Retrospective Data Analysis to Support the Use of Small Body Movements as an Intervention for Prevention of Pressure Ulcer Development

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Abstract

Pressure ulcers cost the healthcare systems millions of dollars every year. The current literature indicates that a multi-modal approach must be used in order to provide the best prevention of pressure ulcers. The use of small body movements is a simple intervention that could be utilized in addition to the regularly used prevention methods. A retrospective data analysis was used to assess the possible need for an additional pressure ulcer prevention intervention and the possible effectiveness it may have had on the intensive care patient population. Data was collected 60 days prior to the implementation of the new intervention in place and the data was assessed to see if pressure ulcers development decreases with an additional intervention. The retrospective data was collected by the clinical nurse specialist from the pressure ulcer prevention team. That data was cleared of any identifying information and then forwarded to the primary investigator. Unfortunately, not enough data was able to be collected in order to indicate if the proposed question was accurate.

Keywords: small body movements, pressure ulcer prevention in the intensive care, pressure ulcer prevention, retrospective analysis of pressure ulcer prevention, ICU pressure ulcer prevention

Retrospective Data Analysis to Support the Use of Small Body Movements as an Intervention for Prevention of Pressure Ulcer Development

Pressure ulcers are one of the most common complications a patient can develop during hospitalization. The definition of a pressure ulcer, as defined by The National Pressure Ulcer Advisory Panel, is a localized damage to the skin and/or it's underlying tissue due to pressure or in combination with shear and friction from movement (Bauer, Rock, Nazzal, Jones & Qu, 2016). A patient in the intensive care unit is at an even higher risk to develop a pressure ulcer due to decreased mobility from either sedation, ventilation, acuity of illness, or a generalized weakness. After a pressure ulcer occurs, mortality rates rise from 15% to 63% for a patient in the intensive care unit, putting them at even further risk for more complications (He, Tang, Ge, & Zheng, 2016). These complications include increased length of hospitalization, added morbidity, pain, isolation, and increased financial burden, not only on the patient, but the facilities as well. Pressure ulcers cost millions of dollars every year and with so many methods available for the prevention, the fact that they continue to occur so frequently is reason for further study to be of the highest priority. The purpose of this capstone project was to assess if the utilization of small body movements to shift body weight decreased the rate of pressure ulcer development.

Overview

Background

Prevention of pressure ulcers has been an uphill battle for many years in regards to methods of prevention and treatments. Mortality rates are increased by 63% when a patient develops a pressure ulcer. Pressure ulcers are also considered a "never event"; insurance companies will not reimburse facilities if a patient develops a pressure ulcer (Mattie & Webster, 2008). Besides lack of reimbursement, there are other consequences, including longer length of

stay in the hospital, increased pain, infection, loss of independence, increased workload for staff, litigation expenses, loss of credibility of facilities, and even social isolation of the patient (Ajami & Khaleghi, 2015; He et al., 2016). The significant impact of these consequences suggest prevention needs to be paramount for patient's health and safety

Pressure ulcers cost around $17 billion a year and are most prevalent in adult intensive care units (Peterson, Gravenstein, Schwab, Oostrom & Caruso, 2013). Stakeholders that are affected by the development of a pressure ulcer include the patient and their families, the bedside staff, educators, providers, the administration of a facility, insurance companies, and the facility. When a patient develops a pressure ulcer the morbidity and mortality rates, longer lengths of stay and complications that can arise all contribute to the increasing costs (Peterson et al., 2013). Standard practice calls for the repositioning of patients every 2 hours, however that intervention does not solely prevent pressure ulcers (PU) from developing. It has been suggested that adding pressure redistribution to scheduled turning could lower the incidences of PUs (Tayyib & Coyer, 2016). Unfortunately, there is a lack of research available in regards to this intervention.

Since the movement of dependent and critically ill patients requires manual manipulation by bedside staff, the added stress on staff's bodies and the effectiveness of their turns may decrease over time. If the intensive care units have a high acuity level, staffing requirements are not met, the patients are obese, or procedures performed limit the turning positions available, the turning and repositioning of patients may become less effective in reducing pressure or altering interface pressure on tissue Krishnagopalan, Johnson, Low & Kaufman, 2002).

When critically ill patients are turned, the interface pressure on the different pressure points of the body is altered, thus allowing better blood flow to pass the pressure point surface. Previous studies have shown that increased blood flow following a small shift in body weight

can reduce pressure ulcers. This phenomenon is known as reactive hyperemia (Oertwich, Kindschuh & Bergstrom, 1995).

Problem Statement

The prevention of pressure ulcers relies on so many different moving parts from body position changes, nutrition management, and use of prophylactic dressings on pressure points, to the effort of bedside staff in repositioning tubes, lines, and the patient's body. With intensive care patients being at higher risk of developing a pressure ulcer, the utilization of more methods to reduce pressure may help improve patient outcomes with a decrease in pressure ulcer rates. The effort bedside staff are required to use in order to turn patients the standard 30 degrees and at least every two hours, has been shown to increase fatigue in staff and lead to higher prevalence in units that are overwrought with lack of staffing, or high acuity patients where there are not enough resources. This capstone project explored the following question: Did small shifts in body weight performed hourly with every 2 hour 30-degree turns, compared to every 2 hours 30-degree turns only, decrease the incidence of pressure ulcers over a 30-day period in the intensive care unit?

Purpose Statement

The purpose of this capstone project was to perform a retrospective data analysis in order to provide supportive data for implementation of a systems change that would require utilization of small body movements as an additional intervention to prevent pressure ulcers from developing on patient in an intensive care unit.

Outcomes

It was expected that the retrospective data analysis would find commonalities in pressure ulcer development and would support small shifts in body weight in conjunction with every 2-

hour 30-degree turns as a viable option to prevent pressure ulcers. The overall outcome goal was a decrease in pressure ulcers occurring during the 30 day intervention period. A benchmark of 5% reduction in pressure ulcers pre/post intervention was used as the targeted benchmark.

Review of the Literature

Search Trail

A review of the literature was completed using Cumulative Index to Nursing and Allied Health Literature (CINHAHL), COCHRANE database of Systemic Reviews and Medline. Using CINHAHL with the phrases *pressure ulcer prevention in the ICU*, and *pressure ulcer prevention in the intensive care unit* along with the terms *turning* and *repositioning*, and *interface pressure* the final selection of included over 1000 journal articles. With the addition of the Boolean "AND" as well as "OR" included *repositioning*, *turning*, *small shift of body weight*, and *interface pressure* (Appendix A). Searching COCHRANE database of Systemic Reviews with the same search terms resulted in 2 articles. Lastly the search of Medline, with the aforementioned search items, resulted in 23 articles. With the addition of limiters which include: narrowing the dates from 2014 to current and excluding research not done in English. Exclusion criteria included research not related to the PICOT question, incorrect age groups and duplicates. Inclusion criteria included adults, full text, pressure ulcer therapy, prevention & control, wound healing. The final selection of included 14 journal articles. One article was excluded for focusing on bed position and reporting its irrelevance to pressure ulcer prevention. Each article was critically appraised and the level of evidence was determined utilizing Melnyk and Fineout-Overholt (2015) (Appendix B). Common themes found amongst the research includes decreased rates of pressure ulcers with additional interventions, the use of small body movements to decrease interface pressure and reduce tissue damage, and overall improved outcomes for patients.

While utilizing multiple options or preventive methods is common practice, there is not a specific set of cares adopted worldwide to be utilized by healthcare providers. Even on different units or floors of the same facility, different healthcare providers or nurses may utilize different methods on a case by case basis. Options of prevention include, but are not limited to: nutrition supplementation, incontinence management, pressure relieving devices, barriers creams, prophylactic dressings, specialty beds and turning systems (Tayyib & Coyer, 2016). Evidence shows all of these methods are effective choices to be used for prevention, however the use of small body movements to alter the interface pressure on different points of the body is not currently a widely practiced choice. According to Oertwhich et al. (1995), small body movements and repositioning is enough to alter the interface pressure on a patient's tissues. Findings suggested that small shifts in body movement relieve pressure and increase blood flow to a patient's skin (Oertwich et al., 1995).

Overall there is a multimodal approach and many prevention methods are utilized at the same time, due to the fact patients in the intensive care require such invasive and close monitoring to occur. Common findings throughout the literature suggest a key proponent in prevention is turning patients and redistributing pressure on different points of their bodies. This redistribution of what is known as interface pressure, prevents tissue ischemia, which leads to tissue breakdown, and helps prevent pressure ulcers from occurring.

Current Prevention Methods

A pressure ulcer is one of the top three complications a patient can develop while in the hospital. A pressure ulcer can cost thousands of dollars to treat and a patient can suffer from increased pain, social isolation, increased rates of infection, and longer lengths of hospitalization. Patient's in the intensive care unit have an increased risk of developing a pressure ulcer

compared to other units in the hospital. The prevalence rate is about 22% to 49% (Tayyib & Coyer, 2016).

Preventing Tissue Breakdown

Studies conducted by Boyko, Longaker and Yang (2018) and Tayyib and Coyer (2016) show that a multi-disciplinary approach is needed to prevent pressure ulcers. Movements utilized to prevent skin breakdown include using a 2-hour repositioning schedule, and reducing turning degrees to less than 30 degrees to reduce and alter interface pressure on pressure points (Gill, 2015; Peterson et al., 2013). Ways to promote skin healing and prevent skin damage include: managing nutrition to improve tissue healing and prevent skin breakdown, repositioning invasive interventions like, nasogastric tubes, indwelling foley catheters, endotracheal tubes, pulse oximetry probes, documenting skin changes by completing skin assessments done every shift and when changes in condition occur, and preventing friction and shear by using repositioning systems to move the patients. Oertwich et al. (1995) further discuss the concern for continued tissue ischemia on certain pressure points including the elbows, shoulders, hips, and coccyx and how small body movement can decrease interface pressure.

These articles were examined closely to gain a better understanding as to how small body movements could impact the development of pressure ulcers. The common themes found throughout these articles include the use of repositioning to prevent tissue ischemia, which leads to pressure ulcers. The research also revealed the importance of a multi-disciplinary approach in order to prevent pressure ulcers, to include important elements such as nutrition and the use of preventive dressings.

Method of Measurement

Continuous body pressure mapping (CBPM) was also being used in multiple studies in order to assess the interface pressure of the different pressure point on a patient's body. Krishnagopalan et al. (2002) state that turning patients every 2 hours is increasingly important in order to prevent tissue breakdown, especially with patients in the intensive care unit. This monitor, when used in conjunction of current practices, i.e. scheduled turning and repositioning, was able to pinpoint where higher levels of pressure were maintained after a turn and where small shifts in movement would help to alter this increased pressure and prevent tissue ischemia (Oertwich et al., 1995). Several researchers report that the use of these monitors were able to show staff actual visual data to represent the increased interface pressure on pressure points where tissue ischemia occurs. This real time visual feedback helped to improve turns and pressure relief and showed how simple small body movements can be used to alter the pressure and improve the blood flow to that tissue (Ajami & Khaleghi, 2015; Behrendt, Ghaznavi, Mahan, Craft & Siddiqui, 2014).

Summary of Findings

Despite pressure ulcer prevention methods and all of the research to support the use of an additional intervention, pressure ulcers continue to develop and cause complications. Oertwich et al. (1995) endorse the use of small body movements to alter interface pressure and decrease tissue ischemia, leading to pressure injuries. Modifying the current standard of practice to include adding small body movements to shift weight distribution and alter interface pressure, would increase the level of pressure ulcer prevention. Research by Peterson et al. (2013) also demonstrates the need for redistribution of patient's tissue in order to have more effective prevention of pressure ulcers. The added prevention measures of small body movements are

highly impactful to patients and are low impact on staff who would be implementing these changes, which in turn will lead to better outcomes.

Theoretical Framework

Iowa Model

The Iowa Model utilizes a twelve-step process to developing a new practice and implementing that practice (Iowa Model Collaboration, 2017). These steps include identifying a triggering issue, state a question or purpose, figuring out if this topic is a priority, forming a team, retrieving and appraising evidence, finding out if the evidence is sufficient, design that practice change, implement the practice, evaluation, using that data and deciding if the change is appropriate to practice, integrate and sustain the practice and lastly, disseminating the results (Appendix C).

With the topic being chosen, the PICO was identified due to an increased number of pressure ulcers developing in this intensive care, and this topic was determined a priority. The next step was to form the team, which included the primary investigator, clinical nurse specialist, and the pressure ulcer prevention team. These individuals were responsible collecting and composing the data.

Evidence and research were identified, literature was collected, and a critical appraisal was completed in regards to the pressure ulcer prevention methods and small shifts in body weight previously identified (Appendix A). The anticipated practice change supported with this capstone project, was be to add small shifts in body weight to alter interface pressure of a patient’s pressure points and increasing blood flow to that tissue, thus decreasing tissue ischemia, and preventing tissue damage.

Data was collected by the clinical nurse specialist and compiled to reveal the prevalence

of pressure ulcers prior to small body movement interventions. The project was interrupted by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, limiting available data. The retrospective data obtained was determined insufficient and a statistical analysis was unable to be completed. Due to the lack of available data to be collected, the completion of the Iowa Model halted.

Organizational Assessment

A Midwest hospital dedicated to teaching and research was selected for implementation of this capstone project. Stakeholders at this institution recognized the need to explore additional methods to decrease pressure ulcers among ICU patients. Several nurses on the designated unit were active members of the pressure ulcer prevention team. These nurses were eager to identify and implement more effective methods to help prevent the occurrence of pressure ulcers. This organization utilized evidenced-based practice. This project was supported by leadership at both administrative and unit levels. Approval to conduct the capstone project was granted and letter of support was obtained (Appendix D and E).

Readiness to change within the organization was evident by staff support of the project and pre-existing interest in the topic within the organization. An anticipated significant barrier included staff push back, however this did not occur. Education and encouragement were provided to help decrease staff resistance. Project risks and unintended consequences were limited. Evaluating and comparing data of the current trial intervention of adding small body movements as it compares to every 2 hour turns only did not pose any threat to patient safety. The comparison data for the project looked retrospectively at existing data, which did not impact the patient population.

Methodology

In the intensive care unit, the patient population consisted of patients requiring support and care for septic shock, liver and kidney transplants, post cardiac arrests, gastrointestinal bleeds, pulmonary emboli, and the use of veletri and remodulin for pulmonary hypertension management, and/or any other condition causing a patient to require a higher level of care. Data from prior to the retrospective data collection, and the time period afterwards was not comparable due to the alteration of the patient population related to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic.

Setting

This capstone project took place on a 12-bed intensive care unit at the Midwest teaching and research hospital. The critical care medicine team managed all of the patients and the consults to different groups included, but were not limited to: cardiology, nephrology, hepatology, neurology and transplant. The population served was diverse. The institution was a high-profile facility that conducts transplants and other extensive procedures. Transfers from outside facilities and patients served from surrounding regions were common.

Sampling

The characteristics of this population included patients whose ages ranged from 18 years old and older and the demographic included people of all races, genders, ethnicities, religions and creeds. As a state institution, this Midwest hospital had some of the most prolific specialties which allowed the patient population to be the most diverse and critically ill. The intensive care included a population of patients who required life sustaining medications, assistive devices, and extensive assessments and cares, continually being provided by bedside staff. These patients may have required mechanical ventilation, vasopressor medication utilization, been subjects of

substance overdosed, needed pulmonary hypertension management with Veletri or Remodulin, required continuous renal replacement therapy (CRRT), needed more invasive vascular access, or overall had a higher risk of compromise of life due to illness, medical condition or injury. The inclusion criteria for this project included all intensive care patients on the unit during the designated 60-day period identified as at risk for pressure ulcers on admission or due to a change in status. The exclusion criteria were if the patient was able to turn themselves and were not dependent on staff assistance for movement.

Implementation Procedures

Retrospective data was requested from patient charts who were hospitalized in this specific intensive care unit during a specific 60-day period of time that included 30 days pre-small body movement intervention. Specific data included, age, gender, admitting diagnosis, Braden scale score, use of prevention methods, stage of pressure ulcer developed, and where the pressure ulcer developed was collected. The clinical nurse specialist was responsible for retrieving the requested data, and removed all identifying health information before the data was placed in to a spreadsheet. This data was forwarded to the primary investigator. Due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic and decreased patient census, there was limited data available to be collected.

This specific intensive care where the retrospective data analysis was being completed, was deemed to be modified to provide care for patients who were being admitted with SARS-CoV-2. This modification required the intensive care to stop admitting patients for a few weeks prior to being closed to all patients. This was done in order to alter the air flow to create the negative air flow required for the SARS-CoV-2 patient population. Since the unit needed to close staff was dispersed throughout the hospital until such time that the population of SARS-CoV-2

patients increased and required the intensive care to reopen. Due to being closed for weeks prior to readmitting patients there was no opportunity for data to be collected in order to be included in this retrospective data analysis.

Measurement Instrument

A retrospective analysis included data from a 60-day period in this intensive care unit. Charts were reviewed to assess the incidence rate of pressure ulcer development or worsening of existing pressure ulcers while the standard interventions were in place. A pressure injury deep dive tool was used to gather all the needed information and the pertinent information required for this capstone (Appendix F). This tool was actively utilized by the pressure ulcer prevention team, and would be used when a pressure ulcer would develop in the intensive care. Data they would collect include basic demographic information about each patient, where the pressure ulcers developed, as well as characteristics about the pressure ulcers. They would evaluate whether or not the proper prevention methods were in place when the pressure ulcer developed, and if not, why they were not utilized.

Data Collection Procedures

Data was collected by the clinical nurse specialist. Charts were assessed to see if preexisting pressure ulcers worsened during the period of the intervention. Each chart was assessed for the gender, age, admitting diagnosis, Braden scale score, and if all the current interventions were in place, the stage of the pressure ulcer and the location. If the interventions were properly utilized, it was noted on the data collection tool by checking the corresponding box.

Ethical Considerations/Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained prior to initiating the capstone project. Data that was collected in regards to this capstone was collected by a Clinical Nurse Specialist and was only reviewed by this investigator. The collected data was stored on a password protected computer and only this same investigator had access to it. When this data was collected, charts were assigned numbers starting from one and increasing in order and were identified further by that assigned number. No personal information other than age and gender were identified. The primary investigator is an employee of this facility, therefore the information was collected by the Clinical Nurse Specialist and given to the investigator without any identifying information to keep it anonymous and prevent any conflict of interest.

The gathering of retrospective data posed no greater than minimal risks to the subjects involved. The population involved in this retrospective data analysis included individuals from different vulnerable populations, however it did not impact the patients directly in any way.

Data Analysis & Results

Due to SARS-CoV-2 pandemic the data available was limited. The data that was collected was insufficient to complete a statistical analysis. The numbers were unable to be compared to determine if pressure ulcers could have had decreased prevalence rates with the use of the additional intervention, due to the fact there was not enough data collected.

Table 1

Pressure Ulcer Data

demographic information	case #1	case #2	case #3
age	67	71	54
gender	Male	Male	Male
admitting diagnosis	septic shock	encephalopathy	acute hypoxemic respiratory failure
braden score	18 or less/16 or less	18 or less/16 or less	18 or less/16 or less
interventions in place	yes	no	no
stage of pressure ulcer	deep tissue injury	unstageable	stage 1
location of pressure ulcer	coccyx	bilateral heels	behind ears

Due to SARS-CoV-2 pandemic the intensive care population this project was focused on, there

was a decreased patient census prior to the intensive care being closed down. This intensive care was transformed into one that specifically cared for patients with SARS-CoV-2, and the usual population was diverted to other intensive care units. When this intensive care reopened it was during the 60-day time frame and the patient population was decreased and did not included the baseline patient population of sepsis, pre-liver transplants, gastrointestinal bleeding, or pulmonary hypertension, which the original intensive care population this capstone was focused on.

Discussion

This project did not reveal sufficient data and the statistical information was due to the inability to collect more data. Attempting to complete this project again in the future can provide more data. Using the Iowa Model, the steps up to the point of having sufficient evidence, were complete but had to stop there as there was insufficient data available. The next step, state a question or purpose was completed after a discussion with the pressure ulcer team took place. It was determined that prevalence rates of pressure ulcers had increased in the Midwest teaching hospital. A team was formed between the primary investigator, the clinical nurse specialist and the pressure ulcer prevention team in order to collect the data. The investigator retrieved and appraised the evidence, however there was insufficient evidence or data to support the utilization of small body movements to prevent pressure ulcer development. This project was greatly impacted by SARS-CoV-2 pandemic and decreased patient population, thus causing the limited available data. Due to this fact the primary investigator was unable to move forward with the project as originally intended.

Plan for Sustainability

The option to move forward and attempt to complete this retrospective data analysis remains possible. Since the onset of the SARS-CoV-2 pandemic, there has been an alteration in the patient population, resulting in patients who are much sicker and have more invasive treatments being performed to help them survive. These procedures yield higher risks of the patient's developing pressure ulcers due to prone positioning of the patients. The prone position limits the pressure relief able to be provided because of how the patient must lay for proper oxygenation. All this data could be collected at a later date, and if the time frame could be extended, there would be an opportunity for data availability.

Implications for Practice

This retrospective data analysis was unable to show how the implementation of small body movements being added to the regularly planned interventions would be a viable option used to prevent pressure ulcers from occurring and worsening. It was important to recognize that due to time constraints, limited availability of patient data, and the impact that the current pandemic had on patient population, it was the responsible choice to not push this project forward. The clinical nurse specialist, pressure ulcer prevention team, and the faculty investigator we all made aware of the barriers to completing this capstone project. The investigator was greatly supported throughout this process and despite the current pandemic, the clinical nurse specialist and pressure ulcer prevention team made themselves available to collect what data they could.

Conclusion

There are a multitude of prevention methods that are used on a daily basis to help prevent pressure ulcers from developing. This capstone was limited due to the SARS-CoV-2 pandemic and the effects it had on the intensive care unit where this capstone project took place.

Reattempting this capstone at a later date would be recommended to obtain a larger data set in order to perform a statistical analysis yielding sufficient data to examine the use of small body movements as an intervention for prevention of pressure ulcer development . This analysis could then assist with the determination if policy change would impact pressure ulcer prevalence.

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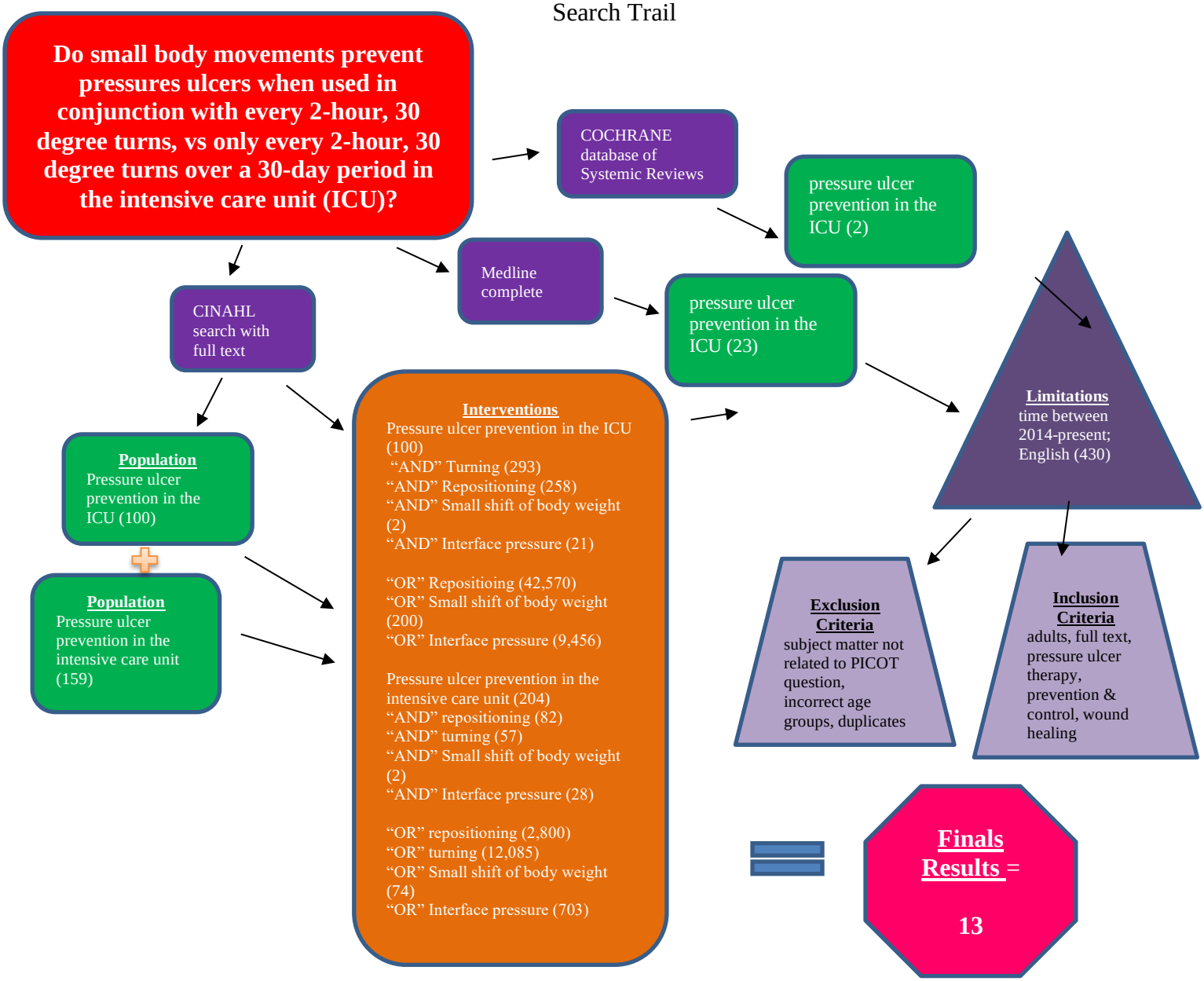
Appendix

Appendix A

Search Trail



Appendix B

Reference Matrix

Clinical Question:
Do small body movements prevent pressures ulcers when used in conjunction with every 2-hour, 30 degree turns, vs only every 2-hour, 30 degree turns over a 30-day period in the intensive care unit (ICU)?

Citation/Level of Evidence	Participant/ Setting/ Sample Size	Purpose/Background	Methods/Design & Limitations	Findings/Summary/Strengths/ Weakness	Applicability to Own Research
Ajami, S., & Khaleghi, L. (2015). A review on equipped hospital beds with wireless sensor networks for reducing bedsores. *Journal of Research in Medical Sciences,* 20(10), 1007. doi:10.4103/1735-1995.172797	ICU patients	Bedsore is the third costly disorder after cancer and cardiovascular diseases. In various studies, treatment costs have been estimated to be about $125-451 for grades 1 and 2 of bedsore and $1,400-2,300 for grades 3 and 4 of bedsore. smart bed and mattress, either alone or in combination with the other technologies, should be capable of providing all of the novel features while still providing the comfort and safety features usually associated with traditional and hospital mattresses. It can eliminate the expense of bedsore in the intensive care unit (ICU) department in the hospital and save much expense there.	This study was a nonsystematic review. The literature was searched for WSNs to reduce and prevent bedsores with the help of libraries, databases (PubMed, SCOPUS, and EMBASE), and also search engines available at Google Scholar including during 1974-2014 while the inclusion criteria were applied in English and Persian. In our searches, we employed the following keywords and their combinations: "wireless sensor network," "smart bed," "smart mattress," "information technology," and "bedsore" in the searching areas of the title, keywords, abstracts, and full texts. In this study, more than 45 articles and reports were collected and 37 of them were selected based on their relevance.	Overall, according to the care method and costs of the care, patient care is very important for caregivers and also for patients and their families. Finding the best and most economic method of patient care has engaged the minds of many experts in various fields of medical services or information technology (IT) and electronic engineering. With the application of smart materials or microsensors in medical equipment and attaching the same to patients as well as physicians, these conditions can be controlled to a great extent and the standard care can be provided for patients.	This use of mattress sensors is not directly related to my capstone, however there is supportive evidence in regards to the cost to the healthcare system when a bedsore does develop, and how systems as a whole, needs more options to assist with pressure ulcer prevention.
Behrendt, R., Ghaznavi, A. M., Mahan, M., Craft, S., & Siddiqui, A. (2014). Continuous bedside pressure mapping and rates of hospital-associated pressure ulcers in a medical intensive care unit. American Journal of Critical Care, 23(2), 127–133. doi:10.4037/ajcc2014192	422 patients in the medical ICU	Critically ill patients are vulnerable to the development of hospital-associated pressure ulcers (HAPUs). Positioning of patients is an essential component of pressure	Prospective controlled study. patients were enrolled and assigned to beds equipped with or without a CBPM device. Patients' skin was assessed daily and weekly to determine the presence and	Significantly fewer pressure ulcers in patients being repositioned every 2 hours and small body movement were made to high pressure areas to alter surface pressure. 2/213 patients in the test groups developed pressure ulcers	This article supports my research because I am wanting to implement the process of small body movements in order to reduce

Randomized prospective controlled study, Level 2, (Melnyk & Fineout-Overholt, 2015).		ulcer prevention because it off-loads areas of high pressure. A continuous bedside pressure mapping (CBPM) device can provide real-time feedback of optimal body position though a pressure sensing mat that displays pressure images at a patient's bedside, allowing off-loading of high-pressure areas and possibly preventing HAPU formation	progress of HAPUs. All patients were turned every 2 hours. CBPM patients were repositioned to off-load high-pressure points during turning, according to a graphic display. The number of newly formed HAPUs was the primary outcome measured. A x^2 test was then used to compare the occurrence of HAPUs between groups Limitations Restricted definition of a pressure ulcer, only stage II or higher Lack of blinding the outcome assessment	and 10/213 patients in the control group developed pressure ulcers.	the surface pressure of the patients to prevent pressure ulcers.
Gill, E. C. (2015). Reducing hospital acquired pressure ulcers in intensive care. *BMJ Quality Improvement Reports*, *4*(1). doi: 10.1136/bmjquality.u205599.w3015	ICU patients	Pressure ulcers are a real and definite problem in our medical system. Regardless of all our new equipment and know how, pressure ulcers are not on a downward trend. Pressure ulcers are growing in incidence, and it is usually the most vulnerable, elderly, and weak of our society who face these complications. Pressure ulcers cause the patient pain and misery and are expensive to treat. They can also be a aspect in patients' mortality rates. High incidences of pressure ulcers in an organization may imply a diminished quality of care	The four main areas targeted were: improving staff education and knowledge of pressure ulcer prevention, correct and timely risk assessment of the patient, frequent patient offloading/relieving pressure, and moisture management. The plan, do, check, act cycle is a four-step management method used in business for the control and continuous improvement of processes. Limitations being forced to limit our quality improvement process to our ICU department due to manpower and time restraints. We are planning to initiate and develop this quality improvement process throughout the facility	Involving key stakeholders and a multi-disciplinary team to identify and improve patient care can be difficult to coordinate, but it can lead to a more successful outcome. Some healthcare professionals have a more positive attitude towards a team approach than others and are more accommodating.	This article support my research as it involves a multidisciplinary approach to pressure ulcer prevention and focusing on ICU patients.

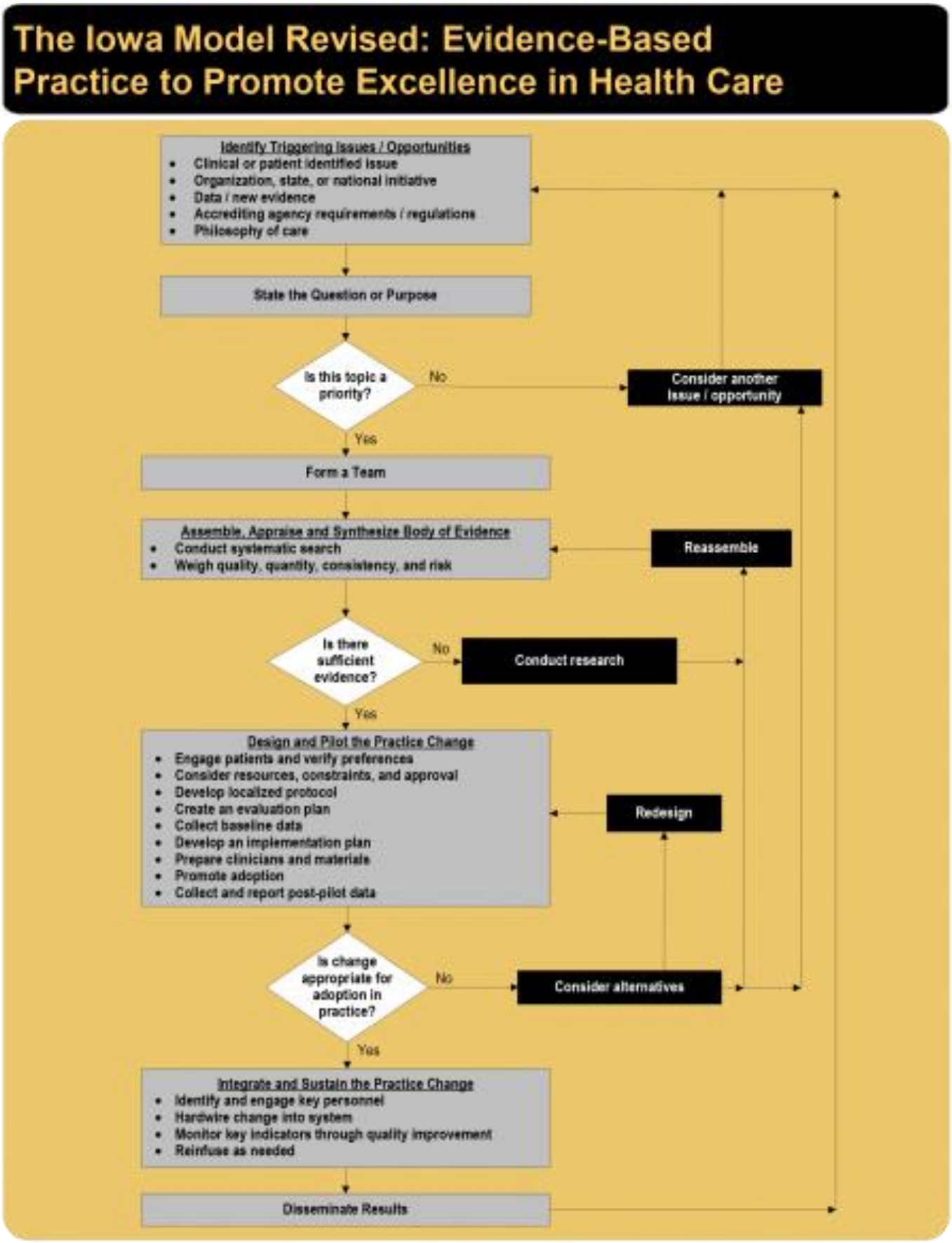
He, M., Tang, A., Ge, X., & Zheng, J. (2016). Pressure ulcers in the intensive care unit. *Advances In Skin & Wound Care*, 29(11), 493–498. doi: 10.1097/01.asw.00004947D79.66288.c9	102 ICU patients (54 men, 48 women). The patients ranged in age from 23 to 88 years	The aim of this study was to determine whether skin barrier factors were associated with the common complication of pressure ulcers (PrUs) in intensive care unit (ICU) patients. It is unclear whether skin barrier factors influence the development of PrUs	Demographic variables and the score for the Acute Physiology and Chronic Health Evaluation IV were recorded on admission. The Braden Scale assessment and measurements of the skin barrier factors were performed daily. Standard care for the prevention of PrUs was strictly administered, and PrUs that developed were evaluated according to the recommendations of the US National Pressure Ulcer Advisory Panel 2007 (Note: The authors used the 2007 recommendations at the time of their study.). Data were analyzed using descriptive statistics and logistic regression.	The mean score for the Braden Scale was 11.2, and the incidence of PrUs was 31.4%. Lower moisture content of the stratum corneum and higher skin surface pH at the lower sacrum and hip were risk factors for PrUs, whereas scapular and heel skin barrier factors were not.	This article provides supportive information as to the prevalence rates of pressure ulcers in ICU patients and how multi method approaches need to be utilized to prevent them from occurring. It also demonstrated likely development places occurred over the hips and sacrum.
Krishnagopalan, S., Johnson, E. W., Low, L. L., & Kaufman, L. J. (2002). Body positioning of intensive care patients: Clinical practice versus standards. *Critical Care Medicine*,*30*(11), 2588-2592. doi:10.1097/00003246-200211000-00031 Prospective longitudinal observational study, Level V, (Melnyk & Fineout-Overholt, 2015).	74 critically ill patients in the intensive care unit. Convenience sample of mixed medical/surgical ICU patients at three tertiary care hospitals in two different cities in the United States. Random sampling of ICU professionals from a directory.	To determine if immobilized patient in the intensive care unit (ICU) receive the prevailing standard of change in body position every 2 hours To determine prevailing attitudes about patient positioning among ICU physicians	Prospective longitudinal observational study. E-mail survey of ICU physicians. Limitations The response rate to survey was quite low (60/72 responded). We utilized an e-mail survey to improve the ease of response for recipients and thereby the response rate. Nonresponders were sent reminders. Despite our efforts, the response rate remained low. We believe, however, that there is no selection bias of this smaller sample that would preclude drawing conclusions from the data for trends. Other limitations of our study stem primarily from its observational nature. Despite our attempts to blind caregivers	In the survey of ICU specialists, 392 surveys were sent by electronic mail, and replies were obtained from 72 people, a response rate of 18.4%. A total of 60 of those replying (83%) agreed that the standard of ICU care was turning the patient every 2 hrs (Table 1). To the question of whether this standard may prevent complications, 65 (90%) again agreed. As to whether this standard is being achieved the majority of the time in their ICUs, the respondents were divided. Only 41 (57%) felt that the standard of turning every 2 hrs was achieved; the remaining 30 (42%) felt that this standard was not practiced in their ICU A total of 74 patients were observed in three separate ICUs. Table 2 shows the total observation times by site and per patient. Patients were observed for an	This article supports my research because it looks at the efficacy of current evidence-based practice of turning every 2 hours to prevent pressure ulcers

			to the nature of our study, it is possible that our intention was known and the data do not accurately reflect the reality of care rendered. Any unblinding, however, would be expected to actually increase adherence to prevailing standards of care	average of 7.7 hrs each (SD, 1.6 hrs), with a median of 8 hrs, and 77% of patients were observed for >7 hrs. A total of 566 patient hours of observation were included in the analysis Weakness not enough responses to the survey and surveys should have been administered to bedside staff like RNs or LPNs for a better idea of utilization	
Oertwich, P. A., Kindschuh, A. M., & Bergstrom, N. (1995). The effects of small shifts in body weight on blood flow and interface pressure. *Research in Nursing & Health, 18*(6), 481-488. doi:10.1002/nur.4770180604 Repeated measures design, Level 4, (Melnyk & Fineout-Overholt, 2015).	A convenience sample of 50 long term care residents from three rural long-term care facilities. 31 women and 19 men ages ranging from 67 to 97	The purpose of this study was to evaluate the effect of small shifts in body weight on blood flow and interface pressure under a dependent bony prominence	A within subject, repeated measures design used to evaluate blood flow and interface pressure in two different positions (lateral oblique and supine) in body weight.	Interface pressure decreased beneath dependent body prominences as a result of small shift interventions Making small shifts in body weight and redistributing a boy's surface area does make an impact on pressure ulcer prevention and is effective in preventing pressure injuries and increase blood flow. Strengths Use of monitors for interface pressure assessment can be repeated Weakness More research is needed	This article supports my research because it is directly related to what I am hoping to implement with patient's in order to prevent pressure ulcers.
Citation/Level of Evidence	**Participant/ Setting/ Sample Size**	**Purpose/Background**	**Methods/Design & Limitations**	**Findings/Summary/Strengths/ Weakness**	**Applicability to Own Research**
Peterson, M. J., Gravenstein, N., Schwab, W. K., Oostrom, J. H., & Caruso, L. J. (2013). Patient repositioning and pressure ulcer risk: Monitoring interface pressures of at-risk patients. *The Journal of Rehabilitation Research and Development,50*(4), 477. doi:10.1682/jrrd.2012.03.0040	This study was completed at a tertiary care, university-affiliated hospital with 23 intensive and intermediate	Pressure ulcers are a high-risk, high-volume, and high-cost problem for hospitalized and bedridden patients. Overall pressure ulcer prevalence rates have been reported at 12.3	Descriptive, observational study. bedridden patients undergoing q2h repositioning would demonstrate a triple-jeopardy area (i.e., triple jeopardy area is not zero). To achieve a power of 80	Bedridden patients at risk for pressure ulcer formation exhibit high skin-bed interface pressures and specific skin areas that are likely always at risk (i.e., triple-jeopardy and always-at-risk areas) for the vast majority of the time patients are in bed despite routine	This research article does support my research as I am trying to improve the pressure relief and interface pressures patients

Descriptive study, Level 6, (Melnyk & Fineout-Overholt, 2015).	care beds with a Braden score ≤18	percent across all facilities, with prevalence being highest in facility-acquired prevalence being highest in adult intensive care units	percent, a one-tailed test with an effect size of 0.8, and an error probability of 5 percent required a minimum sample size of 12. The effect size, though seemingly large, is conservative based on results from our previous study with nondisabled subjects [42] and, since a negative area does not exist, a one-tailed test is appropriate. We enrolled participants in the study until we monitored at least 12 in all three distinct positions: supine, turned left, and turned right. To compute the power, we used G*Power 3.0	repositioning care. Healthcare providers are unaware of the actual tissue relieving effectiveness (or lack thereof) of their repositioning interventions, which may partially explain why pressure ulcer mitigation strategies are not always successful. Limitations First, tissue interface pressures do not directly measure internal tissue and capillary pressures. Second, patient shifting and/or raising the HOB could result in a patient moving off the sensor array, generating unusable pressure profiles (<8% of data collected). Third, we anatomically aligned patient interface pressure profiles when necessary to ascertain that specific areas of skin were correctly tracked over time. We needed alignment for half of the patients we observed. This adjustment, or any patient movement, could have led to minor errors in tracking specific skin areas, but we found no significant difference in triple-jeopardy or always-at-risk areas between patients who had their pressure profiles aligned compared with those who did not. Last, we placed the sensor array beneath the patient's underpads to protect it from the patient and additional contaminants and so that it would not be used in place of the underpads to help lift and reposition the 486 JRRD, Volume 50, Number 4, 2013 patient. The underpads may aid in slight pressure relief, thus resulting in lower measured pressures.	have that increase the risk of developing a pressure ulcer.
Tayyib, N., & Coyer, F. (2016). Effectiveness of pressure ulcer prevention strategies for adult patients in intensive care units: A systematic review. *Worldview on Evidence-*	This was a study retrieval completed through	The purpose of this article was to synthesize the best available evidence regarding the	ICU patients age 18 years and older. Included were randomized controlled	Evidence of effectiveness in nutrition, skin care regimens, positioning and repositioning schedules, support surfaces and	This article does not support my research as it does not provide

Based Nursing, 13(6), 432-444. doi:10.1111/wvn.12177 Systematic review, Level 1, (Melnyk & Fineout-Overholt, 2015).	CINAHL, Medline, Cochrane Central Register of Controlled Trials, Embase, Scopus, and Mednar from 2000-2015. Patient were in the ICU and 18 and older.	efficacy of single strategies to reduce pressure ulcers	trials, quasi-experimental and comparative studies. Limitations Limited number of available studies and specificity of research. Small sample sizes and inconsistency of pressure ulcer staging systems	education in regards to prevention of pressure ulcers in the ICU is limited. 3 studies involved ICU patients and positioning in bed Strength Indicates the use of prophylactic dressings to prevent pressure ulcers of heels and sacrum Weakness 25 collected studies, evidences of effectiveness of repositioning was limited, and the 3 studies that were found did not discuss repositioning frequency.	information in regards to prevention of pressure ulcers by utilizing specific repositioning and small body movement to alter surface pressure.
Wong, H., Kaufman, J., Baylis, B., Conly, J.M., Hogan, D.B., Stelfox, H.T., Southern, D., Ghali, W., Ho, C.H. (2015). Efficacy of a pressure-sensing mattress cover system for reducing interface pressure: Study protocol for a randomized controlled trial. *Trials, 16*(1). doi:10.1186/s13063-015-0949-x Randomized control trials, Level 2, (Melnyk & Fineout-Overholt, 2015).	678 inpatients in an acute care facility. Data in regards to interface pressure collected over 3 days. For 60 of the patients monitoring will continue until discharge.	Pressure ulcers are a leading cause of morbidity for in facility individuals and lead to substantial discomfort, prolonged hospitalizations, additional costs, and in some cases death	A parallel two-group randomized controlled clinical trial will be conducted to study the effect of continuous pressure imaging on reducing interface pressure and on the incidence of pressure ulcers in vulnerable hospital patients. The intervention group will have the ForeSite PT™ system and the LCD monitor turned on to provide visual feedback to the healthcare providers while collecting continuous interface pressure data. The control group will have the ForeSite PT™ system turned on for collecting continuous interface pressure data, but the LCD monitor will be turned off so as not to provide visual feedback to the healthcare providers	This is the first randomized controlled trial to investigate the effect of visual feedback with continuous interface pressure of vulnerable hospital patients across different care settings, and the association between interface pressure and development of pressure-related skin and soft tissue changes. Study is not concluded.	This research article depending on the findings of the study will support my current research. I will be attempting the adjusting turning and interface pressure to assess for decreased rates in pressure ulcer development.

Appendix C


The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care
Identify Triggering Issues / Opportunities
Clinical or patient identified issue
Organization, state, or national initiative
Data / new evidence
Accrediting agency requirements / regulations
Philosophy of care
State the Question or Purpose
Is this topic a priority?
No
Consider another issue / opportunity
Yes
Form a Team
Assemble, Appraise and Synthesize Body of Evidence
Conduct systematic search
Weigh quality, quantity, consistency, and risk
Reassemble
Is there sufficient evidence?
No
Conduct research
Yes
Design and Pilot the Practice Change
Engage patients and verify preferences
Consider resources, constraints, and approval
Develop localized protocol
Create an evaluation plan
Collect baseline data
Develop an implementation plan
Prepare clinicians and materials
Promote adoption
Collect and report post-pilot data
Redesign
Is change appropriate for adoption in practice?
No
Consider alternatives
Yes
Integrate and Sustain the Practice Change
Identify and engage key personnel
Hardwire change into system
Monitor key indicators through quality improvement
Reinfuse as needed
Disseminate Results

Appendix F

MRN:_____ Unit_____ SWAT REP(s)_____

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PRESSURE INJURY DEEP DIVE Complete one Deep Dive per Injury			
1. MRN:	2. Patient Name:	3. Facility Admission Date:	4. Facility Admission Time:
5. Admitting Diagnosis:		6. Secondary Diagnosis (if applicable):	
HOSPITAL ACQUIRED PRESSURE INJURY INFORMATION – LDA			
7. Date HAPI identified:		8. Time HAPI identified:	
9. Anatomical location of HAPI:		10. Stage of HAPI: □ Stage 1 □ Stage 2 □ Stage 3 □ Stage 4 □ Unstageable □ Deep Tissue Injury □ Mucosal	
11. Was injury related to medical device: □ Yes □ No □ N/A If applicable, what medical device was determined to have caused the pressure injury? □Na □Bedpan □Boots □Blood pressure Cuff □Brace/Splint □Brief/Diaper □Chest Tube □Compression therapy □E-Tad □ET Tube □Eyeglasses □Feeding Tube □Foot Board □IV tubing/Art line Tubing □Misc. Tube □NG Tube □Oximetry Probe □Oxygen delivery device □Securement Devices □Sequential SCD's □Trach Tube □Urinary Catheter □Other _____		12. Departments connected to this injury (Mark all that apply for 72 hours PRIOR to date HAPI identified): Werner: □ 8 MS □ 7 SCU □ 6 PCU □ 6 ICU □ OR Lied Tower: □ 4 Lied □ 5 Lied □ 6 Lied □ 7 Lied University: □ 5 West □ MICU □ PICU □ PEDs □ Women's Svcs □ ACU Hixon Lied: □ NICU Clarkson □ 9 Trauma □ 8 CPCU □ NSICU □ SICU □ 7 HVU □ 6 Neuro □ 5 SOTU □ 5 SDCC □ 4 Overflow □ CVICU □ OR □ IR □ ED □ 2 OBS BMC: □ 3 MS □ ICU □ 4 □ ED □ OR □ IR Other: _____	
Interdisciplinary Team			
13. Was PROVIDER notified of HAPI? □ Yes □ No		14. Date PROVIDER Notified:	
15. Was IP WOS consulted PRIOR TO development of HAPI? □ Yes □ No Date/Time of Consult order: _____		16. Was Nutrition Services consulted PRIOR TO development of HAPI?? □ Yes □ No Date/Time of Consult order: _____	
17. Was IP WOS consulted AFTER the HAPI was discovered? * trying to determine if WOS was re-consulted to inform of HAPI □ Yes □ No Date/Time of Consult order: _____		18. Was Nutritional Services consulted AFTER the HAPI was discovered? * trying to determine if Nutrition was re-consulted to inform of HAPI □ Yes □ No Date/Time of Consult order: _____	
19. Was PT consulted PRIOR TO development of HAPI? □ Yes □ No Date/Time of Consult order: _____		20. Was OT consulted PRIOR TO development of HAPI? □ Yes □ No Date/Time of Consult order: _____	
21. Was WOS flagged on admission profile □ Yes □ No		22. Was Nutritional Services flagged on admission profile □ Yes □ No	

MRN:_____ Unit_____ SWAT REP(s)_____

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PRESSURE INJURY PREVENTION SKIN BUNDLE Stage 1 or 2 – Look at 24 hours PRIOR to pressure injury identification Stage 3, 4, or Unstageable – Look at 72 hours PRIOR to pressure injury identification DTI – Look at 48 hours PRIOR to pressure injury identification			
23. Was a 2 RN skin assessment completed within 12 hours of admission?	□ Yes □ No	24. Was a 2 RN skin assessment completed upon transfer from another unit?	□Yes □ No □ N/A
25. Was a 2 RN skin assessment completed upon return from a procedural based area	□Yes □ No □ N/A	26. Was a head to toe skin assessment completed every shift?	
27. Was repositioning schedule assigned per the pressure injury prevention bundle?	□ Yes □ No	28. Was repositioning documented in accordance with repositioning schedule?	
29. Did patient or family refuse repositioning	□ Yes □ No	30. If pressure injury related to medical device, were medical devices rotated or repositioned at least once per shift? Device: _____	□ Yes □ No
31. Was Braden/Braden Q completed within 12 hours of admission?	□ Yes □ No □ N/A	32. Was Braden/Braden Q completed upon transfer from another unit	□Yes □ No □ N/A
33. Was Braden/Braden Q completed every shift?	□ Yes □ No	34. Was Braden Score (18 or less)/ Braden Q (16 or less)	□ Yes □ No
35. Were heels elevated? □ Pillows □ Boots	□ Yes □ No	36. Was a TAPS system utilized?	□ Yes □ No
37. Was a specialty support surface utilized for bed? If yes, what surface was used? _____	□ Yes □ No	38. Was head of bed elevation limited to 30 degrees unless contraindicated?	□ Yes □ No
39. Was a chair cushion or specialty chair surface utilized? If yes, which cushion/chair? _____	□ Yes □ No	40. Was bathing documented per protocol?	□ Yes □ No
41. Were orders in place for wound care?	□ Yes □ No	42. Were wound cares documented per orders?	□ Yes □ No
43. Patient weight on admission	_____kg	44. Patient weight on day HAPI discovered?	_____kg