAPU, and 38 related articles for HAPI. The third strategy is to include ‘prevention’ which yields 10 related articles for HAPU and 12 related articles for HAPI (Polit & Beck, 2016). Nine total articles are evaluated and considered due to the methodology of the

research design. Furthermore, national pressure ulcer prevention standards were review by the Agency for Healthcare Research and Quality (AHRQ) and The United States National Pressure Injury Advisory Panel (NPIAP) a National standard, which has an alliance and peer review collaboration with the European Pressure Ulcer Advisory Panel (EPUAP), and Pan Pacific Pressure Injury Alliance (PPPIA) in alliance provides gold standard EBP recommendation on prevention of HAPI both nationally and internally. Also, the project site intranet was looked over for policy and procedures related to HAPI or HAPU bundles and a gap justified the need for the bundle (NPIAP, 2019).

Review Synthesis

HAPI can have a negative impact on patient outcomes, patient/family experience, relationship-based care, nurse satisfaction, and can be financially costly. Root cause analysis revealed inconsistent strategies for pressure injury prevention (Tayyib & Coyer, 2016). An increase in HAPI rates leads to the development of HAPIPB; according to Institute for Healthcare Improvement (IHI) (2019), that bundle is defined as standardizing processes of care based on evidence-based research to improve patient outcomes. Anderson et al (2015), conducted a quasi-experimental study of various intervention known as the prevention injury bundle that resulted in a significant decrease of HAPI from 15.5% to 2.1% the research's bundle comprised of five traditional components which are; skin emollients, assessment of health-to-toe, floating heels of the bed, early identification of courses of pressures, and repositioning (Anderson et al., 2015).

Whereas Krupp and Monfre (2015) evaluated components associated with the success of the bundle including involvement of all key stakeholders, staff education, pressure injury prevention teams, and continued audits and feedback (Krupp & Monfre, 2015). In addition,

Coyer et al 2015, conducted a quasi-experimental with a control group and intervention group to compare the InSPiRE protocol which is a bundled intervention of; assess skin integrity, strategies to prevent pressure injuries, protect from pressures, and friction reduced pressure injuries from 30% to 18%. These interventions are similar to Anderson et al (2015) research study. Though only Coyer et al 2015 research study considered the mechanical related pressure injuries and targeted intervention for this purpose.

Reviewing all the articles discussed revealed a common theme on the assessment of skin integrity which requires two clinician's verification and/or assessment of the presenting pressure injury (Swaffored, Culpepper, & Dunn, 2016). The two-clinician process of assessing pressure injury not only a safe practice but encourages collaboration within the clinicians for actions (Hommel et al., 2017). Along with the two clinical verification processes within the bundle include certain facility standards such as the use of media application technology for capturing patient-specific pressure injuries not only for the documentation but to track the improvement of the skin injury (Kirkland-Walsh, 2017).

National standard of pressure ulcer/injury prevention was reviewed including AHRQ and WOCNS (Wound, Ostomy, and Continence Nurses Society), both organization preventative information was derived from the National Pressure Injury Advisory Panel (NPIAP) on pressure ulcer prevention clinical practice guidelines.

The NPUIP is an international collaboration that developed a validated evidenced-based recommendation on prevention of pressure ulcers that classified research articles on level of evidence as well as strength of evidence (SOE) which develops a clinical practice guideline related to pressure ulcer/injury prevention and considered the gold standard (Kottner et al.,

2019). Upon reviewing the project site workflows, many of these interventions are embedded into the flowsheets and part of clinicians' workflow.

The gap that was identified is that these sets of interventions are not as consistent as a bundle. Some cases identified that patients present with Braden less than 18 but do not have appropriate interventions; or, intervention is completed but a Braden Scale assessment wasn't completed. The bundle is accomplishing partially hence possibly contributing to the rise of HAPI rates.

The NPIAP recommendations consist of five domains: Risk & Skin Assessment (SOE: B), Nutrition (SOE: A), Reposition (SOE: A), Microclimate Control (SOE: C), Support Surfaces (SOE: C), (NPIAP, 2019). Proper skin assessment and utilization of a risk assessment such as the Braden Scale assist in proper planning and intervention needed to prevent HAPI from developing and progressing (Griswold et al., 2017). The current project site skin assessment workflow consists of the Braden Scale assessment as part of the skin survey.

Proper nutrition and meeting metabolic demand assist in ensuring the integrity of the skin and promotes healing (Chan, 2017). Early collaboration and consult with a dietician can assist in ensuring the patient meets the caloric need to promote not only the healing of other organs but skin. Then, repositioning the patient is a classic intervention that assists in preventing the development and progression of pressure injury. Another to consider is microclimate control such as incontinence, moisture, and shears are a contributor to make the skin vulnerable to damages (O'Brien., 2018).

The current project site supplies various products to manage skin climate control. Lastly support surfaces such as the use of specialty bed redistribution mattresses to provide effective pressure redistribution (Kirkland-Walsh et al, 2015). The current project site consists of various

redistribution beds and mattresses that can be tailored to the patient's needs and/or the use of air-inflated static seat cushion provides the best pressure redistribution in the sacrum area than other surfaces (Kirkland-Walsh et al., 2015).

The NPIAP bundle can be organized with an acronym SKIN: S for skin surfaces with the use of pressure redistribution strategies; K for a reminder to keep turning patient as needed or reposition; I for incontinence for microclimate control from moisture and shears, and N for nutrition support. Along with these bundle documentation standards such as the use of two clinician verification of pressure injury, and the use of media application technology to capture the skin injury.

Theory Identification and Discussion of Historical Development of the Theory

The theoretical framework chosen for this DNP project is Kurt Lewin's change theory for planned changed depending on the literature reviewed (Hussain et al., 2018; Lewin, 1947). The theory started emerging in 1946 when Lewin conducted change workshops at the Massachusetts Institute of Technology; although, the process of change is well known to many but the clarity of the process remains unknown at that time (Lewin, 1947). The change theory contained a three-phase process known as driving forces, restraining forces, and equilibrium these phases are a requirement to reject prior learned behavior and adapt or replaced it with the new as he termed it as the dynamic balance of forces working in different directions (Lewin, 1947).

Evolution of the theory through his focus groups, group dynamics, and workshops emerged the ‘unfreezing, change, and refreezing’ phases of the theory (Lewin, 2016). Then in 1954 the advent of Florence Nightingale and her sufficient contribution and influence to the Crimean War, changing healthcare practices that improved outcomes, transition the social psychology theoretical framework to nursing and decades later because of the foundational

model for planned change in organizations (Cook, 2018; Hussain et al., 2018; Cummings et al., 2016).

Applicability of Theory to Current Practice

Change is inevitable in the healthcare environment and the process of change is more rapid than ever (Barrow et al., 2019; Hussain et al., 2018). In 700+ licensed bed magnet recognized level one trauma academic medical center change occurs more rapidly than any other organization. Batras et al., (2016) analyzed various organizational theory and the implication of this theoretical framework to practice changes, the researches noted that in organizational change influencing group, their experiences are a significant role in behavioral changes and successful practice changes; rather than, influencing individuals in a leadership role and Lewin Change Theory derived from influencing groups whereas other theories seek to influence individual (p. 239). The theoretical framework applies to the current practice site.

Discussion of Major Tenets of the Theory

The healthcare environment is in constant motion, interdisciplinary teams are mediating changes as they arise. Kurk Lewin developed a theoretical framework model known as change theory where he discussed that change is not by chance but by design (Akingbola et al., 2019; McEwen and Wills, 2017). Lewins Change Theory roots from concepts of fields and forces with the implementation of three processes known as the ‘unfreezing, change, freezing’ phases (McEwen and Wills, 2017).

Lewin defined that a field is the ‘system’ and the field that influences the system is the environment for instance the project site that will be undergoing the change. A successful planned change requires the group of individuals and the environmental culture to be assessed and examined. Lewin described the force as a motion, an object of direction and strength that

influences the individuals (McEwen and Wills, 2017). However, resistance to change is expected this expected behavior has an impact on the force and change in the field.

Lewin describes that with the force, there are drivers and restraining forces. The drivers are forces that elicit change towards the desired outcome, the ability of transformational leadership influence (McEwen and Wills, 2017). In contrast with restrain, forces are factors the delays the progression of desired outcome or goals. Therefore, an assessment of current practice culture, forces that drive and restrains the process for the successful incorporation of the change in the environment (McEwen and Wills, 2017). The three major tenets of Lewin's theory of change are ‘unfreezing, the movement toward a desired new state or change, and refreezing are the process to achieve successful adaptation. (McEwen and Wills, 2017).

The initial process is defined as unfreezing it is the platform for the change to this occur a problem needs to be identified and known to others to justify for the practice to change. At this time, the pilots conduct an analysis of the current issue and evaluate the projected change while considering the drivers and restrain agents before a solution is identified. Then the next process is the term moving, change process or transitioning phase; this process is the articulation of the pilot or organization to propel the new change forward with defined strategic planning. At the phase or the change is occurring or in progress, uncertainty about the unknown can rise; hence, continued coaching and direction are constant within this process to assist individuals to adjust to the new norm (Barrow et al., 2019; Hussain et al., 2018; McEwen & Wills, 2017). In addition, this phase requires institutionalization, and stabilization for the change becomes the normal equilibrium (Deborah, 2018).

Application of Theory to DNP Project

The designated setting is a large academic medical level one trauma center, the DNP student is the pilot that facilitate the translation of EBP HAPIPB to influence a reduction of HAPI rates hospital-wide. In order for the DNP student to be successful thoughtful planning for implementation of change is a must (Lynch, 2019). Strategic planning is to identify and measure the strength of the forces in the field (Rosenbaum et al., 2018). The 'field' in this case would be examining the work dynamics between nurses, how they perceived change, and utilize incident reporting of what specific units HAPI event occurred. Everything involved in the field must be taken into account when incorporating change (Hussain et al., 2018). The driving force is working towards obtaining a successful implementation of the HAPIPB and the restraining force would be resistant towards transitioning into the new best practice process. This information is helpful because it will determine the plan to use during the transition (Lewin, 2016).

Unfreezing, the movement to the new state and refreezing phases will also be necessary in order for the change to be implemented permanently. Unfreezing would take place when the staff in the hospital agree with the change. This phase will come with difficulty since letting go of old habits is nerve-racking and anxiety-provoking (Tang, 2019). In order to help decrease this anxiety, the DNP student proactively checks in with staff thoughts as to what methods work best for when learning a new skill.

Once an agreement is reached, the movement towards the new state could be initiated and HAPIPB is introduced. Lastly, during the refreezing phase, the balance must be reached. In order for the transition to be successful, the organization then goes through the policy modification process to integrate HAPIPB for further compliance and monitor HAPI rates (White, 2019).

Setting

This DNP project will be held in a large academic, magnet recognized, beacon recognized, level one trauma medical center, with more than 700 licensed beds. The practice site is located in Northern California in the United States. The medical center uses EPIC as the designated electronic medical health record (EMR), EPIC EMR system will be part of the project process as well as Incident Report (IR) Solutions to evaluate HAPI occurrence. The organization has a designated quality department that consists of a team of data analysts that evaluate and monitor data, which tracks nurse-sensitive indicators such as HAPI. The organization and department use HP Tableau as an analytic platform. A pilot unit is a ten licensed bed intensive care unit.

Population of Interest

The intensive care unit consists of 32 registered nursing staff, two attending surgeons' physicians, 13 resident physicians, the unit specialize in the most complex care of surgical, trauma, and stroke patients. Patient diagnoses include traumatic brain injury, subarachnoid hemorrhage, cerebral aneurysm, intracerebral hemorrhage, subdural and epidural hematomas, spinal surgery, and ischemic stroke. The department utilizes advanced monitoring and innovative interventions that allow for the best quality outcome for the patients. Also, the unit serves as the specialty area for the management of stroke patients.

The HAPI cases had steadily increased and last month the unit had three HAPI cases. The direct population that will receive the bundle is the nursing staff. The organization's nursing structure is primary nursing which encompasses all registered nursing staff. They will be educated on the preventative HAPI bundle during leadership/shift huddle that range from 20 to 30minutes targeting both day shift and night shift. The indirect population will be adult patients admitted to the intensive care unit.

Stakeholders

The main stakeholders are the nursing staff that will be receiving and providing the care to their respective patient populations (Tschirch et al., 2017). For an effective engagement and success of change, the stakeholder's focus is on the hands that will deliver the care, which to this pilot project will be the nursing staff (Maniago et al., 2020). Supporting stakeholders such as the physicians that will be providing orders for pharmacological treatment of pressure injury, project mentor is the director of quality/safety, and the wound care team that will be a guide to the project, and the analytics team to assist with data retrievals. The Director of quality assurance will also be part of the analytics that will be used to monitor, track, and evaluate data. Touro University Nevada already has an established affiliation agreement with the project site, and permission to conduct the project.

Interventions

The pilot unit call to action is the steady rise in the HAPI rates in comparison to the other nursing departments. Therefore, a literature review was conducted and the proposed intervention is the use of the National Pressure Ulcer Advisory Panel (NPIAP) clinical practice guidelines on prevention of pressure ulcer/injury (NPIAP, 2019). This project will follow a five-week implementation and evaluation timeframe (Leis et al., 2017).

In the first week, the NPIAP Preventative Bundle education and teaching will be given to nursing staff as a form of in-service and real-time coaching during leadership huddles that range from 15-30 minutes targeting day shift and night shift staff (Chaghari, 2017). However; before the first week of the implementation, a five-week preliminary chart audit will be conducted of nursing staff for their compliance documentation of initial skin assessment, daily skin inspection,

and positional changes to further evaluate the effectiveness of the project intervention (Elliott, 2018).

The instrument that will be used will be a server program called Qualtrics from Touro University Nevada that is within the cloud/internet and password-protected (Kim, 2017). No patient identifier will be used but room numbers for this are assessing nursing compliance. The data collected will be managed by the Qualtrics program and analysis will require SPSS known as Statistical Package for the Social Science from Touro University Nevada to determine standard deviations, confidence interval, and coefficient alpha (Polit & Beck, 2017).

In the middle of the week will be in collaboration with the quality department for data collection to surveillance nursing activities as a form of chart audit using Qualtrics, while monitoring incident reports related to HAPI rates using project site monitoring system; Incident Report (IR) Solution Systems (Haverkamp et al., 2020).

In the final week, incident reporting solutions will be evaluated for reports related to HAPI, preliminary chart audit data and post-intervention data will be analyzed, and then inputted to the SPSS software to run data analysis to further investigate the data for significant, correlations, and comparison. The data found will then be reported to the project site and stakeholders (Knapp, 2016).

Tools

NPIAP Bundle

The EBP tool that will be primarily used is the NPIAP clinical practice guidelines on the prevention of pressure ulcer/injury the NPIAP bundle outline can be reviewed in Appendix B. The NPIAP preventative bundle has been replicated and validated by various health systems, it utilized gold standard appraisal tools to elevate the rigor and validity of the bundle, Appendix C

illustrates the level of evidence and strength of the evidence used to evaluate literature within the bundle (Sackett, 1989; Burns, Rohrick, & Chung, 2011). The Advisory Committee (NPIAP) discloses the use and adaptation of the guidelines, but a request for a specific citation format is illustrated in appendix A (NPIAP, 2019).

The NPIAP bundle consists of five recommendations: Risk & Skin Assessment, Nutrition, Reposition, Microclimate Control, Support Surfaces, (NPIAP, 2019). The purpose of the NPIAP bundle is to recommend preventative measures to prevent pressure ulcer injury from the development and progression of known pressure injuries, the tool had been validated and used in various health care systems. The primary objective of the bundle is to guide healthcare professionals that are at the point of care of preventative strategies to improve patient care outcomes.

Risk & Skin Assessment. NPIAP recommends that proper skin assessment and utilization of a risk assessment such as the Braden Scale assist in proper planning and intervention needed to prevent HAPI from developing and progressing pressure injury (Griswold et al., 2017; NPIAP, 2019). The current project site skin assessment workflow consists of the Braden Scale assessment as part of the skin survey.

Nutrition. Proper nutrition and meeting metabolic demand assist in ensuring the integrity of the skin and promotes healing (Chan, 2017; NPIAP, 2019). Early collaboration and consult with a dietician can assist in ensuring the patient meets the caloric need to promote not only the healing of other organs but skin.

Reposition. Repositioning the patient is a classic intervention that assists in preventing the development and progression of pressure injury. Utilization of draw sheets as a cost-effective measure to easily shift patient weight and/or the use of the lift team (NPIAP, 2019).

Microclimate Control. Related to incontinence, moisture, and shears are a contributor to make the skin vulnerable to damages (O'Brien., 2018, NPIAP, 2019;). The project site supplies various products to manage skin climate control that can be utilized.

Support Surfaces. Support surfaces are an important aspect of protecting bony prominence such as the use of support surfaces or specialty bed redistribution mattresses to provide effective pressure redistribution (Kirkland-Walsh et al, 2015; NPIAP, 2019;). The current project site consists of various redistribution beds and mattresses that can be tailored to the patient's needs and/or the use of air-inflated static seat cushion provides the best pressure redistribution in the sacrum area than other surfaces (Kirkland-Walsh et al., 2015; NPIAP, 2019).

Educational Materials

The educational materials/handout that will be used is the actual NPIAP reference guide created by the NPIAP council. The NPIAP council collaborated with European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance along with 14 international Associate Organization, 168 international pressure injury experts, and 699 stakeholders to peer review explicit scientific methodology seen in appendix C, to identify and critically appraise all available research to develop EBP recommendations to health professional all over the world in one educational reference guide (NPIAP, 2019). The educational handout can be reviewed in Appendix D.

Incident Report (IR) System

In tracking HAPI rates, the project site utilizes an incident report (IR) solution system for pressure ulcer/injury discovery and tracking. When an IR has been filed, opens an investigation process, evaluating if the pressure ulcer/injury is present on admission and determining patient transition of care whether from home, facility, and another department. The quality department

evaluates and investigates this process to determine if it qualifies as a HAPI. This rate can be tracked by the project site Hewlett-Packard (HP) Tableau systems (Hao et al., 2016).

AHRQ Toolkit Questionnaires

In conjunction with the NPIAP, to further assess the effectiveness of HAPI is to chart audit nursing staff of nursing activities related to NPIAP Bundles (Meehan et al., 2016). The Agency for Healthcare Research and Quality (AHRQ) toolkit on the prevention of pressure injury consists of comprehensive questionnaires that had been validated and adopted in various healthcare systems (AHRQ, 2020). The three indicators that will be chart audit will be documentation of initial skin assessment during patient admission within a 24hour period, daily skin assessments, and positional changes these indicators can be reviewed in appendix C (AHRQ, 2020). These toolkits will be utilized to assist in data collection during chart audits.

Documentation of initial skin assessment during patient admission within a 24hour period. The purpose of chart auditing this indicator yield importance as determining skin assessment upon patient admission creates a specific plan of care if there is a known pressure injury before admission. The question validates NPIAP Bundle. This question applies to patients from various transitions of care in terms of tracking prevalence and incidence (AHRQ, 2020).

Documentation of daily skin assessments. The purpose of chart auditing this specific indicator validates the NPIAP Bundle process. Conducting daily skin assessment determines early recognition and treatments (AHRQ, 2020)

Documentation of positional changes. The classic nursing intervention continued to persist until today. The purpose of chart auditing this specific indicator not only validates the NPIAP bundle but weight shift is the gold standard of HAPI prevention (AHRQ, 2020). The project site shifts operations are 12 hours shifts, patient charts will be audited twice daily to

evaluate nursing staff related both day shift and night shift monitoring of the three indicators. No patient identifiers will be identified but room numbers. Cloud/Internet-based software called Qualtrics from Touro University Nevada will be used for tracking and storing data. Then the data will be exported and imported into SPSS for further data analysis (AHRQ, 2020.)

Study of Intervention / Data Collection

Collection of HAPI Rates. The procedure for collecting HAPI rates is from the quality department of the project site, the project site utilizes an incident report (IR) solution system for pressure injury discovery and tracking (Song & Guo, 2019). When an IR has been filed, opens an investigation process, evaluating the report considering prevalence and incident of the pressure injury either on admission or transition of care from home, facility, and another department. The review process of determining HAPI rates is based upon the IR that has been reported/filed to the system. The report or incident that has been filed will open an investigation process consist of the quality department, and the nursing unit to review as a team. The quality department evaluates the report determining if the HAPI is a new incident, more likely it is, the following steps are to determine which transition of care it was originated; either from a different department or if the patient is from another facility or home. The quality department evaluates and investigates this process to determine if it qualifies as a HAPI (Caldini et al., 2018).

This data is secured and can be tracked by the project site Hewlett-Packard (HP) Tableau systems, which is a data management tool that can retrieve and extract data based on criteria of pressure injury (Hao et al., 2016). This system is integrated into the project site server that is guarded by a matrix of a firewall to maintain protection of confidentiality and protection of healthcare information (Langer, 2017). The collection of HAPI rates will be critical data to assess the effectiveness of the HAPIPB on reducing the prevalence and incidence of HAPI in a

healthcare system, the baseline preliminary HAPI rates for the pilot department will be extracted on the first week of November and post HAPI rates will be the first week of December (Gupta et al., 2020).

Collection of AHRQ Toolkit Questionnaires. To further assess the effectiveness of HAPIPB a conjunction preliminary intervention and post-intervention chart review audit will be conducted utilizing the AHRQ toolkit questionnaires to monitor nursing activities related to HAPIPB. The AHRQ toolkit questionnaires are streamlined, inputted, and integrated into a data collection program called Qualtrics part of a cloud/internet, password-protected server of Touro University Nevada. The preliminary intervention and post-intervention will have a similar collection process (McCormac et al., 2017).

The purpose of the chart review is to monitor and surveillance nursing activity related to the effectiveness of HAPIPB derived from the AHRQ toolkit chart auditing tool. No patient identifiers will be used. The shift work at the project sites is 12-hour shifts and two shift occurs in 24 hours. The chart review audits will occur two times daily for each bed (Griffith, 2019). Chart review audits will occur in a four-week timeline for both the preliminary data collection and post-intervention data collection.

Ethics/Human Subjects Protection

The participants of the HAPIPB will be recruited based on the availability of staff in the leadership huddle. The sampling design is response based; participants will receive in-service education and real-time coaching about the HAPIPB. Participants will be informed that the project does not require Institutional Review Board approval for both the project site, and Touro University Nevada, and no patient information will be used (Metcalf et al., 2016). Furthermore, participants will be assured anonymity, confidentiality, awareness of study purpose, data

collection methods, and the potential benefit is to enhance individual clinical nursing practice while promoting positive outcomes related to HAPI prevention. The perceived risk is the self-realization of practice behavioral change in delivering nursing care. No compensation for participation (Constantin & Andorno, 2020).

Measures/Plan for Analysis

The methodology of the project utilizes a comparative analysis design. The pre-test chart audit will assess the current behavior of nursing activity before the intervention. After the intervention, behaviors will be re-assessing for any changes in nursing behaviors (Peterson & Bredow, 2019).

The instrument that will be used will be a server program called Qualtrics. Reliability will be assured by computing reliability coefficient alpha, utilization of data triangulation with test-retest reliability design by retesting a similar chart audit tool on two occasions; preliminary intervention and post-intervention. Moreover, internal consistency with similar questions to assess post-intervention differences. Data will be collected and managed by the aforementioned program. Analysis of data requires SPSS from Touro University Nevada to further determine participants, mean, median, mode, standard deviations, upper and lower confidence interval, t value, df values, and paired sample t-test data analysis. A statistician from Touro University Nevada was consulted for the statistical methodology (Polit and Beck, 2016).

The chosen statistical testing is a non-parametric testing methodology to generalize conclusions about the sample used in the setting of a specific data collection method that can impact statistical power (Woo, 2017).

HAPI Rates Data Plan. A simpler statistical analysis will be utilized to analyze the rates using a percentage method to highlight the differences in HAPI rates between preliminary

intervention and post-intervention. This is due to the project site quality department control and utilization of the project site data management tool.

AHRQ Toolkit Chart Audit Tool. This is a pretest-posttest methodology. The variables are categorical and nominal and binary in nature (yes/no). This data translates to numerical rates to compare to a variable. A comparison will be in two sets of categories: preliminary intervention and post-intervention data. The sample size is 560 per category based on a four-week time frame; one chart reviews per shift on one bed, two chart reviews per day on one bed, 20 chart reviews a day on the entire pilot unit, 140 a week, 560 in four weeks. Also, a simpler statistical analysis of the percentage method of each questionnaire to compare preliminary and post-intervention. With these criteria, the chosen statistical analysis with a consultation and recommendation of Touro University Nevada statistician is to perform odds ratio with logistic regression; however, due to the nature of the data either Paired T-Test or Wilcoxon Signed-Rank Test based on assumption reliability testing will be more fitting as a data analysis measure. It evaluates the test for the difference between two variables from the same population (Zimmerman, 2017).

Analysis of the Results

AHRQ Toolkit Chart Audit Tool. The preliminary intervention and post-intervention data collection chart audits yield a total *N* of 1120 sample size in eight weeks chart audits. The data is extracted from Touro University Nevada Qualtrics password secured server system to data code entry into IBM SPSS codebook (Field, 2017). Conducted a descriptive statistical analysis shown in Table 1, and frequency table statistics in Table 2.

Performed descriptive statistics to the data to evaluate values out of normal or out of range, to double-check errors, ensures that data coding was properly entered to eliminate statistical analysis distortion (Boutron & Ravaud, 2018). In addition, variables are extracted with

frequency statistical analysis to ensure the reliability of all the items, Table 1. illustrates the variables being measured and each has *N* of 560 which present reliability that 560 participants were conducted on that variable.

In addition, missing values are further evaluated and validated to equal zero (0). The various means, medians, modes, standard deviation, variance, minimum (min), and maximum (max) are illustrated in each variable, and evaluating min as the value of one (1) and max as the value of two (2) are an accurate representation of categorical, nominal, binary within these data sets (Little & Rubin, 2019).

Table 2. Illustrates the different variables used in preliminary (pre) data as well as post-intervention (post) data. Reliability of data used to ensure identifying no missing values is identified that encompasses statistical testing (Fernstad, 2019).

TABLE 1: DESCRIPTIVE STATISTICS

		[Post] Documentation of initial skin assessment with 24hr of admitted patient	[Post] Documentation of daily skin inspection	[Post] Documented of positional changes or 'up ad-lib'	[Preliminary] Documentation of initial skin assessment with 24hr of an admitted patient.	[Preliminary] Documentation of daily skin inspection (Pre)	[Preliminary] Documented of positional changes or 'up ad-lib' (Pre)
N	Valid	560	560	560	560	560	560
	Missing	0	0	0	0	0	0
Mean		1.01	1.03	1.05	1.43	1.73	1.94
Median		1.00	1.00	1.00	1.00	2.00	2.00
Mode		1	1	1	1	2	2
Std. Deviation		.073	.172	.225	.495	.445	.232
Variance		.005	.029	.051	.245	.198	.054
Minimum		1	1	1	1	1	1

Maximum	2	2	2	2	2	2

Pre & Post Data Analysis. Pre data suggested within the collection time frame that 57.2% of nursing staff documented an initial skin assessment within 24hr of patient admission, and 42.5% did not; in contrast with post data suggest 99.5% of nursing staff documents initial skin assessment within 24hrs and 0.5% did not, which yields 42.3% of an increase of nursing staff documenting upon admission that reflects a change in nursing behavior.

TABLE 2: FREQUENCY TABLE STATISTICS

Preliminary Data

[Preliminary] Documentation of initial skin assessment with 24hr of the admitted patient.

	N	%
YES	322	57.5%
NO	238	42.5%

[Preliminary] Documentation of daily skin inspection (Pre)

	N	%
YES	152	27.1%
NO	408	72.9%

[Preliminary] Documented of positional changes or 'up ad-lib' (Pre)

	N	%
YES	32	5.7%
NO	528	94.3%

Post-Intervention Data

[Post] Documentation of initial skin assessment with 24hr of admitted patient

	N	%
YES	557	99.5%
	3	0.5%

[Post] Documentation of daily skin inspection

	N	%
YES	543	97.0%
NO	17	3.0%

[Post] Documented of positional changes or 'up ad-lib'

	N	%
YES	530	94.6%
NO	30	5.4%

Another, the pre-data suggests that 27.1%. documented daily skin assessment and 72.9% did not; in comparison, 97.0% document daily skin inspection post data and only 3.0% did not, which yields a 69.3% increase in documentation of skin monitoring. Moreover, the pre-data claims that only 5.7% of nursing documents positioning changes, and 94.3% did not; however, post data suggests that 94.6% document positioning changes and 5.4 did not, which yields an 88.9% increase in positioning documentation (Doyle et al., 2020). All of these increases are a positive change in nursing behavior.

TABLE 3: TESTS OF NORMALITY

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
[Preliminary] Documentation of initial skin assessment with 24hr of the admitted patient.	.380	560	.000	.628	560	.001
[Post] Documentation of initial skin assessment with 24hr of admitted patient	.524	560	.000	.045	560	.001
[Preliminary] Documentation of daily skin inspection (Pre)	.458	560	.000	.556	560	.001
[Post] Documentation of daily skin inspection	.540	560	.000	.160	560	.001
[Preliminary] Documented of positional changes or ‘up ad lib’ (Pre)	.540	560	.000	.244	560	.001
[Post] Documented of positional changes or ‘up ad lib’	.540	560	.000	.234	560	.001

a. Lilliefors Significance Correction

To generalize conclusions about the sample, non-parametric statistical testing is chosen to generalize the conclusion about the sample. Initially paired t-test data analysis was chosen as it a test of the difference between two variables (preliminary data and post-intervention data) with the same population (White et al., 2014). The data set has undergone parametric testing for

assumptions that violate the result of the analysis and further investigation is required to increase the rigor of the data. (Polancich et al., 2018).

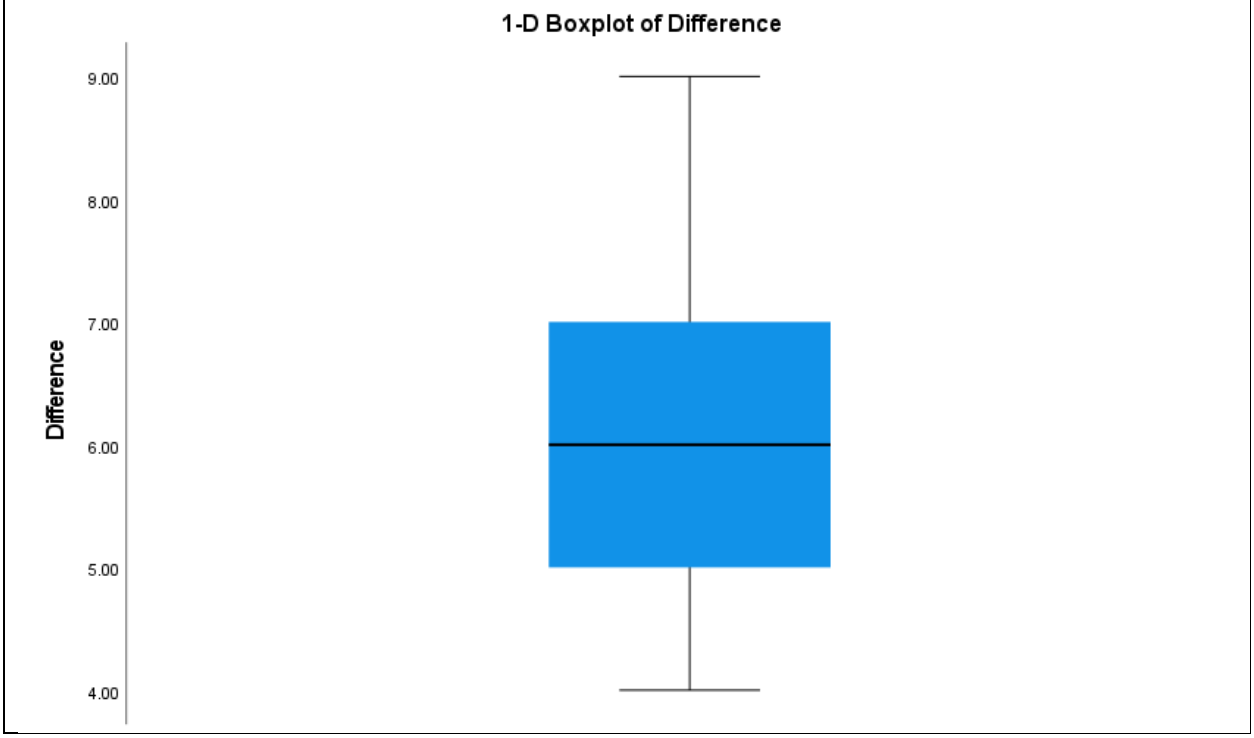
Shapiro-Wilk Normality Testing. In parametric testing normality of data is assumed and further testing is required; however, according to Hanusz et al., (2016) parametric sampling data less than 30 or a small sample, in general, does not have the statistical power to meet parametric testing and non-parametric option are better to interpret the data. The assumption to be considered is differences in variance (Dols et al., 2017). With paired sampling methods such as paired t-test; both variables testing one population always have an equal sampling data variable is assured (Reavy, 2016). The normality is assured as the sampling size is 1120 which is greater than 30 (Hanusz et al., 2016).

However, identifying the evidence by performing an assumption test of normality using Shapiro-Wilk Normality revealed the rejection of normality; hence, the data is not normally distributed. Moreover, the pre-data and post data entered into the Shapiro-Wilk test and sig results do not have any variation between pre and post. The sig value of 0.001 both pre data and post data in comparison to the standard testing alpha of 0.05 is less than 0.05; therefore, we reject the null hypothesis meaning the pre-data and post data are not fully distributed as it can be seen in Table 3 test for normality (Holly, 2019). The Shapiro-Wilk Normality testing reveals to move forward with non-parametric testing. Wilcoxon Signed-Rank Test is an alternative that focuses on repeated measures with the same participants under two periods, occasions, or conditions (Verma et al., 2019).

Wilcoxon Signed-Rank Testing Assumptions. Before conducting the Wilcoxon Signed-Rank test an assumption testing is needed to ensure qualification for the test (Verma et al., 2019). First, the Shapiro-Wilk Normality has already been tested and the result is to reject the null

hypothesis with sig value from Table 3 of 0.001 which is less than the 0.05 standard sig alpha (Verma et al., 2019). Secondly addressing the dependent variable that is ordinal and continues in nature is consistent with the data collection methodology (Verma et al., 2019). Then, testing for independent variables of two occurrences which is also consistent with the design methodology similar subjects with two groups are dependable (Verma et al., 2019). Lastly assessing the data for the assumption of symmetrical distribution by conducting a boxplot difference test as illustrated in Figure 1: 1D Boxplot of Difference a box plot reveals two regions symmetry that validates the assumption of symmetrical distribution for the Wilcoxon signed-rank test (Verma et al., 2019).

FIGURE 1: 1D BOXPLOT OF DIFFERENCE



Wilcoxon Signed-Rank Testing. The assumptions and violations have been addressed and validated to move forward with the Wilcoxon Signed-Rank testing of data. The purpose of the test is to detect implementation of HAPIPB in the adult critical intensive care patient

population reduces and prevents the incidence and prevalence of HAPI rates within the five-week timeframe.

The result from this statistical testing is illustrated in Table 4: Wilcoxon Signed-Rank testing; applying the standard alpha of 0.05 and comparing the *Z* scores of each aforementioned indicator are as follows -15.201, -19.723, and -22.271 which are less than the standard alpha suggests statistically significant hence the null hypothesis is rejected and presume that there is difference between pre data and post data. In addition, the Asymp. Sig (2-tailed) a significant level

Table 4: Wilcoxon Signed-Rank

Test Statistics

	[Post] Documentation of initial skin assessment with 24hr of admitted patient - [Preliminary] Documentation of initial skin assessment with 24hr of the admitted patient.	[Post] Documentation of daily skin inspection - [Preliminary] Documentation of daily skin inspection (Pre)	[Post] Documented of positional changes or 'up ad-lib' - [Preliminary] Documented of positional changes or 'up ad-lib' (Pre)
Z	-15.201[b]	-19.723[b]	-22.271[b]
Asymp. Sig. (2-tailed)	.000	.000	.000

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.

TABLE 5: WILCOX SIGNED RANK DESCRIPTIVE STATISTICS

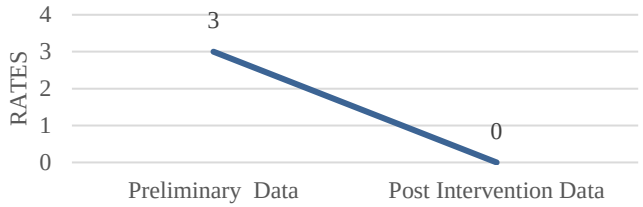
Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum

[Preliminary] Documentation of initial skin assessment with 24hr of the admitted patient.	560	1.43	.495	1	2
[Preliminary] Documentation of daily skin inspection (Pre)	560	1.73	.445	1	2
[Preliminary] Documented of positional changes or 'up ad-lib' (Pre)	560	1.94	.232	1	2
[Post] Documentation of initial skin assessment with 24hr of admitted patient	560	1.01	.073	1	2
[Post] Documentation of daily skin inspection	560	1.03	.172	1	2
[Post] Documented of positional changes or 'up ad-lib'	560	1.05	.225	1	2

is less than 0.05 which can further conclude that the differences between the two sets of data are statistically significant (Verma et al., 2019). Moreover, analyzing Table 5: Wilcox Signed Rank Descriptive Statistics illustrates that the post data mean is lower than the pre-data mean. Thus, the direction of the difference is that the implementation of HAPIPB increases the quality outcomes of reducing the incidence and prevalence of HAPI rates by changing behavior as driven by the HAPIPB. That is measured by the post data when compared with the measured pre-data acknowledged that the HAPIPB is successful in improving quality care and decreasing HAPI rates. Furthermore, evaluating project site HAPI rates after the intervention revealed additional support.

Figure 2. HAPI TRENDS



HAPI Rates from Project Site Data. additional support Before the intervention week, at the start of November, three total HAPI rate cases were extracted from the Hewlett-Packard (HP) Tableau quality metrics reporting system. Seven weeks after the intervention, another extraction of HAPI rates conducted resulted in a zero result as it can be reviewed in Figure 2: HAPI Trends. The National Database of Nursing (NDNQI) reported HAPI incidence to be about 0.28% from 47,365 HAPI among 16,967,687 total adult inpatients (Dreyfus et al., 2018). The project site health system developed 27 HAPI in the last eight quarters which equate to 1.125% incidence per month. The pilot unit has the highest HAPI cases of resulted in three cases in a month; whereas, other HAPI cases are spread over the health system. Post-intervention HAPI data extraction continued to result in zero after four weeks of post-intervention. It can infer that the HAPIPB has a contribution to the reduction of HAPI development.

Discussion of the findings and Significance/Implications for Nursing

The development of HAPI cannot be completely avoided and will continue to occur in hospitalized patients. Exploring the different causes and strategizing interventions can lead to the prevention and progression of HAPI. The HAPIPB is introduced to a pilot unit that has the highest isolated HAPI cases hospital-wide.

The preliminary HAPI cases reported from the project site quality department was three before the intervention. After the implementation of an educational intervention led to a decrease of HAPI cases in the pilot unit by zero. In addition to extracting HAPI data cases, a validated chart audit tool was used to examine nursing behavioral activities that can influence the reduction of HAPI rates. There is a total of 1120 chart audits in eight weeks; 560 chart audits before the intervention and 560 chart audits after the intervention.

The preliminary data illustrates that 57.2% of nursing staff documented an initial skin assessment within 24hr of patient admission, and 42.5% did not; in contrast with post data suggest 99.5% of nursing staff documents initial skin assessment within 24hrs and 0.5% did not, which yields 42.3% of an increase of nursing staff documenting upon admission that reflects a change in nursing behavior.

Another, the pre-data suggests that 27.1%. documented daily skin assessment and 72.9% did not; in comparison, 97.0% document daily skin inspection post data and only 3.0% did not, which yields a 69.3% increase in documentation of skin monitoring. Moreover, the pre-data claims that only 5.7% of nursing documents positioning changes, and 94.3% did not; however, post data suggests that 94.6% document positioning changes and 5.4 did not, which yields an 88.9% increase in positioning documentation (Doyle et al., 2020). All of these increases are a positive change in nursing behavior. The findings; the 42.3% increase in nursing staff documentation, 69.3% increase in documenting skin surveillance/monitoring, and 88.9% increase in documented positional changes are positive clinical behavior changes that factored into the overall reduction of HAPI rates.

An additional statistical examination was conducted to increase the rigor of the data. The data findings have undergone parametric assumption testing which all passed but failed the final trial of normality testing. The sig value of 0.001 both pre data and post data in comparison to the standard testing alpha of 0.05 is less than 0.05; therefore, we reject the null hypothesis meaning the pre-data and post data are not fully distributed. Hence, move forth with a non-parametric equivalent.

Application of the standard alpha of 0.05 and comparing the *Z* scores of each behavior audited as follows -15.201, -19.723, and -22.271 which all are less than the standard alpha,

which suggests statistically significance. Therefore, the null hypothesis is rejected and presume that there is a difference between pre data and post data. Also, Asymp. Sig (2-tailed) revealed a significant level less than 0.05 which can further conclude that the differences between the two sets of data are statistically significant.

In further evaluation, the post data mean is lower than the pre-data mean. Thus, the direction of the difference is that the implementation of HAPIPB increases the quality outcomes of reducing the incidence and prevalence of HAPI rates by changing behavior as driven by the HAPIPB. The post data when compared with the pre-data acknowledged that the HAPIPB is successful in improving quality care and decreasing HAPI rates.

Moreover, the project site HAPI rates were evaluated after intervention revealed zero HAPI cases at beginning of December 2020, a month follow-up conducted beginning of January 2021 showed continued zero HAPI rates, which is further validates the effectiveness of HAPIPB.

In comparing the data to national benchmarks. The National Database of Nursing (NDNQI) reported HAPI incidence to be about 0.28% from 47,365 HAPI among 16,967,687 total adult inpatients (Dreyfus et al., 2018). The project site developed 27 HAPI in the last eight quarters which equate to 1.125% incidence per month. The pilot unit had isolated three HAPI cases reported in November of 2020. Initial post-intervention HAPI data extraction resulted in zero HAPI cases reported in December of 2020, a follow-up data extraction case in January 2021 continued to illustrate zero HAPI cases. These findings support the HAPIPB on reducing HAPI rates in the adult inpatient critical care of a level one trauma academic medical center.

Limitations / Sustainability / Dissemination

The DNP project consists of various limitations related to project design, data recruitment, collection methods, and data analysis. The project design is strictly on a preliminary

and post-intervention chart audit review after the introduction of HAPIPB. The HAPI rates are governed by the project site quality department which has a completely different process that is beyond the scope of the DNP project. Also, the timeline for the project is relatively short, the five-week timeline can be influenced by the Hawthorne effect.

The scope of the population is also restricted only focused on adult intensive care patients. Although no associated cost occurred due to the short project on a larger scale require more personnel to conduct the chart audits and education. The data recruitment and collection methods are only from the intensive care unit.

The patient ratio is at times two to one staff or one to one staff. The level of care ratio can influence the frequency of skin surveillance as related to nurses' rounds, the project timeline, and the hawthorn effect can influence the result of HAPIPB post-intervention. Therefore, to ensure the sustainability of the results monthly HAPI rates extraction needs to be completed as surveillance to ensure ground zero of HAPI rates. At this time December 2020 and January 2021 resulted in zero HAPIPB intervention. The NPIAP HAPIPB and AHRQ chart audit tools are validated tool that is the gold standard, and best practice to many healthcare systems. The DNP Project is a success in contributing to the validity and rigor of the aforementioned tools.

The dissemination plan is an abstract that was submitted to the John Hopkins Nursing Conference, Stanford Healthcare Conference, University of San Francisco Conference, National Teaching Institute & Critical Care Exposition, Magnet Conference, and Doctors of Nursing Practice Conference.

Further dissemination strategies include a presentation of the overall project to the TUN course. The results were disseminated throughout the health systems and currently collaborating with the medical-surgical unit for piloting strategic planning to pilot the tool to the respected

department. Also, in collaboration with project mentor for potential publish material to maximize dissemination of information.

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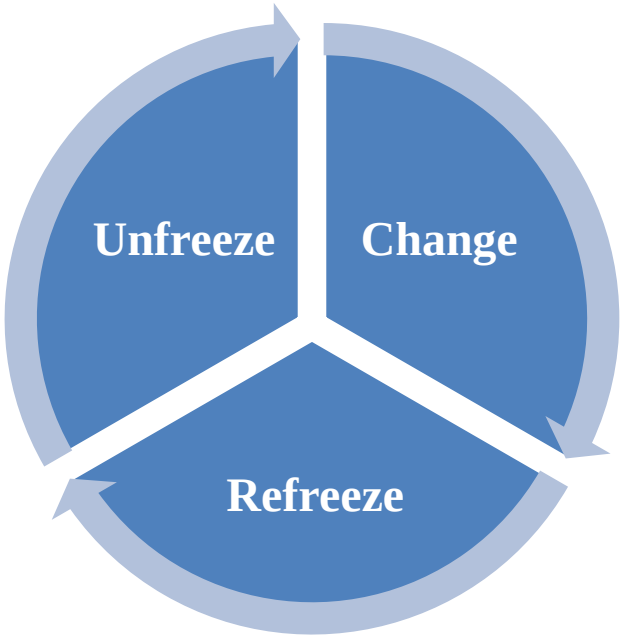
Appendix A

Kurt Lewin Theory of Change / Change Model (Lewin, 1947)



Citation

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Appendix B

NPIAP Preventative Bundle and Specified Citation

NPIAP Preventative Bundle	
Risk and Skin Assessment	Strength of Evidence: A
Reposition	Strength of Evidence: A
Microclimate Control	Strength of Evidence: C
Nutrition	Strength of Evidence: A
Support Surfaces	Strength of Evidence: C

Citation

European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel. Prevention and treatment of pressure ulcers: quick reference guide. Washington DC: National Pressure Ulcer Advisory Panel; 2009.

Appendix C

Appraisal tools used for NPIAP Bundle

Level of Evidence and Strength of Evidence

(Sackett, 1989; Burns, Rohrick, & Chung, 2011)

Table 2: Level of Evidence (Sackett, 1989; Burns, Rohrich, Chung, 2011)	
Level	Criteria
1	Large randomized trial(s) with clear-cut results (and low risk of error)
2	Small randomized trial(s) with uncertain results (and moderate to high risk of error)
3	Non randomized trial(s) with concurrent or contemporaneous controls
4	Non randomized trial(s) with historical controls
5	Case Series with no controls. Specify number of subjects.

Table 3: Strength of Evidence (SOE) (Sackett, 1989; Burns, Rohrich, Chung, 2011)	
SOE	Criteria
1	The recommendation is supported by direct scientific evidence from properly designed and implemented controlled trials on pressure ulcers in humans (or humans at-risk for pressure ulcers), providing statistical results that consistently support the guideline statement (Level 1 studies required).
2	The recommendation is supported by direct scientific evidence from properly designed and implemented clinical series on pressure ulcers in humans (or humans at-risk for pressure ulcers), providing statistical results that consistently support the recommendation. (Level 2, 3, 4, 5) studies)
3	The recommendation is supported by indirect evidence (e.g., studies in normal human subjects, humans with other types of chronic wounds, animal models) and/or expert opinion.

Citation

Burns, P. B., Rohrich, R. J., & Chung, K. C. (2011). The levels of evidence and their role in evidence-based medicine. Plastic and reconstructive surgery, 128(1), 305. Print.

Sackett, D. L. (1989). Rules of evidence and clinical recommendations on the use of antithrombotic agents. Chest, 95(2), 2S-4S. Print

Appendix D

NPIAP Bundle Educational Material Handout

Risk Assessment

Epidemiological research has increased considerably in recent years, allowing for a better understanding of risk factors important in the development of pressure ulcers. This literature should underpin risk assessment practice. However, one must be careful in interpreting the results of these epidemiological research studies, as the results may depend on which risk factors are included in a multivariable model.

Risk Assessment Policy

1. **Establish a risk assessment policy in all health care settings. (Strength of Evidence = C)**

   Each health care setting should have a policy in place that includes clear recommendations for: a structured approach to risk assessment relevant to that health care setting; clinical areas to be targeted; the timing of risk assessment and reassessment; documentation of risk assessment; and communication of that information to the wider health care team.

2. **Educate health care professionals on how to achieve an accurate and reliable risk assessment. (Strength of Evidence = B)**

3. **Document all risk assessments. (Strength of Evidence = C)**

   Documentation of risk assessments ensures communication within the multidisciplinary team, provides evidence that care planning is appropriate, and serves as a benchmark for monitoring the individual's progress.

Risk Assessment Practice

4. **Use a structured approach to risk assessment to identify individuals at risk of developing pressure ulcers. (Strength of Evidence = C)**

   A structured approach may be achieved through the use of a risk assessment scale in combination with a comprehensive skin assessment and clinical judgment. Evidence suggests that the introduction of those elements, in conjunction with the establishment of skin-care teams, education programs, and care protocols, can reduce the incidence of pressure ulcers.

5. **Use a structured approach to risk assessment that includes assessment of activity and mobility. (Strength of Evidence = C)**

   5.1. **Consider individuals who are bedfast and/or chairfast to be at risk of pressure ulcer development.**

6. **Use a structured approach to risk assessment that includes a comprehensive skin assessment to evaluate any alterations to intact skin. (Strength of Evidence = C)**

   6.1. **Consider individuals with alterations to intact skin to be at risk of pressure ulcer development.**

   Alteration in skin condition may include dry skin, erythema, and other alterations. The presence of non-blanching erythema also increases the risk of further pressure ulcer development.

7. **Use a structured approach to risk assessment that is refined through the use of clinical judgment informed by knowledge of key risk factors. (Strength of Evidence = C)**

8. **Consider the impact of the following factors on an individual's risk of pressure ulcer development:**

   a) Nutritional indicators
   Nutritional indicators include anemia, hemoglobin and serum albumin levels, measures of nutritional intake, and weight.

   b) Factors affecting perfusion and oxygenation
   Factors affecting perfusion include diabetes, cardiovascular instability/norepinephrine use, low blood pressure, ankle brachial index, and oxygen use.

   c) Skin moisture
   Both dry skin and excessive skin moisture are risk factors (see Skin Assessment).

   d) Advanced age

9. **Consider the potential impact of the following factors on an individual's risk of pressure ulcer development:**

   a) Friction and shear (Subscale Braden Scale)

   b) Sensory perception (Subscale Braden Scale)

   c) General health status

   d) Body temperature

10. **Conduct a structured risk assessment on admission, and repeat as regularly and as frequently as required by the individual's condition.**

Reassessment should also be undertaken if there is any change in patient condition. (Strength of Evidence = C)

11. **Develop and implement a prevention plan when individuals have been identified as being at risk of developing pressure ulcers. (Strength of Evidence = C)**

    Risk factors identified in a risk assessment should lead to an individualized plan of care to minimize the impact of those variables.

Skin Assessment

Skin Assessment

1. **Ensure that a complete skin assessment is part of the risk assessment screening policy in place in all health care settings. (Strength of Evidence = C)**

   Each health care setting should have a policy in place that includes recommendations for a structured approach to skin assessment relevant to the setting, as well as for clinical areas to be targeted and the timing of assessment/reassessment. It should make clear recommendations for documenting skin assessment and communicating information to the wider health care team.

2. **Educate professionals on how to undertake a comprehensive skin assessment that includes the techniques for identifying blanching response, localized heat, edema, and induration (hardness). (Strength of Evidence = B)**

   These additional assessment techniques can be used in caring for all individuals. However, there is evidence that Category I pressure ulcers are under-detected in individuals with darkly pigmented skin because areas of redness are not as easily seen.

3. **Inspect skin regularly for signs of redness in individuals identified as being at risk of pressure ulceration. The frequency of inspection may need to be increased in response to any deterioration in overall condition. (Strength of Evidence = B)**

   Ongoing assessment of the skin is necessary to detect early signs of pressure damage.

4. **Skin inspection should include assessment for localized heat, edema, or induration (hardness), especially in individuals with darkly pigmented skin. (Strength of Evidence = C)**

   Localized heat, edema, and induration have all been identified as warning signs for pressure ulcer development. As it is not always possible to see signs of redness on darkly pigmented skin, these additional signs should be considered in assessment.

5. **Ask individuals to identify any areas of discomfort or pain that could be attributed to pressure damage. (Strength of Evidence = C)**

   A number of studies have identified pain as a major factor for individuals with pressure ulcers. Several studies also offer some indication that pain over the site was a precursor to tissue breakdown.

6. **Observe the skin for pressure damage caused by medical devices. (Strength of Evidence = C)**

   Many different types of medical devices have been reported as having caused pressure damage (e.g., catheters, oxygen tubing, ventilator tubing, semirigid cervical collars, etc.).

7. **Document all skin assessments, noting details of any pain possibly related to pressure damage. (Strength of Evidence = C)**

   Accurate documentation is essential for monitoring the progress of the individual and to aiding communication between professionals.

Skin Care

8. **Whenever possible, do not turn the individual onto a body surface that is still reddened from a previous episode of pressure loading. (Strength of Evidence = C)**

   Redness indicates that the body has not recovered from the previous loading and requires further respite from repeated loading (see Etiology).

9. **Do not use massage for pressure ulcer prevention (Strength of Evidence = B)**

   Massage is contraindicated in the presence of acute inflammation and where there is the possibility of damaged blood vessels or fragile skin. Massage cannot be recommended as a strategy for pressure ulcer prevention.

10. **Do not vigorously rub skin that is at risk for pressure ulceration. (Strength of Evidence = C)**

    As well as being painful, rubbing the skin can also cause mild tissue destruction or provoke an inflammatory reaction, particularly in the frail elderly.

11. **Use skin emollients to hydrate dry skin in order to reduce risk of skin damage. (Strength of Evidence = B)**

    Dry skin seems to be a significant and independent risk factor for pressure ulcer development.

12. **Protect the skin from exposure to excessive moisture with a barrier product in order to reduce the risk of pressure damage. (Strength of Evidence = C)**

    The mechanical properties of the stratum corneum are changed by the presence of moisture and as a function of temperature.

Nutrition for Pressure Ulcer Prevention

GENERAL RECOMMENDATIONS

1. **Screen and assess the nutritional status of every individual at risk of pressure ulcers in each health care setting.**

   Since undernutrition is a reversible risk factor for pressure ulcer development, early identification and management of undernutrition is very important. Individuals at risk of pressure ulcer development may also be at risk of undernutrition, and so should be screened for nutritional status.

1.1 **Use a valid, reliable and practical tool for nutritional screening that is quick and easy to use and acceptable to both the individual and health care worker.**

1.2 **Have a nutritional screening policy in place in all health care settings, along with recommended frequency of screening for implementation.**

2. **Refer each individual with nutritional risk and pressure ulcer risk to a registered dietitian and also, if needed, to a multidisciplinary nutritional team that includes a registered dietitian, a nurse specializing in nutrition, a physician, a speech and language therapist, an occupational therapist, and when necessary a dentist.**

   If the nutritional screening identifies individuals as being prone to develop pressure ulcers or to be malnourished or at nutritional risk, then a more comprehensive nutritional assessment should be undertaken by a registered dietitian or a multidisciplinary nutritional team. Nutritional support should be offered to each individual with nutritional risk and pressure ulcer risk.

2.1. **Provide nutritional support to each individual with nutritional risk and pressure ulcer risk, following the nutritional cycle. This should include:**
   - **Nutritional assessment**
   - **Estimation of nutritional requirements**
   - **Comparison of nutrient intake with estimated requirements**
   - **Provide appropriate nutrition intervention, based on appropriate feeding route**
   - **Monitoring and evaluation of nutritional outcome, with reassessment of nutritional status at frequent intervals while an individual is at risk.**

   (Strength of Evidence = C)

   Individuals may need different forms of nutritional management during the course of their illness.

2.2. **Follow relevant and evidence based guidelines on enteral nutrition and hydration for individuals at risk of pressure ulcers, who show nutritional risks or nutritional problems.**

2.3. **Offer each individual with nutritional risk and pressure ulcer risk a minimum of 30-35 kcal per kg body weight per day, with 1.25-1.5 g/kg/day protein and 1ml of fluid intake per kcal per day.**

SPECIFIC RECOMMENDATIONS

1. **Offer high-protein mixed oral nutritional supplements and/or tube feeding, <u>in addition to the usual diet</u>, to individuals with nutritional risk**

and pressure ulcer risk because of acute or chronic diseases, or following a surgical intervention. (Strength of Evidence = A)

Oral nutrition (via normal feeding and/or with additional sip feeding) is the preferred route for nutrition, and should be supported whenever possible. Oral nutritional supplements are of value because many pressure-ulcer-prone patients often cannot meet their nutritional requirements via normal oral food intake. Moreover, oral nutritional supplementation seems to be associated with a significant reduction in pressure ulcer development, compared to routine care.

Enteral (tube feeding) and parenteral (delivered outside the alimentary tract) nutrition may be necessary when oral nutrition is inadequate or not possible, based on the individual's condition and goals.

1.1. Administer oral nutritional supplements (ONS) and/or tube feeding (TF) in between the regular meals to avoid reduction of normal food and fluid intake during regular mealtimes. (Strength of Evidence = C)

Repositioning for the Prevention of Pressure Ulcers

Repositioning

1. The use of repositioning should be considered in all at-risk individuals.

1.1. Repositioning should be undertaken to reduce the duration and magnitude of pressure over vulnerable areas of the body. (Strength of Evidence = A)

High pressures over bony prominences, for a short period of time, and low pressures over bony prominences, for a long period of time, are equally damaging. In order to lessen the individual's risk of pressure ulcer development, it is important to reduce the time and the amount of pressure she/he is exposed to.

1.2. The use of repositioning as a prevention strategy must take into consideration the condition of the patient and the support surface in use. (Strength of Evidence = C)

Repositioning Frequency

2. **Frequency of repositioning will be influenced by variables concerning the individual (Strength of Evidence = C) and the support surface in use. (Strength of Evidence = A)**

   2.1. **Repositioning frequency will be determined by the individual's tissue tolerance, his/her level of activity and mobility, his/her general medical condition, the overall treatment objectives, and assessments of the individual's skin condition. (Strength of Evidence = C)**

   2.2. **Assess the individual's skin condition and general comfort. If the individual is not responding as expected to the repositioning regime, reconsider the frequency and method of repositioning. (Strength of Evidence = C)**

   2.3. **Repositioning frequency should be influenced by the support surface used. (Strength of Evidence = A)**

   An individual should be repositioned with greater frequency on a non-pressure-redistributing mattress than on a viscoelastic foam mattress. The repositioning frequency should depend on the pressure-redistributing qualities of the support surface.

Repositioning Technique

3. **Repositioning contributes to the individual's comfort, dignity, and functional ability. (Strength of Evidence = C)**

   3.1. **Reposition the individual in such a way that pressure is relieved or redistributed. (Strength of Evidence = C)**

   3.2. **Avoid subjecting the skin to pressure and shear forces. (Strength of Evidence = C)**

   3.3. **Use transfer aids to reduce friction and shear. Lift — don't drag — the individual while repositioning. (Strength of Evidence = C)**

   3.4. **Avoid positioning the individual directly onto medical devices, such as tubes or drainage systems. (Strength of Evidence = C)**

   3.5. **Avoid positioning the individual on bony prominences with existing non-blanchable erythema. (Strength of Evidence = C)**

3.6. Repositioning should be undertaken using the 30-degree tilted side-lying position (alternately, right side, back, left side) or the prone position if the individual can tolerate this and her/his medical condition allows. Avoid postures that increase pressure, such as the 90-degree side-lying position, or the semi-recumbent position. (Strength of Evidence = C)

3.7. If sitting in bed is necessary, avoid head-of-bed elevation and a slouched position that places pressure and shear on the sacrum and coccyx. (Strength of Evidence = C)

Repositioning the Seated Individual

4. Position the individual so as to maintain his/her full range of activities. (Strength of Evidence = C)

This may be a complex process — for example, in an armchair that tilts back, , the use of a footrest with the heels offloaded may be a suitable position in terms of pressure redistribution, but may impede transfer to and from the chair.

4.1. Select a posture that is acceptable for the individual and minimizes the pressures and shear exerted on the skin and soft tissues. (Strength of Evidence = C)

4.2. Place the feet of the individual on a footstool or footrest when the feet do not reach the floor. (Strength of Evidence = C)

When the feet do not rest on the floor, the body slides forward out of the chair. Footrest height should be adjusted so as to slightly flex the pelvis forward by positioning the thighs slightly lower than horizontally.

4.3. Limit the time an individual spends seated in a chair without pressure relief. (Strength of Evidence = B)

When an individual is seated in a chair, the weight of the body causes the greatest exposure to pressure to occur over the ischial tuberosities. As the loaded area in such cases is relatively small, the pressure will be high; therefore, without pressure relief, a pressure ulcer will occur very quickly.

Repositioning Documentation

5. Record repositioning regimes, specifying frequency and position adopted, and include an evaluation of the outcome of the repositioning regime. (Strength of Evidence = C)

Repositioning Education and Training

6. **Education about the role of repositioning in pressure ulcer prevention should be offered to all persons involved in the care of individuals at risk of pressure ulcer development, including the individual and significant others (where possible). (Strength of Evidence = C)**

   6.1. **Training in the correct methods of repositioning and use of equipment should be offered to all persons involved in the care of individuals at risk of pressure ulcer development, including the individual and significant others (where possible and appropriate). (Strength of Evidence = C)**

Support Surfaces

1. **General Statements**

   1.1. **Prevention in individuals at risk should be provided on a continuous basis during the time that they are at risk. (Strength of Evidence = C)**

   1.2. **Do not base the selection of a support surface solely on the perceived level of risk for pressure ulcer development or the category/stage of any existing pressure ulcers. (Strength of Evidence = C)**

   Selection of an appropriate support surface should take into consideration factors such as the individual's level of mobility within the bed, his/her comfort, the need for microclimate control, and the place and circumstances of care provision.

   1.3. **Choose a support surface that is compatible with the care setting. (Strength of Evidence = C)**

   Not all support surfaces are compatible with every care setting. Support surface use in a home setting requires consideration of the weight of the bed, the structure of the home, the width of doors, the availability of uninterrupted electrical power, and the ability to promote ventilation of heat from the motor.

   1.4. **Examine the appropriateness and functionality of the support surfaces on every encounter with the individual. (Strength of Evidence = C)**

1.5. Verify that the support surface is being used within its functional life span, as indicated by the specific manufacturer's recommended test method (or other industry-recognized test method) before use of the support surface. (Strength of Evidence = C)

2. Mattress and Bed Use in Pressure Ulcer Prevention

2.1. Use higher-specification foam mattresses rather than standard hospital foam mattresses for all individuals assessed as being at risk for pressure ulcer development. (Strength of Evidence = A)

Higher-specification foam mattresses seem to be more effective in preventing pressure ulcers than standard hospital foam mattresses.

2.2. There is no evidence of the superiority of one higher-specification foam mattress over alternative higher-specification foam mattresses. (Strength of Evidence = A)

There seems to be no clear difference in the effectiveness of high-specification foam mattresses.

2.3. Use an active support surface (overlay or mattress) for patients at higher risk of pressure ulcer development where frequent manual repositioning is not possible. (Strength of Evidence = B)

When high-risk patients cannot be repositioned manually, active support surfaces are needed, as they can change their load-distribution properties.

2.4. Alternating-pressure active support overlays and replacement mattresses have a similar efficacy in terms of pressure ulcer incidence. (Strength of Evidence = A)

2.5. Do not use small-cell alternating-pressure air mattresses or overlays. (Strength of Evidence = C)

Alternating-pressure air mattresses with small air cells (diameter <10 cm) cannot be sufficiently inflated to ensure pressure relief over the deflated air cells. Internal sensors are being utilised in models currently under development that may resolve this problem.

2.6. Continue to turn and reposition, where possible, all individuals at risk of developing pressure ulcers. (Strength of Evidence = C)

3. The use of support surfaces to prevent heel pressure ulcers

3.1. Ensure that the heels are free of the surface of the bed. (Strength of Evidence = C)

3.2. Heel-protection devices should elevate the heel completely (offload them) in such a way as to distribute the weight of the leg along the calf without putting pressure on the Achilles tendon. The knee should be in slight flexion. (Strength of Evidence = C)

Hyperextension of the knee may cause obstruction of the popliteal vein, and this could predispose an individual to deep vein thrombosis.

3.3. Use a pillow under the calves so that heels are elevated (i.e., "floating"). (Strength of Evidence = B)

Using a pillow under the calves elevates the heels from the mattress.

3.4. Inspect the skin of the heels regularly. (Strength of Evidence = C)

4. Use of support surfaces to prevent pressure ulcers while seated

4.1. Use a pressure-redistributing seat cushion for individuals sitting in a chair whose mobility is reduced and who are thus at risk of pressure ulcer development. (Strength of Evidence = B)

Different studies show that the use of a pressure-redistributing seat cushion prevents the development of pressure ulcers.

4.2. Limit the time an individual spends seated in a chair without pressure relief. (Strength of Evidence = B)

4.3. Give special attention to individuals with spinal cord injury. (Strength of Evidence = C)

5. The use of other support surfaces in pressure ulcer prevention

5.1. Avoid use of synthetic sheepskin pads; cutout, ring, or donut-type devices; and water-filled gloves. (Strength of Evidence = C)

5.2. Natural sheepskin pads might assist in preventing pressure ulcers. (Strength of Evidence = B)

Some studies show that the use of natural sheepskin on top of mattresses might help in the prevention of pressure ulcers.

Appendix E

AHRQ Toolkit Questionnaires

AHRQ Documentation Audit Tool Questionnaire	
Documentation of initial skin assessment with 24hr of admitted patient	Yes [] No []
Documentation of daily skin inspection	Yes [] No []
Documented of positional changes or ‘up ad-lib’	Yes [] No []

Citation

Section 7. Tools and Resources (continued). Content last reviewed in October 2014. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/pu7c.html