Implementation of A Computerized Clinical Decision Support Tool To Improve Pressure Ulcer Prevention Practices in Long-Term Care

Karen L. Bauer

University of Toledo

Wright State University

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Abstract

The incidence of pressure ulcers, especially in elderly patients, contributes significantly to morbidity and mortality, causes hospital readmissions, affects quality measures, and poses significant financial burden to patients, families, and the healthcare system. Substantial facility fines are metered with on-site acquired or worsening pressure ulcers in long-term care settings. Long-term care admission rates have increased nationwide. As this occurs, the topic of pressure ulcers gains heightened attention from fiscal, regulatory, and clinical standpoints. Current evidence-based guidelines for prevention and management of pressure ulcers exist, however, the extent to which these are carried out in long-term care settings lacks accountability. The multi-dimensional nature of pressure ulcer development coupled with unique staffing, budgetary, and patient care needs in long-term care settings mandate systematic solutions without further taxing already stretched resources. A PICOT question was developed to investigate whether the implementation of a computerized clinical decision support tool would improve pressure ulcer prevention practices in long-term care settings. A literature search was conducted, and a computerized clinical decision support tool with automatic triggers was designed and implemented in a private long-term care facility. Pilot testing lasted three months. Nurse and state-tested nursing assistant pressure ulcer knowledge and attitude toward pressure ulcer prevention, and pressure ulcer rates, were measured using the Pieper Pressure Ulcer Knowledge Test and the Attitude Toward Pressure Ulcer Prevention Instrument. No statistically significant improvements were found in nurse or state-tested nursing assistant knowledge or attitude toward pressure ulcers. The pressure ulcer rate of 5.6% was unchanged in three months. The results of this project confirm the complex nature of pressure ulcer prevention and the need to continue

attempts to simplify and standardize pressure ulcer prevention practices in long term care settings.

Introduction

Pressure ulcers (PUs) present an increasing problem nationally. The aged population and acuity of ill patients continue to increase, setting the stage for pressure ulcer development. Pressure ulcers affect an estimated 2.5 million Americans per year, with significant impacts on patient pain, morbidity and mortality, hospital and long-term care (LTC) length of stay, and carry high financial burden and legal ramifications (Bruce, Shever, Tschannen, & Gombert, 2012). PUs occur most commonly in the elderly, individuals with physical or cognitive compromise, and those with multiple medical comorbidities. Individuals over the age of 70 account for 70% of PU in the developed world (White-Chu, Flock, Struck, & Aronson, 2011).

According to the Centers for Medicare and Medicaid Services' (CMS) Nursing Home Data Compendium in 2015, 14.1% of LTC facilities nationwide were cited for failure to prevent or treat pressure ulcers in 2010. This rate decreased to 12.1% in 2014. In Ohio in 2010, 18.8% of LTC facilities were cited for the same failure. This rate improved to 9.0% in 2014. PU prevalence rates in Ohio showed an average range of 4.7% to 5.3%. in LTC settings, with the national rates being at 5.1%. (CMS, 2015). While these rates are improving, PUs remain a significant problem in LTC settings both nationally and within Ohio.

Description of Problem

Significance

The Omnibus Budget Reconciliation Act of 1987 (OBRA) and the Balanced Budget Act of 1997 (BBA) set forth regulations for LTC settings (Thomas, 2006). Regulations based on the BBA lead to the Prospective Payment System, which then furthered federal regulations and the creation of care standards in LTC settings (Thomas, 2006). In 2004, these policies were utilized to create the CMS' Interpretive Guidelines for Surveyors for use in LTC. This solidified PUs as a

quality indicator in LTC settings (Thomas, 2006). The CMS guidelines state that a resident who enters a LTC facility without a PU must not develop one during their stay and that a resident with a pre-existing PU must not show evidence of PU decline or worsening throughout their stay (Thomas, 2006).

The National Pressure Ulcer Advisory Panel (NPUAP) identifies and outlines quality–care federal regulations with specific regard to pressure ulcers in LTC facilities, with an emphasis on F-tag 686 (National Pressure Ulcer Advisory Panel, 2014). F-tag 686 is a citation applied for the development or worsening of a clinically avoidable PUs and may result in fines for the facility. This citation was recently revised from the previously known F-tag 314 in November of 2017. The federal government is focusing heavily on the prevention of PUs, responding to a financial burden and imposing significant financial consequences on facilities for PU development (American Medical Directors' Association, 2017; NPUAP, 2014).

Problem Identification

There were 15,640 LTC facilities nationwide in 2014, with an accompanying increase in patient acuity and chronicity of medical problems (CMS, 2015). PU development within this setting is common, thus mandating attention to LTC and PU specifically.

The European Pressure Ulcer Advisory Panel (EPUAP) and the American NPUAP launched international evidence-based practice (EBP) guidelines for PU prevention and treatment in 2009 (Paqay, 2010). The American Medical Director's Association (AMDA) also devised and reaffirmed PU clinical practice guidelines (CPGs) that focus on LTC settings (AMDA, 2017). The goal of the CPGs is to help connect research to practice, however studies suggested that CPGs are not consistently implemented in LTC settings (Kapp, 2013; Saliba, et al, 2003). The complexity of LTC settings significantly contributes to the implementation of these

CPGs, and further emphasizes the need for tools to optimize their success (Kapp, 2013; Marchionni, 2008). Optimization must consider the needs of clinicians, involvement of leadership teams, and the creation of an environment conducive to evidence-based practice (EBP).

Especially in wound care, a multidisciplinary field, interprofessional collaboration, streamlined and accessible tools, along with nursing involvement are crucial to success (Kapp, 2013). Although structured PU prevention programs have been shown to help in LTC settings, the translation of evidence-based PU prevention practices are suboptimal.

Pressure ulcer rates in LTC settings are improving at the national and state levels, but many facilities continue to struggle with implementing best PU prevention practices. In a private corporation with six facilities in Northwest Ohio, four facilities have higher acquired PU rates than both the state and national averages. The private corporation is ranked by U.S. News and World Report as a top performing organization (US News & World Report, n.d.).

A targeted facility within this private corporation employs two wound-certified registered nurses. PU data was drilled down to the LTC versus the short stay population in this facility, and only in-house acquired PUs were considered, a 9.67% rate was revealed. This rate was far above both the national benchmark of 6.1% and the state benchmark of 5.3%. Despite having accessibility of wound-certified clinicians, PU prevention measures demonstrate a need for improvement. Although this LTC setting has PU prevention policies that align with best practice principles, a gap exists in the translation of these evidence-based guidelines into practice.

Purpose and Goals

PUs contribute to increased morbidity and mortality, negative social stigma, and higher costs. PUs are key indicators in the quality of nursing care in LTC settings. Despite being largely

preventable, PUs continue to pose a complex challenge to patients in all healthcare settings, most significantly in those who are chronically ill or elderly (Asimus, MacLellan, & Li, 2011). Thus, the incidence of PUs in LTC is a problem that warrants immediate and ongoing attention.

One solution to reduce PUs is to improve implementation of evidence-based CPGs using systematic and standardized tools (Agency for Healthcare Research and Quality, 2014; Clarke, et al., 2005; Timmerman, Teare, Walling, Delaney, & Gander, 2007). The Health Information Technology for Economic and Clinical Health (HITECH) Act as well as the Institute of Medicine's report in 2010 entitled *The Future of Nursing: Leading Change, Advancing Health* promote utilization of electronic health records (EHRs) and information technology (IT) to support and improve care delivery (Bowles, Dykes, & Demiris, 2015). Computerized clinical decision support (CCDS) tools have shown promising potential to improve nursing care processes (Anderson & Wilson, 2008; Randell, et al., 2007; Varghese, Kleine, Gessner, Sandmann, & Dugas, 2017). Studies on CCDS tools within LTC settings are sparse but do show promising results (Beeckman, Clays, Van Hecke, Vanderwee, Schoonhoven, & Verhaeghe, 2012; Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013). PU prevention is multi-factorial and complex. Therefore, simple and standardized tools are needed to improve PU prevention practices in LTC settings.

The goal of this evidence-based project was to improve nurse and state-tested nursing assistant (STNA) knowledge of and attitude toward PU prevention practices and reduce pressure ulcer rates by implementing a CCDS tool in a private LTC facility. CCDS tools serve to help guide clinicians' decision making in an accessible and feasible way, thus improving adherence to best practice (Beeckman, Clays, Van Hecke, Vanderwee, Schoonhoven, & Verhaeghe, 2012). The provision of automatic, point-of-care recommendations aims to streamline work processes

and simplify the complex nature of PU prevention (Fossum, Alexander, Ehnfors, & Ehrenberg, 2011). This Doctorate of Nursing Practice (DNP) project involved staff education on PU prevention, development of a CCDS tool, automatic triggers for risk assessment, utilization of wound champions to support follow-through, and risk-focused multidisciplinary team meetings.

PICOT Question

To investigate CCDS tool use in PU prevention in LTC settings, a clinical question was developed using the PICOT format. A concise and organized clinical question allows for a more efficient literature search, thus promoting the acquisition of accurate information which would lead to better patient outcomes. Formulating an exemplary PICOT question also increases the likelihood that the best possible evidence will be discovered (Stillwell, Fineout-Overholt, Melnyk, & Williamson, 2010).

In the PICOT format, each letter of the acronym represents an aspect of the question. "P" refers to population, "I" to the intervention being investigated, "C" to the comparative factor, "O" to the outcome measure used to determine the effectiveness of the intervention, and "T" to the timing for data collection (Melnyk & Fineout-Overholt, 2015). The following PICOT question was investigated to elucidate growing challenges that PU development and inconsistent adherence to CPG recommendations present within LTC settings: In a private LTC setting (P) how does implementation of a computerized clinical decision support tool with designated wound champions (I) compared to current practices (C)affect nurse and STNA pressure ulcer knowledge and attitude toward pressure ulcer prevention, and pressure ulcer rates (O) in a three-month timeframe (T)?

Guiding Framework

The utilization of a framework to guide EBP processes helps ensure that assessments are complete, implementation of practice changes is appropriate and efficient, and resources are allocated efficiently (Gawlinski & Rutledge, 2008). Such frameworks typically include discrete steps to follow, such as identifying a clinical problem, compiling the best evidence related to the problem, critical analysis of the literature and identification of potential practice change, implementation of the practice change, and outcome measurement (Gawlinski & Rutledge, 2008). For this DNP project, the Iowa Model was utilized to organize implementation and project maintenance (AHRQ, 2014).

The Iowa Model addresses EBP at the organizational level. It consists of well-defined algorithms, recommendations at each decision point, and feedback loops that encourage evaluation of the project (Schaffer, Sandau, & Diedrick, 2012). The model promotes input from all members of the organizational team, including patients and nurses. It utilizes trial runs of the practice change for process analysis, and does not require prior EBP experience (Schaffer, Sandau, & Diedrick, 2012).

The Iowa Model also addresses whether the proposed clinical issue is a top priority for the organization. The topic must be of priority to those involved to ensure project support and cooperation (Doody & Doody, 2011). The Iowa Model considers the issue from the patient, employee, unit, department, and organizational perspectives, thus maximizing buy-in at all levels. It begins with identifying problem-focused triggers. It then proceeds to prioritizing the topic and forming a team to develop, manage, and implement the change. Relevant literature is assembled and critically analyzed. The change is then finalized using input from a pilot in

realistic practice scenarios. For sustainability, outcome measures are evaluated (Titler, et al., 2001). The step-by-step model lends itself to EBP implementation that spans disciplines.

The Iowa Model contains algorithms that are concise and easily understood. This minimizes the time that team members need to spend attempting to figure out and follow the EBP process (Titler, et al., 2001). The model's allowance of a pilot-run also provides security in the implementation process, which allows busy staff members to acclimate to the process on a small scale first. The Iowa Model's promotion of multidisciplinary teams provides a good fit to this DNP project because of the multi-factorial dimensions of PU prevention. (see Appendix A for a visual representation of the Iowa Model).

Review of the Literature

Level of Evidence

When considering EBP, study definition is a crucial step (Melnyk & Fineout-Overholt, 2015). For this project, the Johns Hopkins Nursing Evidence-Based Practice model (JHNEBP) was utilized to determine study design (Dearholt & Dang, 2012). This model delineates five levels of evidence. Level I is comprised of experimental studies, randomized controlled trials (RCT), and systematic reviews of RCTs, with or without meta-analyses. Level II consists of quasi-experimental studies: systematic reviews of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis. Level III contains non-experimental studies, such as systematic reviews of a combination of RCTs, quasi-experimental and non-experimental studies, non-experimental studies only, with or without meta-analysis, or qualitative studies or systematic reviews with or without a meta-synthesis. Level IV studies are expert opinions or nationally recognized expert committees/consensus panels based on scientific evidence, including CPG's. Lastly, level V studies are based on

experiential and non-research evidence: literature reviews, quality improvement programs, case reports, or expert opinions based on experience only (Dearholt & Dang, 2012).

Quality of Evidence

In addition to leveling evidence, it is also important to determine the quality of the evidence based on study characteristics. The JHNEBP model was used to assess study quality. JHNEBP Levels I, II, and III assign quality based on sample size, consistency of results and whether results are generalizable, definitive outcomes and conclusions, adequate control, and recommendations based on scientific evidence. Studies are given a grade of A, B, or C. Level IV studies are also graded A, B, or C, and are based on appropriate sponsorship of the study, documentation of a systematic literature search strategy, consistency, adequate sample sizes, definitive conclusions, national expertise, and timing of development or revision. Level V studies are graded on aims and objectives, consistency across settings, formality, and evaluation methods, again using the A, B, or C system (Dearholt & Dang, 2012).

Search Strategies

A search of literature pertaining to CCDS use in PU prevention in LTC settings was conducted using the databases PubMed, CINAHL, and the Agency for Healthcare Research and Quality's (AHRQ) National Guideline Clearinghouse. The search was limited to the English language. In PubMed, the keywords "decision support", "algorithm", OR "decision tree" were used with Boolean connectors AND "pressure ulcer", "pressure injury", or "decubitus ulcer" AND "long-term care", "extended care facility" OR "nursing home". The search was limited to 10 years and initially resulted in 994 hits. Once limited to five years, hits were reduced to 307. The "best match" tool was then used, which further limited studies to 85. Of these, one out of four RCTs was found to be relevant. Two meta-analyses were identified, neither of which proved

relevant to this project. After abstract review, eight total articles were included. These eight articles had direct relevance to CCDS and PU prevention in LTC or in the acute care setting, and use of CCDS tools in other similar nursing processes that can be applied in LTC settings.

CINAHL was searched using the same keywords and Boolean connectors. The search yielded 22 studies, which was reduced to 17 when limited to 10 years. Of these 17, seven were found to be relevant and not duplicated after abstract review. Articles in LTC settings as well as the acute care setting were included, with topics focused on PU prevention or other similar nursing processes. CINAHL was then searched without the setting modifier, yielding 84 hits. Of these 84 studies, 27 non-academic studies were excluded. Abstracts were reviewed in the remaining 57 studies. From this abstract review, three additional studies were included, however they did not pertain to LTC settings specifically.

The AHRQ National Guideline Clearinghouse (NGC) was searched using the keywords "pressure ulcer" and "prevention", with an advanced search performed to limit results to adults aged 19 to 80 and older. This resulted in 75 hits, which was limited by advanced search for studies that fit the AHRQ 2014 criteria, then manually limited to five by relevance. The NPUAP guideline was selected for direct relevance, clarity, sound evidence-base, and reputation of the producing organization. The AMDA PU guideline was also selected based on setting-specific information.

In total, 18 relevant articles and two CPGs were reviewed for foreground information with the above-discussed limitations, based on relevance with regard to setting and study quality. Inclusion criteria focused on studies that directly addressed CCDS, related to PU prevention. Special attention was given to PU prevention in LTC settings, however, some studies were included from other settings since concepts could be extrapolated to LTC settings. Single case

studies, abstracts, proceedings of symposia, and anecdotal editorials were excluded. Given the paucity of meta-analyses, systematic reviews, and RCTs, priority was considered by relevance to the topic rather than study level alone. See table 1 for a summary of search methods.

The search was repeated prior to project implementation. No additional relevant studies or updates were identified. The search was also repeated after project implementation in April, 2019. One additional study was identified and included.

Table 1

Search Criteria

Date of Search	Keyword(s), Subject Headings, MeSH terms Used	Database/ Source Used	Study Selections		
			# of Hits	# Reviewed	# Keeper Studies for appraisal/eval
03-01-2018 12-10-2018	"pressure ulcer*" OR "decubitus ulcer*" OR "pressure injur*" AND "clinical decision support" OR algorithm OR "decision tree" AND "long term care" OR "extended care" OR "nursing home"	PubMed	305	85	8
03-01-2018 12-10-2018	"pressure ulcer*" OR "decubitus ulcer*" OR "pressure injur*" AND "clinical decision support" OR algorithm OR "decision tree" AND "long term care" OR "extended care" OR "nursing home"	CINAHL	22	17	7
03-01-2018 12-10-2018	"pressure ulcer*" OR "decubitus ulcer*" OR "pressure injur*" AND "clinical decision support" OR algorithm OR "decision tree"	CINAHL	84	57	3

Appraisal and Synthesis

After PICOT question-guided literature searches, the research was critically appraised. The18 most relevant studies were evaluated and appraised using the JHNEBP model (see Appendix B for JHNEBP review of individual studies). Of these studies, two were included in a

systematic review in 2017 and were also appraised individually (Cho, Park, Kim, Lee, & Bates, 2013; Sebastain-Viana, Losa-Iglesias, Gonazales-Ruiz, Lema-Lorenzo, Nunez-Crespo, & Fuentes, 2016). The studies are discussed in accordance with the hierarchy of evidence leveling.

One RCT on PU prevention done in LTC settings was identified. The study by Beeckman, Clays, Van Hecke, Vanderwee, Schoonhoven, and Verhaeghe in 2012, was a 16-week, two-armed implementation study. The study consisted of 464 nursing home residents and 118 healthcare professionals in a convenience sample of four LTC settings. Outcomes in the study were adherence to CPGs, pressure ulcer prevalence, and healthcare professional knowledge and perception of PU prevention practices. The multi-strategy CCDS tool consisted of interactive education, reminders, feedback, and monitoring. The control group received a hard copy of PU prevention practices and one 30-minute lecture. The study found that patients in the intervention groups were more likely to receive adequate PU prevention when seated in a chair ($F = 16.4$, $p = 0.003$). There was no statistically significant finding for professionals' knowledge or PU prevalence, but the mean perception score did improve post implementation in the experimental group (83.5% vs. 72.1%, $F = 15.12$, $p < 0.001$).

A series of four studies led by Fossum between 2009 and 2013 also center on CCDS in PU prevention in LTC settings. In 2009, Fossum created a CCDS tool that focused on PU and undernutrition in LTC settings. The CCDs tool allowed for selection from a list of evidence-based recommendations with optional individualized recommendations. This tool development and pilot project then led to further investigations on PU prevention in LTC (Fossum, Terjesen, Odegaard, Sneltvedt, Andreassen, Ehnfors, &Ehrenberg, 2009).

Following the 2009 pilot study, Fossum, Ehnfors, Fruhling, and Ehrenberg did a qualitative analysis of CCDS barriers and facilitators using evaluations and group interviews.

This was a quasi-experimental study with two intervention groups and one control group. A convenience sample of 15 LTC facilities included 491 resident participants. There was no statistically significant finding among the three groups for PU rates ($p = 0.31$), but there was a significant improvement in nutritional status. This was a single center study with limiting factors such as recent change to electronic charting as well as limited front-line staff involvement. The study found that there was heightened awareness to PU prevention as a result of the CCDS tool and identified usability and a supportive work environment as facilitators. Barriers identified were reluctance to use computers and limited integration of the CCDS to already-existing electronic health records. While Fossum's first two studies do not support or refute the use of CCDS tools in PU prevention in LTC settings definitively, both represent applicable concepts to this DNP project (Fossum, Ehnfors, Fruhling, & Ehrenberg, 2009).

In 2011, Fossum implemented a CCDS tool in LTC settings, using a qualitative, descriptive design. The sample included 25 nursing personnel. Structured group interviews and walkthrough observations were used to expand on CCDS facilitators and barriers within LTC (Fossum, Ehnfors, Fruhling, & Ehrenberg, 2011). Barriers identified were lack of training on CCDS tools, limited integration between the facility's electronic record and the tool, and overall reluctance with computer usage. Facilitators included a supportive working environment, comfort with computer use, and ease of use of the tool.

A fourth study led by Fossum, in 2013, was an intervention study that looked at care planning for PU and undernutrition in LTC settings (Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013). This study used a convenience sample of 150 records pre-intervention and 141 records post-implementation. Both the intervention and the control groups were provided education on PU prevention and CCDS use, but only the intervention group used the CCDS tool.

Records were reviewed for thoroughness and non-parametric statistics were used to analyze record-based data. The intervention group was shown to have more complete documentation on PUs and undernutrition, showing the potential of CCDS tools to improve nursing documentation in LTC settings (Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013).

Another article pertaining specifically to older adults was a non-research, expert-opinion analysis (Bowles, Dykes, & Demiris, 2015). This article discussed the HITECH act and the Institute of Medicine's call to increase the use of IT to improve patient safety and care quality. Written by three gerontology doctoral-prepared nurses, the article summarizes the use of CCDS in scenarios involving older adults, such as symptom management during cancer care, advanced directive education, discharge to post-acute care settings, and fall risk assessment. The authors define the role of Gerontology Advanced Practice Nurses in CCDS and other technological interventions. While this is not a research study nor pertaining directly to PU prevention, the article provides insight into the need for CCDS utilization, aligning with governmental mandates (Bowles, Dykes, & Demiris, 2015).

Given the paucity of studies relating specifically to LTC settings and PU prevention, select studies from other settings were included in this review. One pilot study aimed to develop a usable computer-encoded guideline to help nurses' PU prevention-decision making at the bedside (Choi & Kim, 2013). The guideline-driven CCDS tool was tested on 30 patient scenarios for feasibility. This pilot program was carried out in the acute care setting with the assistance of a wound trained nurse. The program focused on the Braden scale for PU risk assessment and promoted specific interventions based on Braden scoring. While this project was limited in scope, it does demonstrate that CCDS tools can accurately reflect complex nursing care processes (Choi & Kim, 2013).

The utilization of CCDS in the acute care setting is increasing, thus spurring research evaluations. A systematic review of 70 studies assessed CCDS tools and patient outcomes in the acute care setting (Varghese, Kleine, Gessner, Sandmann, & Dugas, 2017). Studies from 2005-2016 were systematically reviewed. Of these studies, five (7%) showed reduced mortality rates, 16 (23%) showed a decrease in life-threatening events, 28 (40%) showed a decrease in non-life-threatening events, and 20 (29%) had no significant impact on patient outcomes. Only one study showed a negative effect on patient outcomes. Two studies were related to PUs, and PU prevention was identified as one of six disease states that displayed high effect scores with low to medium risk of bias. This systematic review found positive patient outcomes in 70% the studies and emphasized the potential for CCDS tools in preventing harmful events such as PU in the acute care setting.

One study in the systematic review included 866 at-risk patients in an intensive-care unit and looked at the implementation of a PU specific computerized support tool. This was a before and after study with a risk-focused hospital-acquired pressure ulcer (HAPU) prevention program built into an EHR, coupled with PU prevention education interventions (Cho, Park, Kim, Lee, & Bates, 2013). The study showed a decrease in HAPU from 21% to 4%, a shortened intensive care unit length of stay (7.6 to 5.2 days), improved documentation of PU risk, and an overall positive attitude toward the system. Primary diagnoses and illness severity were accounted for and there was a significant decrease in HAPU development (odds ratio = 0.1, $p < 0.0001$). This study showed promise for success of EHR or computerized PU prevention support tools (Cho, Park, Kim, Lee, & Bates, 2013).

The second PU study in the systematic review measured the clinical impact of a reminder system that focused on PU risk, presence, and assessment (Sebastian-Viana, Losa-Iglesias,

Gonzalez-Ruiz, Lema-Lorenzo, Nunez-Crespo, and Fuentes, 2015). The study used an on-screen alert system that notified staff of high-risk patients at the beginning of each shift. This study was conducted at six acute-care settings in Madrid. The result was a decrease in HAPU in the post-intervention group (0.9% to 0.6%, respectively; $p = 0.038$). The study demonstrated promise that computerized reminders and support tools can help decrease the incidence of HAPUs (Sebastian-Viana, Losa-Iglesias, Gonzalez-Ruiz, Lema-Lorenzo, Nunez-Crespo, and Fuentes, 2015). While completed in the inpatient setting, the study design and methods did not look at patient acuity or inpatient-specific processes and thus can be extrapolated to LTC settings.

An interrupted time series study in 2011 assessed the integration of EHR and CCDS tools, focusing on risk assessment and HAPU (Dowding, Turley, & Garrido, 2011). This study was completed at 29 hospitals affiliated with a large, non-profit, healthcare organization. The study found that EHR implementation was significantly associated with increased documentation of PU risk (coefficient 2.21, 95% CI 0.67 to 3.75) and a 13% decrease in hospital-acquired PU rates. PUs also decreased over time in facilities without EHR integration, suggesting that results may have been affected by increased attention paid to PU risk assessment and PU prevention. This study showed potential for CCDS to improve nursing processes and care outcomes. (Dowding, Turley, & Garrido, 2011).

One PU-specific, non-research article was chosen for this review given its direct relevance and identification of key points related to CCDS and PU (Wang & Gong, 2017). The article emphasized a gap between knowledge and practice in the realm of PU prevention, citing communication and systems breakdown as key factors. The authors discussed the potential of CCDS tools, presented as standardized, systematic processes that minimize human error. PU are identified as receiving too little attention in many settings and decision support tools were

suggested as potential solutions (Wang & Gong, 2017). Decision support tools can help to reinforce communication, provide valuable feedback loops, and optimize PU-related care plans.

A literature review published in 2015 looked at PU and many other patient outcomes (Alvin, 2015). This review examined measures such as falls, length of stay on intensive care units, user perception, and mortality. Included studies were critiqued and revealed inherent limitations in CCDS utilization in healthcare: the multifactorial nature of CCDS as an intervention, CCDS-guided treatment validity, and potential for subpar clinician behavior or usage of CCDS tools. These factors made it difficult to achieve solid statistical data. This study discussed the 2014 AHRQ report, which included mandates on Advanced Decision Support Tools, Big Data Analytics, and Using Health Information Technology to Display and Communicate Health Information as top research priorities (Dimitropoulos, 2014). Although RCTs on CCDS are sparse, studies such as this show potential for CCDS tools to improve nursing care processes and patient outcomes (Alvin, 2015).

CCDS research exists in fields other than PU prevention. A 2015 systematic review analyzed articles published from 2000 to 2013 and included both qualitative and quantitative studies (Hovde, Jensen, Alexander, & Fossum, 2015). This systematic review is focused on computerized CPGs and identified one study that found CCDS tools to be more effective than non-computerized support tools (Hoekstra, et al., 2010). Study outcomes were patient safety, adverse events, and quality of care, with a focus on nursing and CPGs. Over 5,000 articles were reviewed for inclusion, but only 16 studies met all criteria. Five key positive effects with computerized CPGs were found: a) improved care quality, b) prevention of complications, c) economic benefits, d) care standardization, and e) improved communication.

The majority of studies in this systematic review were pre/post-studies, demonstrating a paucity

of experimental investigations (Hovde, Jensen, Alexander, and Fossum, 2015).

Another computerized, guideline-based, support tool was developed in the management of the diabetic foot and looked primarily at user perception and usability (Peleg, Shachak, Wang, & Karnieli, 2009). This qualitative study used a) structured interviews, b) official documents, c) workflow observations, d) decision support goals, and e) medical practice data. This study focused on a multi-factorial and multidisciplinary wound-related condition, which is relevant to PU prevention. Results included an overall positive response from users. The authors discussed the need to implement multiple methods and perspectives when developing a CCDS tool and to focus the tool on end-users as well as CPGs (Peleg, Shachak, Wang, & Karnieli, 2009).

Other studies showed promise for CCDS tools in healthcare, such as a study by Bowles, et. al., in 2015. This quasi-experimental study measured hospital readmissions in three hospitals across 76 units and looked at risk assessment and alert systems. The study implemented a risk-assessment program that alerted discharge planners to a patient's potential need for post-acute care. High-risk patients had a decrease in 30-day hospital readmissions from 22.2% to 9.4%. When high and low risk groups were combined, there was still a decrease found in hospital readmission rates (Bowles, et al., 2015). These decreases were sustained at 60 days.

A systematic review by Kawamoto, Houlihan, Balas, & Lobach investigated RCTs on CCDS. Although computerized tools were not the sole focus of this study, the number and quality of studies on generalized decision support tools was useful to this DNP project. From 10,500 reviewed studies, 88 studies were selected for this review. This systematic review delineated four tool features as independent predictors of improved clinical practice: a) integration of automatic tools into clinical workflow ($p < 0.00001$), b) provision of treatment recommendations versus assessments alone ($p = 0.0187$), c) point-of care decision making ($p =$

0.0263), and d) computer-based support tools ($p = 0.0294$). This systematic review supports the potential for decision support tools in PU prevention in LTC settings.

Another before and after analysis by Hoekstra, et al., was conducted in a 26-bed surgical intensive care unit. The authors implemented a nurse-driven computerized protocol for potassium regulation. Prior to implementation, potassium regulation was physician driven, while after implementation, potassium regulation was CCDS and nurse driven. Although the transition from physician to nurse regulation may have affected the results, maintenance of normal range potassium levels improved post implementation (2.4% to 1.7%, $p < 0.001$ and 7.4% to 4.8%, $p < 0.001$ respectively). This study represents potential for nurse driven CCDS tools to positively effect patient outcomes.

A 2019 update to the AHRQ On-Time project, which used electronic risk notification systems to support clinical decision making in PU prevention in LTC, found no statistical difference in PU rates between control and intervention groups (Davidson, et. al.). This was a quasi-experimental study with an intervention group that used automatic triggers based on patient PU risk. The study suggests that while IT-based support tools can be useful in LTC settings, implementation requires detailed attention.

Strength of Recommendation

The JHNEBPM was used to determine the overall strength of recommendation. This model recommends that only studies of "A" and "B" quality be considered and separates recommendations into categories: strong, compelling evidence, consistent results (solid indication for a practice change), good and consistent evidence (consider pilot of change or further investigation), good but conflicting evidence (no indication for practice change, consider further investigation for new evidence or develop a research study), or little or no evidence (no

indication for practice change, consider further investigation for new evidence, develop a research study, or discontinue project) (Dearholt & Dang, 2012).

Based on the number and quality of studies that present PU prevention in LTC as an ongoing challenge, the need for application of evidence-based solutions is undeniable. One such solution is the integration of CCDS tools. Studies supporting CCDS implementation in PU prevention and management range from level I to level V studies. This body of evidence is not compelling, however it does suggest the potential benefit of CCDS tools.

While there is also a paucity of RCTs on CCDS implementation in PU prevention, two JHNEBP appraised studies are level I. One is specific to PU prevention in LTC settings while the other focuses on the benefit of CCDS in the hospital setting as applied to multiple outcomes (Beeckman, et al., 2012; Kawamoto, Houlihan, Balas, & Lobach, 2005). Two level II studies support CCDS in PU prevention in LTC, three studies in the acute care setting also support CCDS in PU prevention, and two level II studies support CCDS in non-PU fields (Bowles, et al., 2015; Cho, Park, Kim, Lee, & Bates, 2013; Fossum, Alexander, Ehnfors, & Ehrenberg, 2011; Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013; Sebastian-Viana, Losa-Iglesias, Gonzalez-Ruiz, Lema-Lorenzo, Nunez-Crespo, and Fuentes, 2015; Varghese, Klein, Gessner, Sandmann, & Dugas, 2017; Hoekstra, et al., 2010) Level III and level IV studies align with the higher level studies, although statistical analyses and experimental design were not present. After thorough search, review, and appraisal of the evidence, the case is made for strong and consistent evidence to support the use of CCDS tools to improve PU prevention in LTC settings (see Appendix C for an evidence synthesis table).

Evidence based standards must accommodate the unique needs of the LTC facility while satisfying literature-based recommendations. The evidence clearly supports that PUs are a

significant source of morbidity and mortality in LTC settings. The evidence also displays suboptimal CPG guideline implementation (Higuchi, Davies, & Ploeg, 2017; Padula, Mishra, Makic, & Valuck, 2014; Saliba, et al., 2003; Strand & Lindgren, 2010; van Gaal, et al., 2010). The goal of the DNP project was to develop a CCDS tool to improve PU prevention practices in LTC settings.

Clinical Practice Guidelines

The AGREE II (2009) tool was used to appraise the CPGs that were referenced for this DNP project. The guidelines synthesize evidence-based practice recommendations for the prevention and treatment of pressure ulcers globally (AMDA, 2017; National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, & Pan Pacific Pressure Injury Alliance, 2014). The CPGs propose many specific recommendations for implementation to reduce PUs. AGREE II appraisal of each CPG revealed a seven out of seven rating.

The CPGs represented solid, high-quality evidence for PU prevention and clearly delineate multidisciplinary input from national experts and from research. The chosen CPGs were based on concise and well-defined scientific evidence (AMDA, 2017; NPUAP, EPUAP, & PPPIA, 2014). The guidelines ensure that scientific data is up to date within the last five years and contain methodology for literature analysis, classification, and strength of recommendation for each subsection.

The CPGs identify the gap in knowledge translation to practice for PU prevention. They reference the most recent literature base. Study inclusion criteria are clearly defined and discussed with accuracy in each CPG. If inclusion criteria were not met, studies that documented sustainability of significant positive outcomes as a result of PU prevention program implementation were included with explanation. Studies were excluded if repeatability was not

documented (AMDA, 2017; NPUAP, EPUAP, & PPIA, 2014; RNAO, 2016).

Clinical Knowledge Gap

Multiple studies indicate the research-to-practice gap that exists in PU prevention, especially in LTC settings (Higuchi, Davies, & Ploeg, 2017; Padula, Mishra, Makic, & Valuck, 2014; Saliba, et al., 2003; Strand & Lindgren, 2010; van Gaal, et al., 2010). Studies central to CCDS implementation in PU prevention cite a clinical knowledge gap as the impetus to develop support tools (Cho, Park, Kim, Lee, & Bates, 2013; Choi & Kim, 2013; Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013). The HITECH Act, the AHRQ (2014), and the Institute of Medicine encourage use of EHRs and IT to support and improve care delivery (Bowles, Dykes, & Demiris, 2015; Dimitropoulos, 2014).

Practice Recommendations

The EBP recommendation for this DNP project was to design and systematically implement a CCDS tool and risk-based automatic triggers in a private LTC facility utilizing a multidisciplinary team, designated wound champions, and education. The AMDA guideline is specific to PU in LTC and suggests that the multidisciplinary team employ a designated wound nurse and provide education in any PU prevention program (AMDA, 2017).

A literature review by Sullivan and Schoelles (2013) concluded that the success of PU prevention programs is conditional upon: a) simplification and standardization of interventions, b) involvement of multidisciplinary teams, c) engagement of leadership, d) use of designated wound champions, e) ongoing education, and f) sustained feedback loops. A pre-post longitudinal study by Edwards, et al. (2017) found that utilization of wound champions and a multi-modal approach significantly decreased PU development (24% pre vs. 10% post, $p = 0.041$). Woo, Milworm, and Dowding (2017) conducted a systematic review and determined

that wound champions were one of the most significant facilitators of PU prevention program success, with many of these champions being nursing assistants. A fourth study discussed a nurse-led, multidisciplinary approach to PU prevention in LTC as necessary (Kennerly, Yap, & Miller, 2012). Lastly, a non-research paper identified seven organizational factors from the literature that promote PU prevention program success: a) administrative support, b) board of directors' engagement, c) multidisciplinary team involvement, d) quality assurance team involvement, e) sound and consistent data tracking, f) effective communication structures and processes, and g) direct care staff involvement (Bergquist-Beringer, Derganc, & Dunton, 2009).

Methods

Project Setting

The setting for this DNP project was a privately owned LTC facility in Northwest Ohio. The facility is part of a larger corporation where four out of six facilities in Ohio recently had PU rates that exceeded both national and state benchmarks. The facility has 62 LTC beds and employs two wound-certified nurses. The LTC unit was chosen for this DNP project to maximize consistency in the resident population and per the preference of facility leaders. When looking at PU rates, short-stay, assisted living, and independent living units were excluded.

Project Population

The participants were selected from a private LTC facility. This facility employs 28 nurses and 34 STNAs on the LTC unit. The majority of nurses were licensed practical nurses, with some registered nurses. All STNAs were state-tested.

Human Subject Concerns

This DNP project was approved as exempt through the University of Toledo Institutional Review Board. Implementation of the CCDS tool into daily nursing practice in LTC settings did

not introduce potential harm to patients. Clinician and administrator safety were not at risk. Data did not contain protected health information and were stored on a password-protected and secure intranet site. Resources were not diverted from other valuable programs. The time and resources needed for project follow through showed potential improvement in quality and safety outcomes.

Iowa Model: Implementation and Evaluation Plan

Step One: Identify Triggering Issues and Question Statement

The trigger for this DNP project was consistently high PU rates. The DNP Student worked with the Quality Assurance Manager, the Director of Nursing, and the Assistant Director of Nursing over two months to determine the main causes for continued PU development. DNP student-lead root cause analysis revealed that PU prevention strategies were not consistently implemented until after a resident developed a PU. The DNP student presented the CPGs' main components for PU prevention programs, which are individualized risk assessment, risk mitigation programs, and multidisciplinary team involvement (AMDA, 2017). After multiple meetings and thorough review of the facility's PU-related policies and procedures, it was found that although risk assessment was done at consistent intervals, risk-based interventions were not usually implemented prior to PU development. These analyses revealed a lack of systematic processes for PU prevention care plans in high-risk patients.

The DNP student then proposed a CCDS tool to standardize and simplify risk-based interventions. The DNP student lead numerous meetings with facility administrative and clinical leaders to determine the feasibility of CCDS implementation and how to optimize the use of a CCDS tool in LTC settings. Ancillary services such as dietary and physical therapy were included and provided input on their involvement in PU prevention. After continued discussion with clinical and administrative leaders, the decision was made to focus this DNP project on the

utilization of a CCDS tool for the development of patient-specific care plans and risk-based interventions to reduce PU.

Step Two: Forming a Team

An implementation team was formed and lead by the DNP student, in accordance with the 2017 AMDA guidelines (see Appendix D for AMDA recommended roles). In addition to the AMDA recommendations for a PU focused team, the Information Technology (IT) Manager and quality assurance team leaders were also crucial to project implementation.

Stakeholders and team members. The literature supports use of engaged clinical and administrative leaders in PU prevention to promote staff buy-in and resource availability (AHRQ, 2014; Ploeg, Davies, Edwards, Gifford, & Miller, 2007; Saliba, et al., 2003; Scovil, et al., 2014; Timmerman, Teare, Walling, Delaney, and Gander, 2007). The DNP student established and lead an implementation leadership team that consisted of the a) Quality Assurance Manager, b) Director of Nursing, c) Assistant Director of Nursing, d) Education Manager, and e) Information Technology Manager. The DNP student drafted a letter to stakeholders, delineating the purpose and goals of the project (see Appendix E for the sample letter to stakeholders). The letter was disseminated to all clinical staff members by the Education Manager.

The facility's Director of Nursing helped secure leadership engagement and served as a liaison to both the clinical and administrative leadership teams. The Assistant Director of Nursing encouraged buy-in from the nurses and STNAs and oversaw implementation of the PU risk-based interventions. The Director of Nursing and the Assistant Director of Nursing were also wound-certified and thus served as the designated wound champions. The Education Manager scheduled the webinar and helped distribute project-related material. The Quality

Assurance Manager helped ensure LTC-specific verbiage in the CCDS tool and was critical to tracking PU rates.

In addition to leadership team members, nurses and STNAs were crucial components to the project's success. These staff members held primary responsibility for following through with CCDS tool use and implementation of recommended care practices. Physical and occupational therapists were important in the selection and acquisition of support surfaces and offloading devices as well as repositioning and mobility efforts. The Dietary Technician managed the nutritional needs of at-risk patients.

Step Three: Evidence Retrieval

This step is discussed in the preceding sections. Literature searches were conducted and updated to ensure up-to-date material. Trends and recommendations were extracted from the literature.

Step Four: Grading the Evidence

This step of the Iowa model is demonstrated in preceding sections as well as appendices B and C.

Step Five: Developing an Evidence-Based Standard

The selected CPGs were referenced for all components of the CCDS tool, as they demonstrated the most complete and current evidence base in PU prevention. In addition, the sample care plan (see Appendix F) and Pieper Pressure Ulcer Knowledge Test (see Appendix G for knowledge test with answers) from the AHRQ toolkit were used to help guide LTC-specific PU prevention interventions. The toolkit was created under contract with the AHRQ through the Accelerating Change and Transformation in Organizations and Networks (ACTION), with additional support from the Health Services Research and Development Service of the

Department of Veterans Affairs. The goal of the AHRQ PU prevention toolkit is to help hospital staff implement successful PU prevention strategies. It was developed at the Boston University School of Public Health by field experts and guided by additional experts at six medical centers (AHRQ, 2014). The toolkit is evidence-based. The Pieper Pressure Ulcer Knowledge Test was also reliability-tested among nurses in 2014 (Pieper & Zulkowski). Although the AHRQ toolkit is geared toward the acute care setting, these tools can be applied to LTC settings to guide CCDS creation.

The Attitude Towards Pressure Ulcer Prevention (APuP) instrument was developed through literature review and validated by nine PU experts and five experts in psychometric instrument validation using a double Delphi procedure (see Appendix H for the APuP instrument). Content validity was evaluated by nine European pressure ulcer experts and five experts in psychometric instrument validation in a double Delphi procedure. The tool is a 13-item instrument that measures five components: a) attitude towards personal ability to prevent PU (three items), b) attitude towards PU prioritization (three items), c) attitude towards the consequences of PU development (three items), d) attitude towards personal accountability in PU prevention (two items), and e) attitude towards confidence in the effectiveness of PU prevention (two items). For the total instrument, the internal consistency (Cronbachs a) was 0.79. The APuP instrument was found to be a valid tool that can be used to evaluate attitudes towards pressure ulcer prevention (Beeckman, Defloor, Demarre, Van Hecke, & Vanderwee, 2010).

Step Six: Implementation

Practice recommendations. This DNP project utilized risk assessment to guide both specific and multidisciplinary care plans, thus aligning with the individualized assessment, inter-professional teams, and risk mitigation portions of the 2017 AMDA CPG. This DNP project also

employed multidisciplinary prevention strategies and incorporated discussion of at-risk residents in multidisciplinary team meetings.

Based on the literature, the recommended practice changes for this DNP project were as follows: a) implement a CCDS tool using the AHRQ "Sample Care Plan" based on PU risk assessment, b) employ an automatic alert to reassess PU risk with defined significant changes in resident condition, c) integrate wound champion-lead risk assessment evaluation at weekly multidisciplinary team meetings, d) educate all nursing and STNA teams on PU prevention and use of the CCDS tool, and e) mandate wound champion follow-through on all at-risk patients for implementation of CCDS-generated interventions.

Timeline. The DNP student met with the implementation team to determine a well-defined timeline for project implementation. The project timeline was shared with direct stakeholders (see Appendix I for DNP project timeline).

Phase one. The CCDS tool and automatic risk-assessment trigger were designed and developed over three months. The DNP student lead this effort by requesting, scheduling, and directing numerous meetings and electronic information exchanges. The DNP student and Quality Assurance Manager evaluated and modified the AHRQ sample care plan to conform with LTC-specific verbiage. This resulted in multiple iterations of the sample care plan. The final version was cross referenced with the AHRQ tool to make sure that wordsmithing did not alter the clinical content of the tool.

The DNP student also worked with the Assistant Director of Nursing and the Education Manager during this time to ensure that the interventions that were triggered by the CCDS tool aligned with nursing and STNA workflow and scope of practice. The EHR was evaluated by the DNP student and the Education Manager to ascertain optimal placement of the interventions. The

interventions needed to be accessible and visible to the appropriate staff members for follow-through.

During this three-month period, the DNP student met frequently with the IT Manager to solidify feasibility of CCDS tool integration into the existing EHR. During these meetings, the DNP student and IT manager merged clinical needs with technological needs to promote usability of the CCDS tool. At the end of this phase, the CCDS tool was successfully built and integrated into existing EHR templates.

The CCDS tool was built such that each time a Braden risk assessment was completed, score-based interventions were automatically transferred to the resident's care plan (see Appendix J for screenshots of the trigger and resulting interventions). Interventions were based on the AHRQ sample care plan, which focused on both Braden subcategory (sensory perception, moisture, activity, mobility, nutrition, and friction/shear) and specific score in each subcategory (see Appendix K for the Braden Scale for Predicting Pressure Ulcer Risk).

The last portion of phase one resulted in the creation of an automatic trigger that correlated with significant changes in resident condition. The Director of Nursing identified the existing nursing process for completion of an electronic "change in condition" template. This electronic form was completed when a resident experienced a change that required clinical provider intervention. The DNP student, the Director of Nursing, the Assistant Director of Nursing, the Quality Assurance Manager, the IT manager, and the Education Manager met to review the pre-existing list of significant changes within the EHR. The 13 most pertinent changes in condition related to PU risk were selected, using the CPGs as a guide. The IT manager then built an automatic trigger in the electronic change of condition form that triggered a repeat Braden Scale risk assessment (see Appendix L for a screenshot of the 13 trigger

conditions). The alert was tested by the DNP student, a unit manager, and a wound champion prior to implementation.

Phase two. This three-month phase of the DNP project involved continued meetings to merge the electronic tools with point of care processes and creation of the educational webinars. During this phase, the wound champions' roles were defined. The wound champions were responsible to review at-risk residents with the nurses and STNAs to help ensure that interventions were carried out. The wound champions were also tasked with presentation of at-risk residents at weekly multidisciplinary leadership meetings. These meetings were already occurring at the facility, but prior to this DNP project, residents at-risk for PU development were not routinely discussed. The DNP student worked closely with the wound champions to optimize follow-through of the CCDS generated recommendations at the bedside. The DNP student faced many challenges during this phase, as the wound champions' dual roles within the facility left limited time for full attention to the DNP project or PU prevention. Attempts were made to mitigate this but proved unsuccessful given the lack of budgetary and other resources.

The educational webinars were prepared by the DNP student during this phase. The DNP student met with the Education Manager to review, record, and upload the webinars to the secure facility intranet site. The webinars were based on the CPGs chosen for this DNP project. The nurse-targeted webinar was 60 minutes in length and the STNA-targeted webinar was 30 minutes in length, with the STNAs receiving only the portions of the full education that were relevant to the STNA role (see Appendix M for examples of educational webinar slide deck).

Phase three. Phase three of this DNP project was the 30-day pre-testing and educational webinar completion window. This phase began with administration of the AHRQ Pieper Pressure Ulcer Knowledge test and the Attitude Towards Pressure Ulcer Prevention instrument

(APuP) (Beeckman, Defloor, Demarre, Van Hecke, & Vanderwee, 2010). These tests were uploaded to the facility's secure intranet site by the Education Manager at the request of the facility's leadership team. The DNP student provided the Education Manager with answer keys and data collection code sheets that were separated by test question by individual participants. The code sheets provided for de-identification of participants. The Education Manager verified that knowledge and attitude test data would be appropriately coded and stored on the facility's secure intranet site and requested that the DNP student avoid manual data collection. Each nurse and STNA was given 30 days to sign-on to the familiar intranet site and take the two pre-tests, complete the educational webinar tailored separately to the nurses and the STNAs, and complete the knowledge post-test immediately following the educational webinar. Instructions were drafted by the DNP student and provided to each nurse and STNA by the Education Manager.

Next, baseline data for PU rates on the LTC unit was provided to the DNP student by the Quality Assurance Manager. PU data were already separated by quarter.

Phase four. Phase four consisted of the three-month pilot of the CCDS tool. Braden Scale risk assessment scores were done by the wound champions on all long-term residents during the first week of the pilot, with the CCDS tool and automatic alerts in use. All Braden scales completed as a result of a resident's significant change in condition via the automatic trigger were completed by the LTC nurses. Fliers were posted and disseminated by the DNP student as reminders (see Appendix N for examples of fliers). PU educational material and resources on appropriate completion of the Braden scale were disseminated by the Education Manager via email and during regular staff meetings (see Appendix O). The alerts generated by significant condition changes were made active, thus increasing the frequency of Braden scale completion.

Throughout the 90-day pilot, the DNP student led weekly telephone conferences with the Director of Nursing, Assistant Director of Nursing, Education Manager, and occasionally the Quality Assurance and IT managers. These teleconferences were held to discuss any nurse, STNA, or leadership concerns, to review PU development, and to promote PU prevention and CCDS tool successes. The calls were brief in nature but also served to maintain engagement in the DNP project.

At the end of the pilot implementation, the nurses and STNAs were provided two weeks to revisit the secure intranet site and complete the post-attitude test. The DNP student created instructions for completion and the Education Manager disseminated this information to each participant.

Step Seven: Outcomes and Evaluation

PICOT restatement. A DNP project was completed to investigate the PICOT question: In a private LTC setting (P) how does implementation of a computerized clinical decision support tool with designated wound champions (I) compared to current practices (C) affect nurse and STNA pressure ulcer knowledge and attitude toward pressure ulcer prevention, and pressure ulcer rates (O) in a three-month timeframe (T)?

Outcomes included comparison of nurses' and STNAs' PU knowledge, nurses' and STNAs' attitude toward PU prevention practices, and PU rates before and after project implementation. Validated tools were used throughout the project to enhance implementation.

Results

Nurse and STNA demographics. The majority of nurses were female (92.1%), Caucasian (85.7%), and Licensed Practical Nurses (67.9%). Nurses ranged in age from 18 to over 50 years of age. Approximately one half (46.6%) had been working at the facility for fewer

than five years. See table 5 for nurse demographics. The STNAs were primarily high-school educated (47.1%), Caucasian (75.5%), female (94.1%), varied in years of experience at the facility, and ranged in age from 18 to over 50 years of age. At the end of the project, 25 nurses and 31 STNAs completed the study. Both the nurse group and the STNA group lost three participants to attrition (see table 2 for STNA demographics).

Table 2

Nurse and STNA Demographics (Percentages in Parentheses)

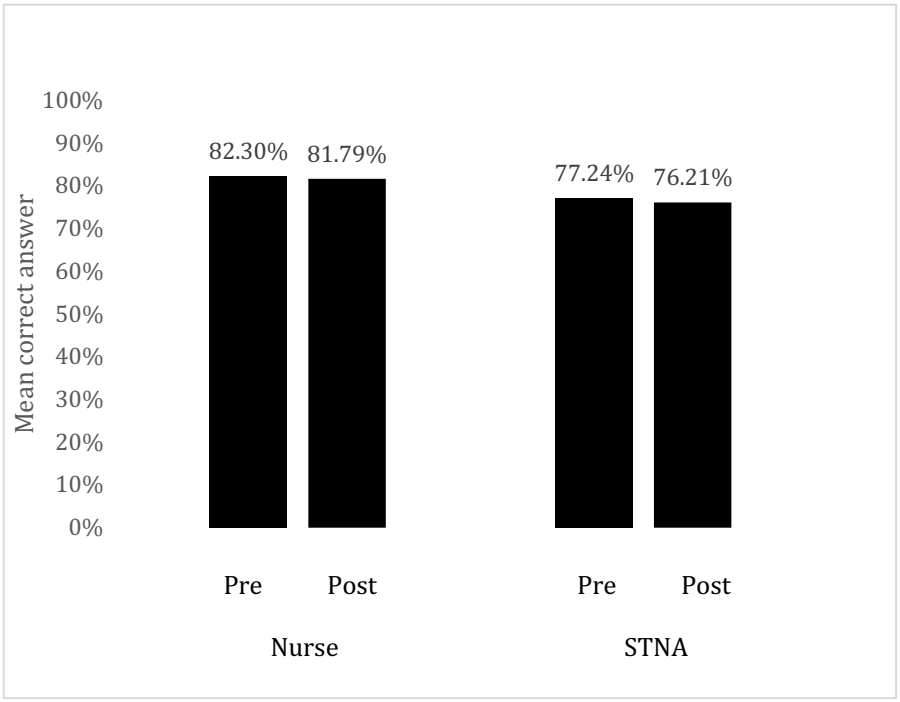
Characteristics	Nurse (n=28)	STNA (n=34)
Gender		
Male	2 (7.1)	2 (5)
Female	26 (92.9)	32 (94.1)
Ethnicity		
Asian	0 (0.0)	0 (0.0)
Black or African American	3 (10.7)	3 (8.8)
Hispanic or Latino	0 (0.0)	2 (5.9)
White or Caucasian	24 (85.7)	26 (76.5)
Other	1 (3.6)	3 (8.8)
Age group (years)		
18 - 25	4 (14.3)	7 (20.6)
26 - 33	6 (21.4)	10 (29.4)
34 - 41	8 (28.6)	6 (17.6)
42 - 50	7 (25.0)	5 (14.7)
50 +	3 (10.7)	6 (17.6)
Role/title		
STNA	0 (0.0)	34 (100.0)
LPN	19 (67.9)	0 (0.0)
RN	9 (32.1)	0 (0.0)
Experience at facility (years)		
0 - 2	5 (17.9)	11 (32.4)
3 - 5	14 (50.0)	7 (20.6)
6 - 8	3 (10.7)	7 (20.6)
9 +	6 (21.4)	9 (26.5)
Highest education level		
High school	0 (0.0)	16 (47.1)
College	23 (82.1)	12 (35.3)
Post-college course work	2 (7.1)	4 (11.8)
Post-college degree	3 (10.7)	2 (5.9)

Note. STNA = State Tested Nursing Assistant

Nurse and STNA knowledge. Nurses and STNAs completed the knowledge tests on the intranet site. Means were automatically calculated for each question based on group. Paired t-

tests were used to compare pre- and post-knowledge test results independently by group. There was no statistically significant difference between the nurse (82.36% and 81.79%, p=.91) or the STNA group (77.24% and 76.21%, p=0.466). In both groups, the post-test mean score was lower than the pre-test mean score. See figure 1.

Figure 1. Nurse and STNA Pre- and Post-Knowledge Test, Mean Correct Answer



Further analysis of test questions revealed that the nurse group answered four questions (Q) with less than 50% accuracy on the knowledge pre-test: a) Q13, the use of heel protectors as pressure relieving devices (11.1%), b) Q 17, repositioning patients when sitting (11.1%), c) Q18, encouraging weight shifting when sitting (3.7%), and d) Q43, the relation of Braden score to PU risk (29.6%) . Each of these improved after education, with all four exceeding 60% accuracy after the webinar. STNAs answered eight pre-test questions with less than 50% accuracy: a) Q5, massaging bony prominences to prevent pressure ulcers (48.5%), b) Q6, tissue loss in stage 3 ulcers (18.2%), c) Q13, the use of heel protectors as pressure relieving devices (11.1%), d) Q14, the use of donut cushions in PU prevention (21.2%), e) Q17 repositioning patients when sitting

(6.1%), f) Q 18, encouraging weight shifting when sitting (6.1%), g) Q23, whether low humidity decreases PU risk (42.4%), and h) Q24, whether underpads should be used in incontinent patients to decrease PU risk (45.5%). Seven of these means improved post education, with only two exceeding 50% accuracy (Q23 and Q24) and two additional exceeding 20% accuracy (Q6 and Q14). There was one average that decreased post-education in the STNA group (Q5).

Nurse and STNA attitude. Based on review of the responses to the pre- and post-attitude test, and issues with data collection, it was decided to alter the scoring mechanism of this tool to preserve statistical analysis. The tool was designed in domains with positively worded answers and domains with negatively worded answers. For this analysis, the strongest positively or negatively worded answer was selected as the ideal response. Therefore, percentage of answers "strongly agree" or "strongly disagree," depending on the positive or negative wording of the question, were tabulated. The Mann-Whitney nonparametric test was used to compare pre- attitude versus post-attitude test results in each group. The analysis showed significant improvement in the nurse group after the project in: a) Q1, "I feel confident in my ability to prevent PU," b) Q3, "PU prevention is too difficult. Others are better than I am," c) Q8, "The financial impact of PU on a patient should not be exaggerated," and d) Q 13, "PU are almost never preventable." The nurse group showed increased negative attitude in Q10 "I am not responsible if a PU develops in my patients," and Q11, "I have an important task in PU prevention." There was no significant improvement in the STNA group. The STNA group displayed statistically significant responses signifying a more negative attitude in Q1, "I feel confident in my ability to prevent PU," and Q12, "PU are preventable in high-risk patients" (see table 3).

Table 3

Nurse and STNA Pre- and Post- Attitude Test by Strongest Answer (Percentages in Parentheses)
Note. Significant results (p value) are in boldface. STNA= State Tested Nursing Assistant.

	Nurse			STNA		
Question	Pre (n=28)	Post (n=25)	p	Pre (n=34)	Post (n=31)	p
1	15 (53.6)	21 (84)	**0.019***	27 (79.4)	16(52)	**0.036****
2	14 (50)	13 (52)	0.791	24(70.6)	16(52)	0.119
3	9 (32.1)	13 (52)	**0.049***	24(70.6)	19(60)	0.445
4	18 (64.3)	13 (52)	0.608	21(61.8)	19(60)	0.811
5	18 (64.3)	17 (68)	0.713	32(94.1)	29(92)	0.925
6	22 (78.6)	23 (92)	0.177	28(82.4)	22(72)	0.28
7	22 (78.6)	15 (60)	0.164	27(79.4)	26(84)	0.612
8	5 (17.9)	18 (72)	**<.001***	9(26.5)	3(8)	0.054
9	8 (28.6)	13 (52)	0.075	13(38.2)	9(28)	0.971
10	11 (39.3)	2 (8)	**0.01****	23(67.6)	16(52)	0.236
11	15 (53.6)	2 (8)	**<.001****	28(82.4)	21(68)	0.24
12	4 (14.3)	7 (28)	0.187	14(41.2)	3(8)	**0.002****
13	3 (28.6)	15 (60)	**0.012***	20(58.8)	16(52)	0.726

Note. * = statistically significant result from negative to positive attitude; ** = statistically significant result from positive to negative attitude

Pressure ulcer rates. There was no difference in acquired PU rates when comparing three months prior to project implementation and three months post implementation. PUs developed in four residents immediately pre-DNP project implementation and four residents developed PUs throughout DNP project implementation. Both rates were calculated out of 62 total residents. There was a decrease in acquired PU between quarter two of 2018 (16.7%) and quarter three of 2018 (9.2%). During this time, the DNP student began working with the facility on PU prevention.

Root cause analysis was done on each resident that developed PU during implementation, using general information. One resident was a palliative care patient and developed two PU despite appropriate interventions being in place. One resident had a low-risk Braden score

initially, but experienced a change in condition that did not trigger the need to repeat a Braden score. One resident developed an open area that was caused by an ostomy pouch, which on close examination was determined to be a contact dermatitis as opposed to a PU. The fourth resident developed an ischemic toe ulcer which was related to peripheral arterial disease but erroneously documented as a PU.

Cost Considerations

According to the 2014 AHRQ report, the average cost of PU treatment in the United States ranges from $9.1 to $11.6 billion per year, with an average per-patient cost of $20,900 to $151,700 per pressure ulcer. In 2007, CMS estimated a cost of $43,180 additional cost per PU per hospital stay. In addition, there are more than 17,000 PU-related lawsuits yearly (AHRQ, 2014). While the up-front cost of pressure ulcer prevention may present budgetary concerns in LTC settings, the potential for return on investment is high (Xakellis & Frantz, 2001).

Spetz, Aydin, Brown, and Donaldson (2013) determined that return on investment justified the cost of PU prevention. Data on PU prevalence was taken from a not-for-profit, benchmarking registry. A convenience sample of 78 hospitals primarily in California was sampled over eight years, totaling 258,456 patients. The study determined a return on investment ratio of 1.61, with a $127.51 savings per patient (Spetz, Aydin, Brown, & Donaldson, 2013). This financial data can be extrapolated to the LTC setting, but does not take into consideration factors such as improved quality indicators, decreased financial penalties due to PU development, improved patient, family, and clinician satisfaction. This DNP project demanded little up-front cost and showed potential for cost savings by streamlined use of expensive prevention modalities and decreased PU rates (see Appendix P for supplies needed).

Discussion

Barriers to Implementation

Melnyk and Fineout-Overholt (2015) cited numerous barriers and facilitators of EBP implementation. Lack of knowledge, negative attitudes, limited time and resources, limited independence in decision-making, overwhelming workloads, leadership resistance, and peer pressure toward traditional care practices are some of the primary obstacles. Facilitators to EBP are the development of institutional EBP-based policies and protocols, promotion of EBP champions, integration of tools, and structured time to focus on EBP. These barriers and facilitators have been associated with PU prevention programs and are key to address the complex nature of PU prevention (Chaboyer & Gillespie, 2014; Hartmann, et. al., 2016; Jankowski & Nadzam, 2011; National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance, 2014; Worsley, et. al. 2017).

It was predicted that staffing ratios and staff turnover would be a significant barrier to implementation of this DNP project. According to McConnell, Lekan, and Corazzini (2010), approximately three-million licensed nurses and STNAs are employed in LTC settings. It is suggested that this staff will need to double in the coming decades to account for the rising need in geriatric care. In 2007, over 105,000 positions for direct care workers remained vacant in LTC settings (McConnell, Lekan, & Corazzini, 2007). The demand for direct care workers leaves many staff members overworked, with little time for extra endeavors beyond minimal care duties.

Throughout this DNP project, there was minimal staff turnover, which did not significantly affect outcomes. Heavy workload that lead to marginal leadership and staff engagement in the DNP project were significant barriers to implementation. Time and workload

restraints contributed to inability for the wound champions to consistently and fully oversee follow through of CCDS guided interventions. The wound champions' limited time contributed to suboptimal attention to at-risk residents both in daily care practices and in multidisciplinary meetings.

Another barrier to implementation of the DNP project was the facility leadership team's hesitancy to fully incorporate the DNP student in the facility's routines. This limited optimal engagement in the project. Staff members needed to recognize and believe in the benefit of PU prevention methods and results for residents. The extended responsibility of the leadership team, the wound champions, nurses, and STNAs, coupled with the limited integration of the DNP student in daily routines, created a significant challenge in DNP project implementation.

Fossum identified lacking of training on CCDS tools, limited integration of CCDS tools into the existing EHR, and reluctance to utilize computers as barriers in the study (Fossum, Ehnfors, Fruhling, & Ehrenberg, 2011). Nurse and STNA discomfort with computerized systems contributed to this DNP project also. This was discussed during the DNP student-led weekly meetings and found to be expressed by only a few participants, however. While the facility boasts a fully integrated EHR, the additional step in the risk assessment portion of charting was discouraging to some nurses and STNAs. This was also discussed at weekly meetings and thought to be related to the newness of the process. Although the CCDS tool was built to fit into the system without extraneous navigation, it did present an additional step in charting that was not always welcomed.

Facilitators to Implementation

Barriers to implementation were mitigated with a focus on facilitators throughout project implementation. Facilitators to CCDS implementation were delineated in a program evaluation

study following implementation of an AHRQ CCDS tool (Sharkey, Hudak, Horn, Barrett, Spector, & Limacangco, 2013). The main facilitators identified for successful decision support tool implementation in the Sharkey, et. al. (2013) study included high-level administrative and clinical leadership involvement, presence of in-house ancillary staff such as dieticians, nurse manager engagement, involvement of the quality assurance and educational teams, and involvement of wound champions. Wang and Gong (2017) discussed CCDS tools as facilitators to EBP practice, given the potential of CCDS tools to systematically standardize processes and simplify decision making in complex situations.

The DNP student secured facility leadership involvement to the extent possible given the previously discussed barriers. The DNP student met frequently with the Assistant Director of Nursing and the unit managers in attempt to secure commitment to the DNP project. The DNP student also met with the dietary and therapy teams periodically before and throughout implementation to further buy-in from ancillary teams. Ancillary teams were included in the weekly multidisciplinary meetings. The Education Manager and Quality Assurance Manager were frequently encouraged to provide input to optimize CCDS tool implementation. Wound champions were designated.

The CCDS tool allowed for standardization of risk-based care plan development and was successfully integrated into the facility's existing EHR, thus streamlining PU prevention interventions. Although facility policies were not changed, facility processes in PU prevention were modified by the CCDS tool and automatic alerts in attempt to promote EBP.

Lastly, the potential for pressure ulcer related citation-free state surveys, decreased cost related to prevention of PUs, and decreased hospital readmissions were used as motivators for

EBP adherence in this DNP project (see Appendix Q for a table of DNP project barriers and facilitators).

Outcomes

Studies that focused on areas outside of PUs concluded that CCDS tools have the potential to improve care processes and outcomes. The study by Bowles, et. al. (2015) showed decreased hospital readmissions after implementation of a computerized risk alert system. Hovde, Jensen, Alexander, & Fossum (2011) showed that CCDS tools can improve nursing adherence to CPGs, improving safety, care quality, and decreasing adverse events. Another study that looked at CCDS tool use in the diabetic foot showed a positive effect on the clinician's perception of workflow, although it did not look at ulcer specific outcomes or prevalence. In this DNP project, adherence to CPGs was not quantifiable. While the CCDS tool allowed for creation of a risk-based care plan, there was no way to objectively measure implementation of the prescribed interventions. Specific outcomes in this DNP project were judged by PU knowledge and attitude toward PU prevention in 28 nurses and 34 STNAs, and PU rates in 62-bed LTC unit.

Nurse and STNA PU knowledge. There was no significant change in PU knowledge post-education in either the nurse or the STNA group. This finding is consistent with the 2012 Beeckman study, which also demonstrated no significant change in nurse PU knowledge.

The knowledge pre-test was administered after the educational webinar was created and immediately prior to nurse and STNA webinar completion. This deterred use of the pre-test results to focus the educational webinar on knowledge gaps that were identified by the pre-test. The post-knowledge test was administered immediately following the educational webinar, thus deterring additional sources of education prior to the post-test. These factors may have limited the scope of education and contributed to the unchanged outcomes in PU knowledge.

Nurse and STNA Attitude toward PU. Some questions on the APuP survey suggested improvement in nurses' positive attitude toward PU post-project, but this was not reflected in the majority of questions. STNA perception did not improve. Beeckman, et. al. (2012) demonstrated an improvement in mean nurse PU perception scores. Cho et. al. (2013) identified an overall positive attitude toward the CCDS tools, but did not specifically analyze perception toward PUs. Weekly teleconferences with the DNP student in the DNP project revealed overall positive reception of the CCDs tool, with few concerns expressed.

PU rates. There was no decrease in PU rates in this DNP project. This is consistent with Beeckman's 2012 RCT, which demonstrated no significant improvement in PU rates after utilization of interactive PU education, electronic reminders, feedback, and PU monitoring, and Fossum's 2009 study, where use of a CCDS tool did not decrease PU rates but did show improvement in rates of undernutrition (Fossum, Ehnfors, Fruhling, & Ehrenberg, 2009).

The Cho study in 2013 and the Sebastian-Viana study (2015), which were included in the 2017 systematic review conducted by Varghese, Kleine, Gessner, Sandmann, and Dugas, displayed a decrease in hospital acquired PUs. In the Cho study, there was a decrease from 21% to 4%, after implementation of a PU focused CCDS tool (Cho, Park, Kim, Lee, & Bates, 2013). Cho's study considered illness severity and comorbid factors, and was conducted in the acute care setting. The Sebastian-Viana, et. al., (2015) study demonstrated decreased hospital acquired PU rates from 0.9% to 0.6% ($p=0.038$), without consideration of illness severity or comorbid factors. The Sebastian-Viana study was also done in the acute care setting (Sebastian-Viana, Losa-Iglesias, Gonzalez-Ruiz, Lema-Lorenzo, Nunez-Crespo, and Fuentes, 2015).

Dowding, Turley, and Garrido (2011) identified a 13% decrease in PU rates in the CCDS intervention group, but also found that PU rates in the control group decreased after time. The

authors suggested that this was because of increased attention to PU risk and prevention overall, thus suggesting that the CCDS tool alone was not responsible for decreased PU rates. This DNP project demonstrated similar findings. An effect on PU rates was seen before implementation from 16.7 to 9.2, when the DNP student was actively engaged in PU practices.

Limitations

This DNP project had several limitations that contributed to the outcomes. This DNP project was conducted at a single, private facility, and the total number of participants was small. The participant demographics were not diverse in gender or race.

The DNP student was available throughout the 10-month project, however the facility mandated that the wound champions and facility leadership interact directly with the nurses and STNAs. Data collection methods were suboptimal because of similar facility recommendations to allow facility-employed implementation team members to upload and manage the data. The wound champions and facility leadership were educated about the CCDS tool with a goal to sustain efforts within the facility without reliance on the DNP student, but PUs were not a consistent priority to the wound champions. This may have compromised the commitment to the DNP project.

Although the CCDS tool was based on a validated AHRQ sample care plan, the electronic tool itself was not validated or reliability tested. No formal training was completed for the nurses or STNAs on tool usage, as it was integrated into preexisting EHR templates. No formal Braden scale completion training was provided to the nurses or STNAs.

The goal of the CCDS tool was to optimize care plans independently of nurses' or STNAs' experience. However, it was difficult to measure the execution of the PU prevention care plans. As discussed in the barriers to implementation section, the facility's administrative and clinical

leadership teams, the nurses, and the STNAs did not have sufficient time or focus to dedicate to PU prevention and CCDS tool implementation. The wound champions were not fully devoted to this project, as they had other roles and responsibilities that interfered.

Another limitation is that using a single educational webinar format may not have been ideal for all study participants. Additionally, the educational webinar provided general, but not specific, PU prevention information. Focusing the educational webinar on the specific gaps identified by the pre-test may have been more beneficial. Although the wound champions and specially-trained unit managers completed the Braden assessments, and resources on Braden scoring were provided, standardized teaching on Braden risk assessment completion was not done for the nurses and STNAs. While the Braden scale is a validated and widely-accepted tool, it does not allow for a resident's comorbidities or illness severity in PU prevention, which are significant factors in PU development. Highly contributory factors such as nutritional status, perfusion, and cognitive status were not objectively measured or considered in this project.

Lastly, PU rates were affected by nurses' ability to accurately determine ulcer cause. As seen in the root cause analysis of PU development throughout this DNP project, ulcers that may not have been of pressure etiology were documented as PU. Nurses' limited knowledge of and competence in determining ulcer etiology contributed to DNP project outcomes.

Future Considerations

This DNP project contributes to the body of literature on the complex and multi-factorial nature of PU prevention, especially in LTC settings. The results of this DNP project are both similar to and different from other published data. The DNP project outcomes suggested that adequate attention and effort should be provided to PU prevention using different tools. Lack of full implementation and attention to details surrounding PU prevention are likely to lead to

failure of any tool associated with a PU prevention program. This DNP project is consistent with the literature's suggestion that PU prevention programs are complex and need multi-modal and consistent tactics to be successful. While many studies have revealed positive outcomes with reduction of PU rates, improved PU documentation, or improved clinicians' attitude toward PUs, they have also concluded the complex and multi-factorial nature of PU prevention programs.

Future considerations for this DNP project include a longer data collection period to evaluate PU rates at six and nine months to see if rates remain stable. Expansion of the project to additional sites with an increased number and diversity of participants is recommended. In the future, the DNP student aims to adapt this pilot of the CCDS tool and PU prevention tactics to other facilities within the same private corporation.

The concept of wound champion utilization is crucial for future consideration. The literature base supports the use of EBP champions and wound champions in PU prevention. Allowing wound champions to devote ample time to PU prevention may maximize the CCDS tool's adoption and promote improved nurse and STNA attitude toward PU prevention. The dedication of time for wound champions to devote specifically to PU prevention is recommended by the DNP student to optimize CCDS tool implementation.

Future plans should also include ongoing education throughout implementation, with administration of the knowledge post-test at longer intervals. Education may also be focused on knowledge pre-test scores to enhance the nurses' and STNA' learning. It would be of benefit to increase DNP student involvement in data collection to ensure analysis of knowledge by individual participant.

The APuP scale, while validated, contained some language that may have been confusing to participants. In future projects, it would be of benefit to address the verbiage within the tool to ensure accuracy in responses.

Lastly, patient acuity and comorbid factors are key in PU development and should be considered in conjunction with risk assessment and the CCDS tool. This could be achieved by increasing the sensitivity of the resident change in condition triggers. While the risk assessment scale addresses multiple known factors in PU development, it does not directly account for contributing medical conditions. Coupling a risk-based CCDS tool with assessment of other contributory factors may prove beneficial.

Conclusion

EBP solutions are at the core of nursing practice. EBP projects that elucidate ways to enhance point-of-care and multi-disciplinary collaboration are of utmost importance. This DNP project was consistent with a literature base that supports the implementation of PU related CCDS tools in LTC settings and addressed a major concern in this arena. Given the few financial resources needed and lack of potential risk to the patient or involved staff, this DNP project carried potential for easily obtainable improvements in the quality of care provided at LTC facilities.

The aim of this project was to utilize implementation strategies in evidence-based guidelines to prevent PU from developing or worsening. At the facility level, decreased PU occurrences or PU decline contributes to decreased cost per resident stay, improved patient and family satisfaction, improved quality scores and potentially less penalties to facilities with high PU rates. These outcomes were expected to lessen financial burden on the healthcare system as a whole and lead to further advances and research.

With a goal to support implementation of a PU related CCDS tool in LTC settings to reduce acquired PU rates, the JHNEBP model was used to analyze the quality of the literature. Based on this analysis, the literature provided adequate and thorough evidence to support the suggested practice changes. The project was implemented using the CCDS tool, automatic triggers for risk assessment, education, and wound champion follow-through. Outcomes showed no statistically significant improvement in direct care staff PU knowledge and no statistically significant decrease in PU rates, but did show improvement in nurse confidence with PU prevention practices. With modification of the conditions to trigger risk assessment, increased involvement of wound champions, and concurrent consideration of comorbid factors, the CCDS tool may show increased potential for improved outcomes. This project exemplified the complex nature of PU prevention and highlighted the need for multiple concurrent strategies, which is consistent with the literature base.

This DNP project was completed by utilization of several DNP core essentials. Essential I, "Scientific Underpinnings for Practice," and Essential III, "Clinical Scholarship and Analytical Methods for Evidence-Based Practice," were displayed in the DNP student's thorough literature search, critical analysis, and application of the evidence base on CCDS tools and PU prevention. Essential II, "Organizational and Systems Leadership for Quality Improvement and Systems Thinking" was addressed by the DNP students' continuous collaboration among multiple disciplines and acknowledgement of clinical, administrative, and financial systems in PU prevention and the CCDS tool. Essential IV, "Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care" was at the core of this DNP project. The DNP project was focused on the use of IT to create systematic and standardized solutions to promote EBP practice, and the DNP student worked closely with the IT

manager during the DNP project. Essential VII, “Clinical prevention and Population Health for Improving the Nation’s health,” was also applied in this DNP project, concurrent with the federal government’s regulatory call to focus on PU and the goal to optimize prevention tactics to improve the health of the LTC population. Lastly, Essential VIII, “Advanced Nursing Practice,” was important, as the DNP student was called on for advanced nursing decisions and treatment recommendations (see Appendix R for a list of DNP core essentials tied to this DNP project).

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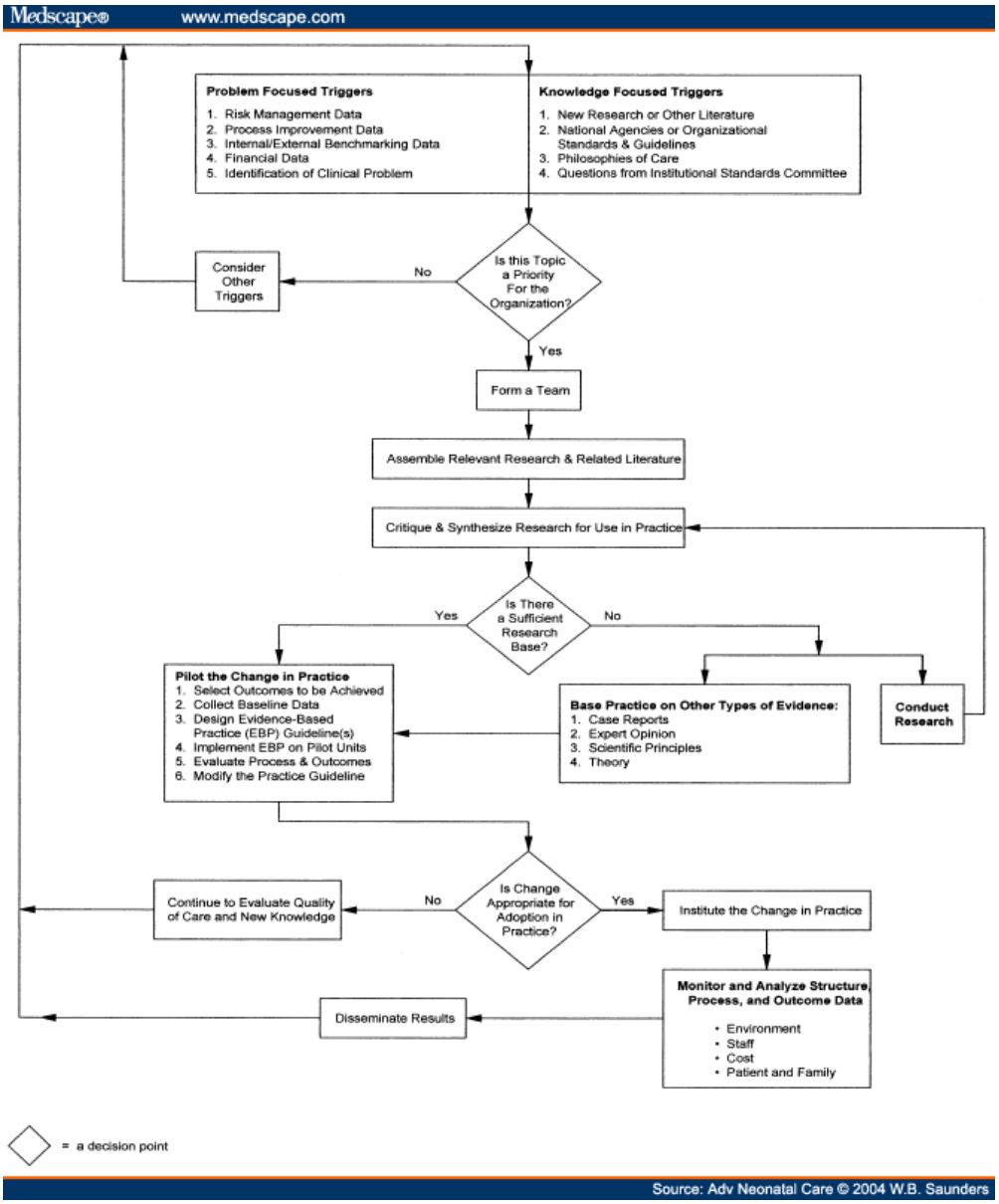
Appendix A
Iowa Model of EBP



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Appendix B
Johns Hopkins Nursing Evidence-Based Practice Model Individual Studies

Article #	Author & Date	Evidence Type	Sample, Sample Size & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
1	Beeckman, et al., 2012	RCT	Random sample -11 wards 4 LTC facilities 464 residents 118 healthcare professionals	PU prevention improved for chair-bound residents Attitudes on PU prevention of HCP improved post-implementation PU knowledge and rates showed no statistical difference however there was a positive trend in PU rates	Control group outcomes may have been impacted by increased awareness of PU prevention practices Limited involvement of HCP in education	IB
2	Fossum, et al., 2009	Design/Pilot Study	N/A	CCDS development in response to promising studies for CCDS in nursing processes	Not a research study	VA
3	Fossum, Ehnfors, Fruhling, & Ehrenberg, 2011	Qualitative/ Descriptive	25 nursing personnel form 4 LTC facilities	Ease of use and supportive work environment key factors to CDSS success Lack of training and resistance to computer use are Barriers	Small sample size Limited participation of evaluating nurses in the use of CCDS itself	VB
4	Fossum, Alexander, Ehnfors, & Ehrenberg, 2011	Quasi-experimental	Convenience Sample 46 units 15 LTC facilities 491 residents at baseline 480 residents and follow-up	Proportion of malnourished residents showed positive statistically significant findings Field test of CCDS use in LTC setting	Small sample size Limited participation in education	II B

Article #	Author & Date	Evidence Type	Sample, Sample Size & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
5	Fossum, Ehnfors, Svensson, Hansen, & Ehrenberg, 2013	Quasi-experimental Intervention Study	15 LTC facilities 150 records before 141 records after intervention	More complete and thorough nursing documentation post-intervention CCDS has potential to improve nursing charting	Non-randomized Only residents with documented PU/ malnutrition were reviewed Bias in nurse experience with using CPGs	II B
6	Bowles, Dykes, & Demiris, 2015	Expert Opinion	N/A	Review of other areas of CCDS use pertaining to older adults	Non-research article No systematic review of other studies summarized	VB
7	Choi & Kim, 2013	Pilot Feasibility Study	Acute care setting 30 patient scenarios	Feasibility of encoding an accurate nursing guideline for PU prevention Goal to improve nurses' decision making at the point of care	Use of only one nurse wound expert in pilot development Small number of patient scenarios	VB
8	Varghese, Kleine, Gessner, Sandmann, & Dugas, 2017	Systematic Review	Acute Care Setting 70 studies reviewed 2 PU studies (n = 1,214, n = 18483)	Positive patient outcomes in 70% of studies PU shows promise to prevent harmful events	Studies reviewed were single center Some studies with selection bias	IIA
9	(Cho, Park, Kim, Lee, & Bates, 2013).	Before-After Quasi-experimental	866 intervention cases and 348 baseline cases ICU setting	Decrease in HAPU rates Shortened LOS in ICU Positive attitudes Improved documentation	Single Center Not RCT	IIA

Article #	Author & Date	Evidence Type	Sample, Sample Size & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
10	Sebastian-Viana, Losa-Iglesias, Gonzalez-Ruiz, Lema-Lorenzo, Nunez-Crespo, and Fuentes, 2015	Pre- and post-test	6 medical-surgical units 9263 baseline patients 9220 intervention patients	Decreased HAPU rates post-intervention	Quasi-experimental Unknown factors not controlled	IIB
11	Dowding, Turley, & Garrido, 2011	Interrupted time series analysis	29 acute care centers affiliated with a large, non-profit hospital system	Significant findings for nurse documentation of PU risk improvement Decrease in PU rates	Results may be partially related to increased PU awareness accompanying CCDS Patient mix not accounted for	III B
12	Wang & Gong, 2017	Program Evaluation	N/A	Identification of gap between knowledge and practice with communication as a key element Potential of CCDS to improve adherence to best practices related to PU	Non-research Anecdotal	VB
13	Jeffery, 2015	Literature Review	4 studies	All studies conducted with or by nurses or NPs Some outcomes improved by use of CCDS, PU included (Cho study)	Non-research Only 4 studies reviewed	VB
14	Hovde, Jensen, Alexander, & Fossum, 2015	Systematic Review	16 studies Acute care setting	Positive effects of computerized CPGs identified	Paucity of experimental studies to review Studies significantly differed in outcomes and results	IIIA

Article #	Author & Date	Evidence Type	Sample, Sample Size & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
15	Peleg, Shachak, Wang, & Karnieli, 2009	Program Evaluation	N/A	Positive response from end-users Need for multi-factorial consideration in CCDS development Done in a wound-related, multi-factorial field	Qualitative methods Perception study without clinical outcome measurement	VA
16	Bowles, et al., 2015	Quasi-Experiemental	3 hospitals 82 units 3,005 control assessments and 4,507 intervention assessments	Risk assessment focused Implementation of CCDS decreased 30 and 60 day readmissions based on risk assessment	Results may also be based on increased education, awareness, and communication Exact interventions unable to be determined	IIA
17	Kawamoto, Houlihan, Balas, & Lobach, 2005	Systematic review with Meta-Synthesis	88 studies	Computerized decision support identified as independent predictor of practice improvement	Binary analysis Types of decision support tools varied	IA
18	Hoekstra, et al., 2010	Quasi-Experimental Before/After Study	Surgical ICU at Tertiary Center 26 beds 775 patients before 1435 patients after	Computerized potassium regulation protocol resulted in decreased hypokalemia and hyperkalemia	Before/after design can introduce bias Potassium regulation was MD driven prior to intervention and nurse driven after	IIA

Note. EBP = evidence based practice; RCT = randomized controlled trial; LTC = long-term care; PU = pressure ulcer; HCP = health care provider; CCDS = computerized clinical decision support; ICU = intensive care unit; HAPU = hospital acquired pressure ulcer; CPG = clinical practice guideline

Appendix C
Johns Hopkins Nursing Evidence-Based Practice Model Synthesis of the Evidence

Level I · Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis	**#1** **#17**	**B** **A**	Staff attitudes improved with CCDS implementation CCDS can lead to decreased PU rates CCDS as independent predictor of improved clinical practice
Level II · Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	**#4** **#5** **#8** **#9** **#10** **#16** **#18**	**B** **B** **A** **A** **B** **A** **A**	Improved nursing documentation with CCDS Positive patient outcomes with CCDS Decreased HAPU rates Shortened ICU LOS Decreased hospital readmission at 30 and 60 days
Level III · Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis	**#11** **#14**	**B** **A**	Decreased HAPU rates Positive outcomes related to safety and complications
Level IV · Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
<u>Level V</u> · Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence	**#2** **#3** **#6**	**A** **B** **B**	CCDS tools feasible with involvement of utilizing teams Nursing decision making can be improved with CCDS

	#7 **#12** **#13** **#15**	**B** **B** **B** **A**	CCDS may positively impact guideline adherence End-user satisfaction is obtainable

Note. RCT = randomized controlled trial; CCDS = computerized clinical decision support; PU = pressure ulcer; HAPU = hospital acquired pressure ulcer; ICU = intensive care unit; LOS = length of stay

Appendix D
American Medical Director's Association Pressure Ulcer team and Roles

TABLE 3
Roles of Interprofessional Team Members in Wound Care

Wound-care team	■ Establish a system for risk assessment and care plan interventions using best practices ■ Reward staff for early identification and reporting of skin lesions ■ Establish a notification system and parameters for how team members are notified about the need for assessment of a new lesion ■ Establish a system to track healing ■ Establish a nonpunitive system of identification, reporting, and investigation (root-cause analysis) ■ Implement a system to thoroughly investigate and document all new in-house pressure ulcers. ■ Establish an interprofessional system of oversight and review that includes monitoring quality indicators, investigating deviances, and addressing system-wide problems ■ Require that any pressure ulcer or skin lesion be inspected and staged by a trained, expert professional ■ Establish systems to enable staff to readily obtain pressure-relieving devices
Medical director	■ Collaborate in all key care decisions ■ Provide input on plan of care as needed ■ Oversee QI processes
Attending physician **Advanced care practitioners**	■ Periodically inspect wounds visually and document their status ■ Provide direction to other caregivers for difficult-to-treat ulcers ■ Assess the patient's need for nutritional consultation

TABLE 3 Continued
Roles of Interprofessional Team Members in Wound Care

Administrator	■ Establish facility wound care systems ■ Establish a nonpunitive system for reporting of skin-related concerns ■ Oversee QI and resources ■ Allocate adequate time for staff education ■ Assure appropriate resources are available to staff
Wound nurse or "wound champion"	■ Coordinate with Administrator to ensure availability of proper wound-care products ■ Consult with wound-care team members to help determine causation, diagnosis, and treatments and define appropriate ulcer management strategies as the patient's status changes ■ Work collaboratively with other caregivers to establish an appropriate plan of care for each patient with a pressure ulcer or other skin lesion ■ Help to select appropriate support surfaces for patients with ulcers ■ Educate all staff, including nursing assistants, on proper skin assessment and recognition of skin lesions; including procedures for reporting findings to a nurse, advanced care practitioner, or physician ■ Implement a monitoring system to assure that all patients receive skin assessments weekly (or more frequently for those at higher risk) ■ Assure that pressure ulcer risk assessment takes place on admission, with a change in condition, on readmission to the facility following a hospital stay, quarterly, and when a new skin lesion is observed to which pressure is a contributing factor ■ Evaluate the effectiveness of the current ulcer-treatment regimen ■ Establish a formulary of commonly used wound-care products
Nursing staff **Nursing assistants**	■ Be aware of all components in the wound care program ■ Consult with wound care team members ■ Report all skin changes
Dietitian	■ Assess nutritional requirements for all patients with or at risk for pressure ulcers or other wounds ■ Make recommendations in regard to nutritional management
Physical therapist	■ Assist in the selection of appropriate support surfaces for patients with ulcers ■ Provide direct care (e.g., debridement) if applicable ■ Coordinate with staff for mobility and off-loading goals
Pharmacist	■ Provide information on chemical debriding agents, antibiotic use as applicable, and medications that interfere with healing or cognition, or that may decrease mobility
Wound consultant	■ Coordinate with attending physician or advanced care practitioner regarding recommendations for wound care (may be an outside consultant)

Appendix E
Letter to Stakeholders

Dear Stakeholder:

We would like to introduce you to a new pressure ulcer prevention project. We hope that you will support this exciting new endeavor. Your facility is embarking on an important new initiative focused on the prevention of pressure ulcers among your long-term care (LTC) patients.

Pressure ulcers acquired during stays in LTC settings present significant treatment and recovery delays for patients, increase length and cost of resident stays, and have become a topic of attention from the federal government.

In the past, pressure ulcer care has sometimes been seen as solely a nursing unit responsibility. However, recent research has made it clear that successfully reducing pressure ulcer incidence requires a coordinated multidisciplinary approach.

Thus, the implementation of new prevention approaches may require, for example, the efforts of: facility administrators and clinical leaders, nurses, dieticians and dietary technicians, physical and occupational therapists, information technology and quality assurance teams, nurses, and certified nursing assistants.

In this project, we will be developing a Clinical Computerized Decision Support Tool (CCDS) that will be integrated into the already-existing electronic health record. The tools will be based on pressure ulcer risk assessment scores and be guided by current clinical practice guidelines. Automatic alerts will also be incorporated into the electronic health record. Multidisciplinary team meetings will encompass residents deemed at-risk for pressure ulcer development and wound certified nurses will be assisting in follow-through of CCDS- guided care plans.

Using these tools, we will assess staff awareness and knowledge of pressure ulcer prevention, analyze patient care processes to identify where there are risks to patient skin integrity, and target interventions in those areas. Pressure ulcer incidence while patients are under our care will be tracked so that progress can be assessed. Everyone has a role: Most important in this effort is a shift of thinking and culture, from seeing pressure ulcers as the inevitable result of patient immobility to seeing them as events that should rarely occur and can be prevented.

Your support in helping staff make this shift is essential to the success of this effort. Thank you!

Karen Bauer, APRN-CNP, CWS

Appendix F
Sample Care Plan

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
Sensory Perception	**Completely limited** • Skin assessment and inspection q shift. Pay attention to heels. • Elevate heels and use protectors. • Consider specialty mattress or bed. • Use pillows between knees and bony prominences to avoid direct contact.	**Very limited** • Skin assessment and inspection q shift. Pay attention to heels. • Elevate heels and use protectors. • Consider specialty mattress or bed.	**Slightly limited** • Skin assessment and inspection q shift. Pay attention to heels. • Elevate heels and use protectors .	**No limitation** • Encourage patient to report pain over bony prominences. • Check heels daily.
Moisture	**Constantly Moist** • Skin assessment and inspection q shift. • Use moisture barrier ointments (protective skin barriers). • Moisturize dry unbroken skin. • Avoid hot water. Use mild soap and soft cloths or packaged cleanser wipes. • Check incontinence pads frequently (q 2-3h) and change as needed. • Apply condom catheter if appropriate. • If stool incontinence,	**Moist** • Use moisture barrier ointments (protective barriers). • Moisturize dry unbroken skin. • Avoid hot water. Use mild soap and soft cloths or packaged cleanser wipes. • Check incontinence pads frequently (q 2-3h). • Avoid use of diapers but if necessary, check frequently (q 2-3h)and change as needed. • If stool incontinence, consider bowel training and	**Occasionally Moist** • Use moisture barrier ointments (protective skin barriers). • Moisturize dry unbroken skin. • Avoid hot water. Use mild soap and soft cloths or packaged cleanser wipes. • Check incontinence pads frequently. • Avoid use of diapers but if necessary, check frequently (q 2-3h) and change as needed. • Encourage patient to report any other moisture problem (such as under breasts). • If stool incontinence, consider bowel training and toileting after meals.	**Rarely Moist** • Encourage patient to use lotion to prevent skin cracks. • Encourage patient to report any moisture problem (such as under breasts).

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
	consider bowel training and toileting after meals or rectal tubes if appropriate. • Consider low air loss bed	toileting after meals. • Consider low air loss bed		
Activity	**Bedfast** • Skin assessment and inspection q shift. • Position prone if appropriate or elevate head of bed no more than 30 degrees. • Position with pillows to elevate pressure points off of the bed. • Consider specialty bed. • Elevate heels off bed and/or use heel protectors. • Consider physical therapy consult for conditioning and W/C assessment. • Turn/reposition q 1-2h. • Post turning schedule. • Teach or do frequent small shifts of body weight.	**Chairfast** • Consider specialty chair pad. • Consider postural alignment, weight distribution, balance, stability, and pressure relief when positioning individuals in chair or wheelchair. • Instruct patient to reposition q 15 minutes when in chair. • Stand every hour. • Pad bony prominences with foam wedges, rolled blankets, or towels. • Consider physical therapy consult for conditioning and W/C assessment.	**Walks Occasionally** • Provide structured mobility plan. • Consider chair cushion. • Consider physical therapy consult..	**Walks Frequently** • Encourage ambulating outside the room at least bid. • Check skin daily. • Monitor balance and endurance.

PRESSURE ULCER GUIDELINE IMPLEMENTATION

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
Mobility	**Completely Immobile** • Skin assessment and inspection q shift. • Turn/reposition q 1-2 hours. • Post turning schedule. • Teach or do frequent small shifts of body weight. • Elevate heels. • Consider specialty bed.	**Very Limited** • Skin assessment and inspection q shift. • Turn/reposition 1-2 hours. • Post turning schedule. • Teach or do frequent small shifts of body weight. • Elevate heels. • Consider specialty bed.	**Slightly Limited** • Check skin daily. • Turn/reposition frequently. • Teach frequent small shifts of body weigh. • PT consult for strengthening/conditioning. • Gait belt for assistance.	**No Limitations** • Check skin daily. • Encourage ambulating outside the room at least bid. • No interventions required.
Nutrition	**Very Poor** • Nutrition consult. • Skin assessment and inspection q shift. • Offer nutrition supplements and water. • Encourage family to bring favorite foods. • Monitor nutritional intake. • If NPO for > 24 hours, discuss plan with MD. • Record dietary intake and I & O if appropriate.	**Probably Inadequate** • Nutrition consult. • Offer nutrition supplements and water. • Encourage family to bring favorite foods. • Monitor nutritional intake. • Small frequent meals. • If NPO for > 24 hours, discuss plan with MD. • Record dietary intake and I & O if appropriate.	**Adequate** • Monitor nutritional intake. • If NPO for > 24 hours, discuss plan with MD. • Record dietary intake and I&O if appropriate.	**Excellent** • Out of bed for all meals. • Provide food choices. • Offer nutrition supplements. If NPO for > 24 hours, discuss plan with MD. • Record dietary intake.
Friction and Shear	**Problem** • Skin assessment and inspection q shift. • Minimum of 2 people + draw sheet to pull patient up in bed. • Keep bed linens clean, dry, and wrinkle free.	**Potential Problem** • Keep bed linens clean, dry, and wrinkle free. • Avoid massaging pressure points. • Apply transparent dressing or elbow/heel protectors to intact skin over	**No apparent problem** • Keep bed linens clean, dry, and wrinkle free.	

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
	• Apply elbow/heel protectors to intact skin over elbows and heels. • Elevate head of bed 30 degrees or less.	elbows and heels.		

Agency for Healthcare Research and Quality (last reviewed 2014). Preventing pressure ulcers in hospitals. Rockville, MD. Retrieved from: http://www.ahrq.gov/professionals/systems/hospital/pressureulcertoolkit/index.html

Appendix G
Pieper Knowledge Test and Answers

1. Stage I pressure ulcers are defined as intact skin with nonblanchable erythema in lightly pigmented persons.		
2. Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness.		
3. All hospitalized individuals at risk for pressure ulcers should have a systematic skin inspection at least daily and those in long-term care at least once a week.		
4. Hot water and soap may dry the skin and increase the risk for pressure ulcers.		
5. It is important to massage bony prominences.		
6. A Stage III pressure ulcer is a partial thickness skin loss involving the epidermis and/or dermis.		
7. All individuals should be assessed on admission to a hospital for risk of pressure ulcer development.		
8. Cornstarch, creams, transparent dressings (e.g., Tegaderm, Opsite), and hydrocolloid dressings (e.g., DuoDerm, Restore) do not protect against the effects of friction.		
9. A Stage IV pressure ulcer is a full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structure.		
10. An adequate dietary intake of protein and calories should be maintained during illness.		
11. Persons confined to bed should be repositioned every 3 hours.		
12. A turning schedule should be written and placed at the bedside.		
13. Heel protectors relieve pressure on the heels.		
14. Donut devices/ring cushions help to prevent pressure ulcers.		
15. In a side lying position, a person should be at a 30-degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority.		
16. The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions.		
17. A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair.		
18. Persons who can be taught should shift their weight every 30 minutes while sitting in a chair.		
19. Chair-bound persons should be fitted for a chair cushion.		
20. Stage II pressure ulcers are a full thickness skin loss.		
21. The epidermis should remain clean and dry.		
22. The incidence of pressure ulcers is so high that the government has appointed a panel to study risk, prevention, and treatment.		
23. A low-humidity environment may predispose a person to pressure ulcers.		
24. To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture.		
25. Rehabilitation should be instituted if consistent with the patient's overall goals of therapy.		
26. Slough is yellow or creamy necrotic tissue on a wound bed.		
27. Eschar is good for wound healing.		
28. Bony prominences should not have direct contact with one another.		

29. Every person assessed to be at risk for developing pressure ulcers should be placed on a pressure-redistribution bed surface.		
30. Undermining is the destruction that occurs under the skin.		
31. Eschar is healthy tissue.		
32. Blanching refers to whiteness when pressure is applied to a reddened area.		
33. A pressure redistribution surface reduces tissue interface pressure below capillary closing pressure.		
34. Skin macerated from moisture tears more easily.		
35. Pressure ulcers are sterile wounds.		
36. A pressure ulcer scar will break down faster than unwounded skin.		
37. A blister on the heel is nothing to worry about.		
38. A good way to decrease pressure on the heels is to elevate them off the bed.		
39. All care given to prevent or treat pressure ulcers must be documented.		
40. Devices that suspend the heels protect the heels from pressure.		
41. Shear is the force that occurs when the skin sticks to a surface and the body slides.		
42. Friction may occur when moving a person up in bed.		
43. A low Braden score is associated with increased pressure ulcer risk.		
44. The skin is the largest organ of the body.		
45. Stage II pressure ulcers may be extremely painful due to exposure of nerve endings.		
46. For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals.		
47. Educational programs may reduce the incidence of pressure ulcers.		

PRESSURE ULCER GUIDELINE IMPLEMENTATION

1. Stage I pressure ulcers are defined as intact skin with nonblanchable erythema in lightly pigmented persons.	**True**	
2. Risk factors for development of pressure ulcers are immobility, incontinence, impaired nutrition, and altered level of consciousness.	**True**	
3. All hospitalized individuals at risk for pressure ulcers should have a systematic skin inspection at least daily and those in long-term care at least once a week.	**True**	
4. Hot water and soap may dry the skin and increase the risk for pressure ulcers.	**True**	
5. It is important to massage bony prominences.		**False**
6. A Stage III pressure ulcer is a partial thickness skin loss involving the epidermis and/or dermis.		**False**
7. All individuals should be assessed on admission to a hospital for risk of pressure ulcer development.	**True**	
8. Cornstarch, creams, transparent dressings (e.g., Tegaderm, Opsite), and hydrocolloid dressings (e.g., DuoDerm, Restore) do not protect against the effects of friction.		**False**
9. A Stage IV pressure ulcer is a full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structure.	**True**	
10. An adequate dietary intake of protein and calories should be maintained during illness.	**True**	
11. Persons confined to bed should be repositioned every 3 hours.		**False**
12. A turning schedule should be written and placed at the bedside.	**True**	
13. Heel protectors relieve pressure on the heels.		**False**
14. Donut devices/ring cushions help to prevent pressure ulcers.		**False**
15. In a side lying position, a person should be at a 30-degree angle with the bed unless inconsistent with the patient's condition and other care needs that take priority.	**True**	
16. The head of the bed should be maintained at the lowest degree of elevation (hopefully, no higher than a 30 degree angle) consistent with medical conditions.	**True**	
17. A person who cannot move him or herself should be repositioned every 2 hours while sitting in a chair.		**False**
18. Persons who can be taught should shift their weight every 30 minutes while sitting in a chair.		**False**
19. Chair-bound persons should be fitted for a chair cushion.	**True**	
20. Stage II pressure ulcers are a full thickness skin loss.		**False**
21. The epidermis should remain clean and dry.	**True**	
22. The incidence of pressure ulcers is so high that the government has appointed a panel to study risk, prevention, and treatment.	**True**	
23. A low-humidity environment may predispose a person to pressure ulcers.	**True**	
24. To minimize the skin's exposure to moisture on incontinence, underpads should be used to absorb moisture.	**True**	
25. Rehabilitation should be instituted if consistent with the patient's overall goals of therapy.	**True**	
26. Slough is yellow or creamy necrotic tissue on a wound bed.	**True**	
27. Eschar is good for wound healing.		**False**
28. Bony prominences should not have direct contact with one another.	**True**	
29. Every person assessed to be at risk for developing pressure ulcers should be placed on a pressure-redistribution bed surface.	**True**	
30. Undermining is the destruction that occurs under the skin.	**True**	
31. Eschar is healthy tissue.		**False**

32. Blanching refers to whiteness when pressure is applied to a reddened area.	**True**	
33. A pressure redistribution surface reduces tissue interface pressure below capillary closing pressure.	**True**	
34. Skin macerated from moisture tears more easily.	**True**	
35. Pressure ulcers are sterile wounds.		**False**
36. A pressure ulcer scar will break down faster than unwounded skin.	**True**	
37. A blister on the heel is nothing to worry about.		**False**
38. A good way to decrease pressure on the heels is to elevate them off the bed.	**True**	
39. All care given to prevent or treat pressure ulcers must be documented.	**True**	
40. Devices that suspend the heels protect the heels from pressure.	**True**	
41. Shear is the force that occurs when the skin sticks to a surface and the body slides.	**True**	
42. Friction may occur when moving a person up in bed.	**True**	
43. A low Braden score is associated with increased pressure ulcer risk.	**True**	
44. The skin is the largest organ of the body.	**True**	
45. Stage II pressure ulcers may be extremely painful due to exposure of nerve endings.	**True**	
46. For persons who have incontinence, skin cleaning should occur at the time of soiling and at routine intervals.	**True**	
47. Educational programs may reduce the incidence of pressure ulcers.	**True**	

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Appendix H
Attitude Towards Pressure Ulcer Prevention Instrument

	Strongly agree	**Agree**	**Disagree**	**Strongly disagree**
1. I feel confident in my ability to prevent pressure ulcers.	**O**	**O**	**O**	**O**
2. I am well trained to prevent pressure ulcers.	**O**	**O**	**O**	**O**
3. Pressure ulcer prevention is too difficult. Others are better than I am.	**O**	**O**	**O**	**O**
4. Too much attention goes to the prevention of pressure ulcers.	**O**	**O**	**O**	**O**
5. Pressure ulcer prevention is not that important.	**O**	**O**	**O**	**O**
6. Pressure ulcer prevention should be a priority.	**O**	**O**	**O**	**O**
7. A pressure ulcer almost never causes discomfort for a patient.	**O**	**O**	**O**	**O**
8. The financial impact of pressure ulcers on a patient should not be exaggerated.	**O**	**O**	**O**	**O**
9. The financial impact of pressure ulcers on society is high.	**O**	**O**	**O**	**O**
10. I am not responsible if a pressure ulcer develops in my patients.	**O**	**O**	**O**	**O**
11. I have an important task in pressure ulcer prevention.	**O**	**O**	**O**	**O**
12. Pressure ulcers are preventable in high-risk patients.	**O**	**O**	**O**	**O**
13. Pressure ulcers are almost never preventable.	**O**	**O**	**O**	**O**

Beeckman, D., Defloor, T., Demarre, L., Van Hecke, A., & Venderwee, K. (2010). Pressure ulcers: development and psychometric evaluation of the Attitude towards Pressure ulcer Prevention instrument (APuP). *International Journal of Nursing Studies, 47,* 1432-1441.

Appendix I
Implementation Timeline

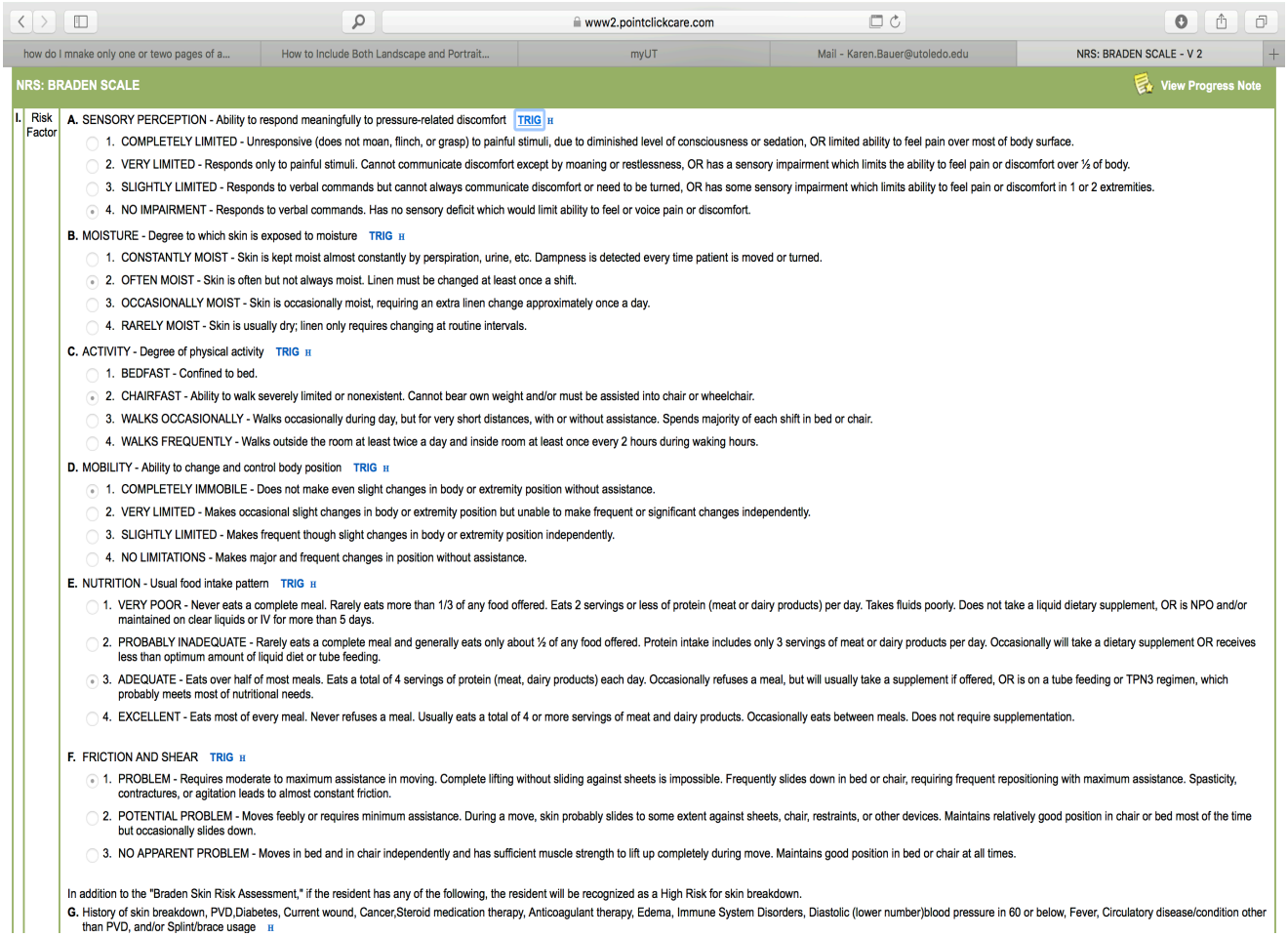
DNP Student/Project Lead: Karen Bauer, APRN-CNP, CWS
Committee Members: Dr. Eileen Walsh, Dr. Colleen Taylor, Dr. Kristine Scordo
Implementation Team Members: Director of Nursing, Assistance Director of Nursing, Wound Champions, Quality Assurance Manager, Education Manager, Information Technology Manager
Ancillary Team Members: Unit Managers, Statistician

Activity	Stakeholders/Key Participants	Action	Timeline
Step 1: Topic Selection	DNP Student Committee Members	• Identify problem triggers: above national benchmark PU in LTC facility • Identify Stakeholders • Identify barriers and facilitators	Completed November 2017, Reviewed July 2018 and November 2018
Step 2: Team Formation	DNP Student Quality Assurance Manager	Determine team members and roles	Completed February 2018, Reviewed November 2018
Step 3: Evidence Retrieval	DNP Student	• Conduct Literature search • Revise literature Search to ensure timeliness	Completed October 2017-January 2018, Reviewed June 2018
Step 4: Evidence grading	DNP Student	• Evidence Appraisal	Completed October 2017 January 2018 Updated November 2018
Step 5: Develop an Evidence-based Standard/Recommendation	DNP Student Project Committee Implementation Team	• Define project purpose • Clarify project outcomes to display project success • Develop data collection tools • Create process evaluation tools • Develop project-related products • Complete educational presentations	October 2017 February/March 2018 Updated and approved November 2018

		• Acquire necessary approval s(IRB and Project Site) • Baseline data review to ascertain where practice gaps exist • Plan interventions based on this review	
	DNP Student Project Committee	• Defend Project Proposal	September 2018
Step 6: Implement the EBP Project	DNP Student Implementation Team	• Meet with team and clarify timeline • Develop formal implementation schedule • Systematic assessment of current practices in the facility and how they align with the AMDA PU CPG	November 2018
Timeline and Baseline Data Collection	Project Lead Implementation Team	• Complete baseline assessment for outcome, structure, and process indicators • Complete direct care staff pre-testing based on AHRQ PU knowledge test • Complete Nurse perception baseline testing using APuP instrument	November, 2018-January 2019
Design Clinical Change Interventions	DNP Student Implementation Team	• Develop additional project products as needed • Decide on "go live" date	June 2018, November 2018
Review Clinical Change Interventions	DNP Student Implementation Team	• Complete formal education sessions for direct care staff and leadership/	June 2018, November 2018

		implementation teams	
"Go Live"	DNP Student Implementation Team	Initiate Pilot	January 2019
Step 7: Evaluate the Clinical Change	DNP Student Project Committee Implementation team	• Complete outcome evaluation • Monitor PU rates via MDS/CASPER data • Post-implementation knowledge testing • Post-implementation perception testing	April-May, 2019
Data Analysis/Project Completion	DNP Student Project Committee Implementation Team	• Review outcomes • Exit focus group discussions	May, 2019

Appendix J
Screenshots of Braden Intervention Triggers



www2.pointclickcare.com

how do I mnake only one or tewo pages of a... | How to Include Both Landscape and Portrait... | myUT | Mail - Karen.Bauer@utoledo.edu | NRS: BRADEN SCALE - V 2

NRS: BRADEN SCALE — View Progress Note

I. Risk Factor

A. SENSORY PERCEPTION - Ability to respond meaningfully to pressure-related discomfort TRIG H

1. COMPLETELY LIMITED - Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, OR limited ability to feel pain over most of body surface.
2. VERY LIMITED - Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, OR has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.
3. SLIGHTLY LIMITED - Responds to verbal commands but cannot always communicate discomfort or need to be turned, OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.
4. NO IMPAIRMENT - Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.

B. MOISTURE - Degree to which skin is exposed to moisture TRIG H

1. CONSTANTLY MOIST - Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.
2. OFTEN MOIST - Skin is often but not always moist. Linen must be changed at least once a shift.
3. OCCASIONALLY MOIST - Skin is occasionally moist, requiring an extra linen change approximately once a day.
4. RARELY MOIST - Skin is usually dry; linen only requires changing at routine intervals.

C. ACTIVITY - Degree of physical activity TRIG H

1. BEDFAST - Confined to bed.
2. CHAIRFAST - Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.
3. WALKS OCCASIONALLY - Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.
4. WALKS FREQUENTLY - Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.

D. MOBILITY - Ability to change and control body position TRIG H

1. COMPLETELY IMMOBILE - Does not make even slight changes in body or extremity position without assistance.
2. VERY LIMITED - Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.
3. SLIGHTLY LIMITED - Makes frequent though slight changes in body or extremity position independently.
4. NO LIMITATIONS - Makes major and frequent changes in position without assistance.

E. NUTRITION - Usual food intake pattern TRIG H

1. VERY POOR - Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, OR is NPO and/or maintained on clear liquids or IV for more than 5 days.
2. PROBABLY INADEQUATE - Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement OR receives less than optimum amount of liquid diet or tube feeding.
3. ADEQUATE - Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally refuses a meal, but will usually take a supplement if offered, OR is on a tube feeding or TPN3 regimen, which probably meets most of nutritional needs.
4. EXCELLENT - Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.

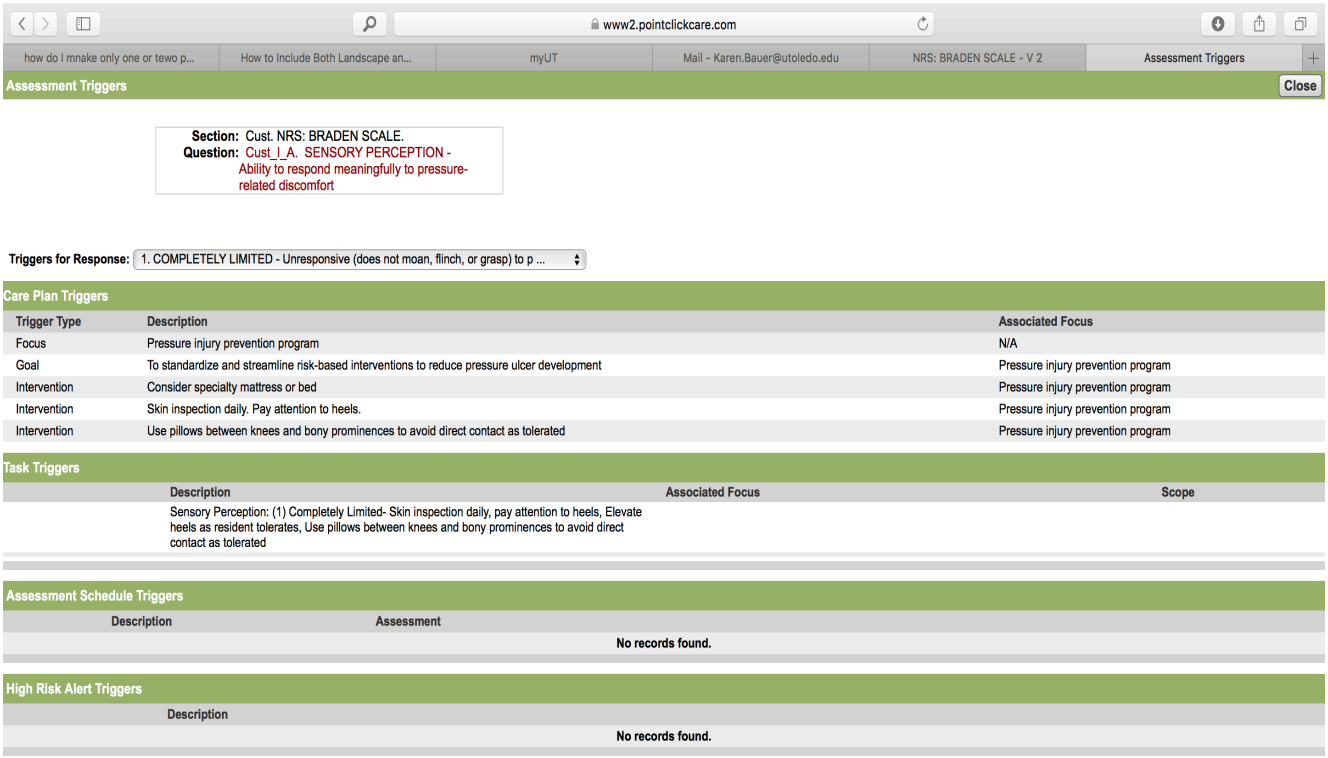
F. FRICTION AND SHEAR TRIG H

1. PROBLEM - Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.
2. POTENTIAL PROBLEM - Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.
3. NO APPARENT PROBLEM - Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.

In addition to the "Braden Skin Risk Assessment," if the resident has any of the following, the resident will be recognized as a High Risk for skin breakdown.

G. History of skin breakdown, PVD,Diabetes, Current wound, Cancer,Steroid medication therapy, Anticoagulant therapy, Edema, Immune System Disorders, Diastolic (lower number)blood pressure in 60 or below, Fever, Circulatory disease/condition other than PVD, and/or Splint/brace usage H

PRESSURE ULCER GUIDELINE IMPLEMENTATION



Appendix K
Braden Scale for Pressure Ulcer Risk

Patient's Name _____ Evaluator's Name_____ Date of Assessment _____

SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	1. Completely Limited Unresponsive (does not moan, flinch, or grasp) to painful stimuli, owing to diminished level of consciousness or sedation OR Limited ability to feel pain over most of body.	2. Very Limited Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness. OR Has sensory impairment that limits the ability to feel pain or discomfort over half of body.	3. Slightly Limited Responds to verbal commands but cannot always communicate discomfort or the need to be turned. OR Has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	4. No Impairment Responds to verbal commands. Has no sensory deficit that would limit ability to feel or voice pain or discomfort.				
MOISTURE Degree to which skin is exposed to moisture	1. Constantly Moist Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	2. Very Moist Skin is often, but not always, moist. Linen must be changed at least once per shift.	3. Occasionally Moist Skin is occasionally moist, requiring an extra linen change approximately once daily.	4. Rarely Moist Skin is usually dry. Linen requires changing only at routine intervals.				
ACTIVITY Degree of physical activity	1. Bedfast Confined to bed.	2. Chairfast Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	3. Walks Occasionally Walks occasionally during day, but only for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	4. Walks Frequently Walks outside room at least twice a day and inside room at least once every 2 hours during waking hours.				
MOBILITY Ability to change and control body position	1. Completely Immobile Does not make even slight changes in body or extremity position without assistance.	2. Very Limited Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	3. Slightly Limited Makes frequent though slight changes in body or extremity position independently.	4. No Limitation Makes major and frequent changes in position without assistance.				
NUTRITION *Usual* food intake pattern	1. Very Poor Never eats a complete meal. Rarely eats more than _ of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement. OR Has no oral intake and/or has been maintained on clear liquids or IV nutrition for more than 5 days.	2. Probably Inadequate Rarely eats a complete meal and generally eats only about half of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR Receives less than optimum amount of liquid diet or tube feeding.	3. Adequate Eats more than half of most meals. Eats 4 servings of protein (meat or dairy products) per day. Occasionally will refuse a meal, but will usually take a supplement when offered. OR Is receiving tube feeding or total parenteral nutrition that probably meets most of nutritional needs.	4. Excellent Eats most of every meal. Never refuses a meal. Usually eats 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION AND SHEAR	1. Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	2. Potential Problem Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time, but occasionally slides down.	3. No Apparent Problem Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.					
				Total Score				

Note. Barbara Braden and Nancy Bergstrom. Copyright, 1988. Reprinted with permission.

Appendix L
Change in Condition: 13 Triggers for Automatic Alert

Description

Cust_1_A_1 The change in condition, symptoms or signs I am calling about is/are: **(continued...)**

Response: **9. Diarrhea**

Consider doing a BRADEN related to resident's change in condition

2/19/2019 UDA High Risk Triggers Report

Date: Feb 19, 2019
Time: 09:06:52 ET
User: Ted Liszeski, RN/LNHA

Us_Khc_Multi
UDA High Risk Triggers Report

Page # 1

Description

Cust_1. Situation

Cust_1_A_1 The change in condition, symptoms or signs I am calling about is/are:

Response: **10. Edema (new or worsening)**

Consider doing a BRADEN related to resident's change in condition

Response: **12. Fever**

Consider doing a BRADEN related to resident's change in condition

Response: **13. Food and/or fluid intake (decreased or unable to eat and/or drink adequate amounts)**

Consider doing a BRADEN related to resident's change in condition

Response: **14. Functional decline (worsening function and/or mobility)**

Consider doing a BRADEN related to resident's change in condition

Response: **19. Nausea/Vomiting**

Consider doing a BRADEN related to resident's change in condition

Response: **20. Pain (uncontrolled)**

Consider doing a BRADEN related to resident's change in condition

Response: **22. Respiratory infection**

Consider doing a BRADEN related to resident's change in condition

Response: **25. Skin wound or ulcer**

Consider doing a BRADEN related to resident's change in condition

Response: **26. Stroke/CVA/TIA/new neurological signs**

Consider doing a BRADEN related to resident's change in condition

Response: **29. Urinary incontinence (new or worsening)**

Consider doing a BRADEN related to resident's change in condition

Response: **3. Altered mental status**

Consider doing a BRADEN related to resident's change in condition

Response: **30. Weight loss**

Consider doing a BRADEN related to resident's change in condition

Appendix M
Educational Webinar Slide Deck

PREVENTION OF PRESSURE ULCERS

Wounds Are Important!

- noun 1. an injury, usually involving division of tissue or rupture of the integument or mucous membrane, due to external violence or some mechanical agency rather than disease.
- 2. a similar injury to the tissue of a plant.
- 3. an injury or hurt to feelings, sensibilities, reputation, etc.

Incidence/Prevalence

- Affect 1.3-3 million individuals in the US today
- First treatment guidelines published in AHRQ in 1994
- 10-18 % in acute care
- 2-28% in long term care: National Nursing Home Survey (NNHS), 2004: About 11% of all nursing home residents have PU
- 1-29% in home care
- AHRQ- PrU related hospitalizations increased by 80% from 1993-2006
- 10-16 billion dollars in healthcare dollars per year

It's not JUST a wound!

Dressings– Aren't magical fairy dust!

Correct/Manage:

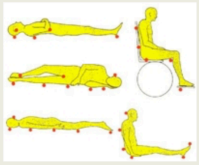
1. Ischemia
2. Nutrition
3. Glycemic control
4. Infection
5. Pressure
6. Incontinence
7. Edema

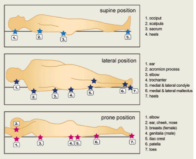
...and the list goes on...

Significance

- Compromised physical function
- Social Stigma
- Financial Burden
- Psychological well-being
- Quality Indicator

Diagnosis





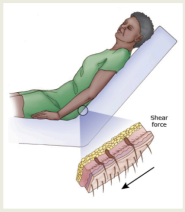
Diagnosis

- **Ischemic soft tissue injuries directly resulting from pressure**
- **Over a bony prominence**
- **Direct, identifiable source (casts, appliances)**
- **Differential: DM, VLU, Ischemic ulcers, trauma**

TABLE 1
Distinguishing Features of Common Types of Ulcers

Ulcer Type	Pathophysiology	Location
Diabetic	Peripheral neuropathy secondary to small or large vessel disease in chronic, uncontrolled diabetes	Usually lower extremities
Arterial	Reduction in blood flow to tissues caused by coronary artery disease, diabetes mellitus, hypertension, hyperlipidemia, peripheral arterial disease, or smoking	Usually distal lower extremities Tips of toes
Pressure	Unrelieved pressure and/or shear* resulting in damage to skin or underlying tissue	Usually over bony prominences (e.g., buttocks, elbows, heels, ischium, medial and lateral malleolus, sacrum, trochanters)
Venous	Venous hypertension resulting from incompetence of venous valves, post-phlebotic syndrome, or venous insufficiency. Tend to be irregularly shaped	Usually lower-leg region

Shear



Friction/Shear

- Friction alone does not cause pressure ulcers
- Is a contributing factor r/t shear forces
- Skin tear/laceration- friction related
- Look at surrounding tissue, location

Rationale/Quality Criteria

Center for Medicare Services: Interpretive Guidelines for Surveyors for use in nursing homes: November 2004

"Based on the comprehensive assessment of a resident, the facility must ensure that (1) A resident who enters the facility without pressure sores does not develop pressure sores unless the individual's clinical condition demonstrates that they were unavoidable; and, (2) A resident having pressure sores receives necessary treatment and services to promote healing, prevent infection, and prevent new sores from developing."

Thomas, 2006

Quality Indicators

- ODH Survey Results (PU included)
- Facility Details
- Family and Resident Satisfaction Surveys
- MDS data regarding falls, pain, infections, pressure ulcers…

https://www.ltc.ohio.gov/NursingHomes.aspx

TABLE 4
F314 Surveyor Guidance: Risk Factors for Developing Pressure Ulcers

According to the surveyor guidance accompanying F314, the risk factors that increase a patient's susceptibility to developing pressure ulcers, or that may impair the healing of an existing pressure ulcer, include but are not limited to the following:

- Comorbid conditions (e.g., diabetes mellitus, end-stage renal disease, thyroid disease),
- Drugs that may affect ulcer healing (e.g., steroids),
- Exposure of skin to urinary or fecal incontinence,
- History of a healed pressure ulcer,
- Impaired diffuse or localized blood flow (e.g., generalized atherosclerosis, lower-extremity arterial insufficiency),
- Impaired or decreased mobility and functional ability,
- Increase in friction* or shear*,
- Cognitive impairment,
- Resident refusal of some aspects of care and treatment, and
- Undernutrition, malnutrition, and hydration deficits.

Adapted from CMS, 2014[11]

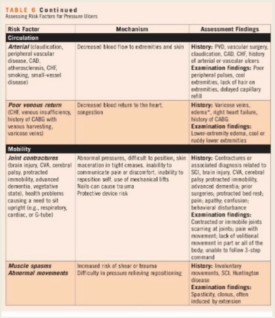
Risk Assessment: Braden Scale

- Braden Scale
  - 6 subscales
    - Sensory perception: 4
    - Moisture: 4
    - Mobility: 4
    - Activity: 4
    - Nutrition: 4
    - Friction/shear: 3

Mild risk: 15-18 Moderate: 13-14
High: 10-12
Severe: <9

Risk Factors

- Pressure
- Pre-existing Ulcers
- Shear
- Moisture
- Immobility
- Incontinence
- Nutritional compromise
- Neurological Diseases- immobility, contractures, sensory loss, dementia
- Remote infection
- Systemic diseases such as DM, COPD, CHF



PRESSURE ULCER GUIDELINE IMPLEMENTATION

TABLE 6 Continued
Assessing Risk Factors for Pressure Ulcers

Risk Factor	Mechanism	Assessment Findings
Lack of protective sensation (peripheral neuropathy, spinal cord injury, diabetic neuropathy, smoking)	Pressure from clothes, shoes, or other protective devices Lack of pressure sensation	**History:** SCI, CVA, diabetes or neuropathy, neuropathic pain syndrome **Examination findings:** Numbness, pressure/temperature/pressure sensation testing
Moisture/Skin Issues		
Urinary incontinence	Moisture, maceration, poor functional status	**History:** Use of catheter, bladder accidents, surgery or diagnosis impacting continence **Examination findings:** Distended bladder, positive cough test, pad test, wearing incontinent device
Bowel incontinence ***Diarrhea***		**History:** surgery or diagnosis impacting continence (bowel diversion) **Examination findings:** Poor rectal tone, stool on perineal skin
Prior pressure ulcer, vascular ulcer, or surgery, scarring in area where pressure may develop	Impaired neurovascular system, impaired skin architecture, risk of deeper and more rapid breakdown, impaired healing	**History:** History of prior pressure ulcers, or other vascular ulcers, LE surgery **Examination findings:** Scarring over pressure ulcer or other vascular ulcer, impaired skin integrity
Rashes ***Incontinent dermatitis*** ***Candidiasis***	Moisture and skin maceration reduce skin integrity	**History:** incontinence of urine and or stool **Examination findings:** Rashes, pustules, redness, partial-thickness skin loss

TABLE 6
Assessing Risk Factors for Pressure Ulcers

Risk Factor	Mechanism	Assessment Findings
Nutrition		
Obesity	Higher pressures resulting from own body weight; reduced muscle mass; skin maceration* increases due to sweating, moisture, skin contact, candidiasis May be associated with poor nutrition	**History**: Weight loss or gain, intake and type of foods, psychological issues **Examination findings**. Elevated BMI, prominent skin and adipose folds, low exercise tolerance
Low body weight	Increased bony prominences	**History:** Intake, weight history, weight loss history **Examination findings:** Low BMI, prominent bones, low subcutaneous padding and fat
Dehydration	Impaired circulation, impaired skin integrity	**History:** Poor fluid intake, requires staff to provide fluid intake **Examination findings:** Lack of skin turgor, tenting, dry mouth or eyes, dry skin **Other tests:** BUN/creatinine, sodium
Poor nutrition (low albumin, low intake, dysphagia, anorexia, cancer)	Unable to repair skin damage, impaired skin integrity Leads to low body weight May be associated with frailty, which has high morbidity	**History:** Low oral intake, cancer, weight loss, cachexia **Examination findings:** Underweight

TABLE 6 Continued
Assessing Risk Factors for Pressure Ulcers

Risk Factor	Mechanism	Assessment Findings
Autonomic instability ***Diaphoresis***	Moisture, temperature dysregulation	**History:** Spinal cord injury, catheter placement **Examination findings:** moist skin; hyperhidrosis, fluctuating BP, HR
Psychosocial Issues		
Nonadherence to care	Engaging in behavior that worsens ulcers or ulcer risk, failing to engage in behavior to reduce risk or promote healing	**History:** Psychiatric illnesses, TBI, psychiatric or social work consultation **Examination findings:** Apathy, cognitive impairment, confusion, delirium, depression, disengagement
Dementia ***Cognitive loss***	Poor memory, motivation and understanding of interventions; apraxia; inability to understand, recall instructions	**History:** Apathy, confusion, irritability, behavioral disturbance, inability to understand or recall information

BMI: body mass index; BP: blood pressure; BUN: blood urea nitrogen; CABG: coronary bypass artery graft; CAD: coronary artery disease; CHF: congestive heart failure; CVA: cerebrovascular accident; HR: heart rate; LE: lower extremity; PVD: peripheral vascular disease; SCI: spinal cord injury; TBI: traumatic brain injury

Management

■ 1. Prevention

- 2. Frequent assessment
- 3. Appropriate topical therapy
- 4. Appropriate debridement
- 5. Manage infection
- 6. Offload
- 7. Optimize nutrition
- 8. Manage pain

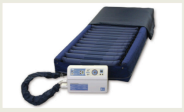


TABLE 8
Pressure Ulcer Prevention Measures

- Create a turning and positioning schedule based on the patient's individual risk factors
- Do not massage reddened areas over bony prominences
- Evaluate and manage urinary and fecal incontinence
- Initiate a plan to prevent or manage a contracture
- Inspect skin during bathing or daily personal care
- Maintain adequate nutrition and hydration to the extent possible
- Maintain the lowest possible head elevation to reduce the impact of shear* (may not be possible if patient is tube fed or on ventilator support)
- Position the patient to minimize pressure over bony prominences and shearing forces over the heels, sacrum, elbows, base of head, and ears
  - Use appropriate offloading or pressure-redistribution devices
  - Use lifting devices such as draw sheets or a trapeze
  - Use proper transferring techniques

Prevention

- Turn q 2hours or more frequently
- Avoid prolonged sitting/standing/walking depending on site of ulcer
- Offloading surfaces-
  - Bed: LAL overlay, ALAL mattress, air-fluidized bed, dolphin bed
  - Cushion: gel, foam, inflatable, ROHO
  - Heel suspension boots: PRAFO vs. soft
  - Shoewear: involve orthotist when possible
- Incontinence Care
- Nutritional assistance/support
- Risk assessment

Offload

- HOB at lowest possible level
- No sheepskin
- Avoid foam rings
- Avoid vigorous massage
- Use trapeze bars to assist with mobility when possible
- PRD cushions in W/C at all times
- Soft Heel suspension boots/pillows

TABLE 11
Characteristics of Available Support Surfaces

Type of Support Surface	Description	Goal	Selection
Reactive	Provides ability to change its load distribution properties only in response to applied loads. Surface deforms in response to the load (individual's weight or morphology)	Provide deep immersion and a high degree of envelopment to reduce sustained deformation caused by pressure concentrations over bony prominences	Patients at low risk for pressure injury. Review the characteristics of foam mattresses to ensure they are high specification.
Active	Produces alternating pressure through mechanical means and has the ability to change its load distribution properties with or without an applied load	Reduce the risk of pressure ulcer development by periodically shifting the areas of support from between anatomical locations so that deformation is not sustained over any one area. The weight-shifting feature is typically achieved by cycling air into and out of bladders within the support surface (alternating pressure).	Use overlay or mattress for individuals at higher risk of pressure ulcer when frequent manual reposition is not possible. Select a support surface that provides enhanced pressure redistribution, shear reduction, and microclimate control for individuals with Stage 3, 4, and Unstageable pressure ulcers.

Adapted from NPUAP, 2014 [2]

Skin Care

- Barrier cream/spray/moisture wicking on ALL incontinent patients
- Do not scrub off- wipe gently and reapply
- Clear barrier is good
- Barrier wipes
- Check and change- crucial!

Nutrition

- Increased protein needed
- Is your patient eating?
- Important to monitor intakes and communicate frequently
- Encourage supplement intake

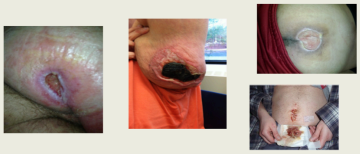
YOU ARE IMPORTANT

- PREVENTION
- PREVENTION
- PREVENTION
- PREVENTION
- PREVENTION

STNAs: YOU are Important!

You see patients most frequently!

Let a nurse know if you see:

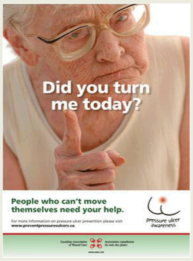


Communicate Changes

NPUAP

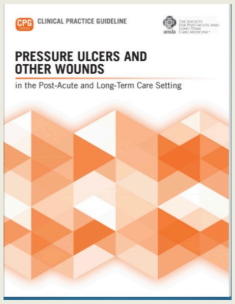
- The National Pressure Ulcer Panel (NPUAP) serves as the authoritative voice for improved patient outcomes in pressure ulcer prevention and treatment
- Identifies research priorities and initiatives with regard to PrU prevention, treatment, and policy
- EPUAP: European Pressure Ulcer Advisory Panel

- Wound Healing Society
- RN of Ontario
- AAWC- International Consolidated Guidelines
- AMDA PU and other Wounds for LTC

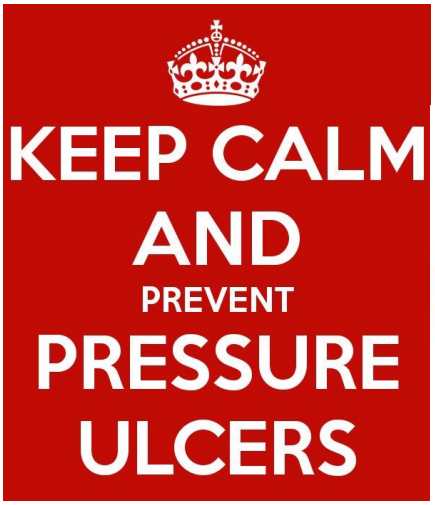


Stages- Pressure ONLY!

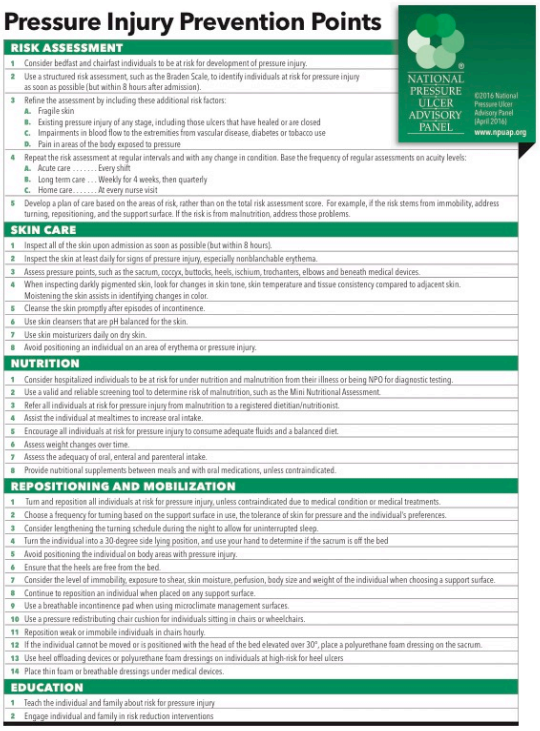
Stage I



Appendix N
Reminder Fliers



IT'S BRADEN TIME!



Pressure Injury Prevention Points

NATIONAL PRESSURE ULCER ADVISORY PANEL
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www.npuap.org

RISK ASSESSMENT

1. Consider bedfast and chairfast individuals to be at risk for development of pressure injury.
2. Use a structured risk assessment, such as the Braden Scale, to identify individuals at risk for pressure injury as soon as possible (but within 8 hours after admission).
3. Refine the assessment by including these additional risk factors:
   - A. Fragile skin
   - B. Existing pressure injury of any stage, including those ulcers that have healed or are closed
   - C. Impairments in blood flow to the extremities from vascular disease, diabetes or tobacco use
   - D. Pain in areas of the body exposed to pressure
4. Repeat the risk assessment at regular intervals and with any change in condition. Base the frequency of regular assessments on acuity levels:
   - A. Acute care . . . . . Every shift
   - B. Long term care . . . Weekly for 4 weeks, then quarterly
   - C. Home care . . . . . At every nurse visit
5. Develop a plan of care based on the areas of risk, rather than on the total risk assessment score. For example, if the risk stems from immobility, address turning, repositioning, and the support surface. If the risk is from malnutrition, address those problems.

SKIN CARE

1. Inspect all of the skin upon admission as soon as possible (but within 8 hours).
2. Inspect the skin at least daily for signs of pressure injury, especially nonblanchable erythema.
3. Assess pressure points, such as the sacrum, coccyx, buttocks, heels, ischium, trochanters, elbows and beneath medical devices.
4. When inspecting darkly pigmented skin, look for changes in skin tone, skin temperature and tissue consistency compared to adjacent skin. Moistening the skin assists in identifying changes in color.
5. Cleanse the skin promptly after episodes of incontinence.
6. Use skin cleansers that are pH balanced for the skin.
7. Use skin moisturizers daily on dry skin.
8. Avoid positioning an individual on an area of erythema or pressure injury.

NUTRITION

1. Consider hospitalized individuals to be at risk for under nutrition and malnutrition from their illness or being NPO for diagnostic testing.
2. Use a valid and reliable screening tool to determine risk of malnutrition, such as the Mini Nutritional Assessment.
3. Refer all individuals at risk for pressure injury from malnutrition to a registered dietitian/nutritionist.
4. Assist the individual at mealtimes to increase oral intake.
5. Encourage all individuals at risk for pressure injury to consume adequate fluids and a balanced diet.
6. Assess weight changes over time.
7. Assess the adequacy of oral, enteral and parenteral intake.
8. Provide nutritional supplements between meals and with oral medications, unless contraindicated.

REPOSITIONING AND MOBILIZATION

1. Turn and reposition all individuals at risk for pressure injury, unless contraindicated due to medical condition or medical treatments.
2. Choose a frequency for turning based on the support surface in use, the tolerance of skin for pressure and the individual's preferences.
3. Consider lengthening the turning schedule during the night to allow for uninterrupted sleep.
4. Turn the individual into a 30-degree side lying position, and use your hand to determine if the sacrum is off the bed
5. Avoid positioning the individual on body areas with pressure injury.
6. Ensure that the heels are free from the bed.
7. Consider the level of immobility, exposure to shear, skin moisture, perfusion, body size and weight of the individual when choosing a support surface.
8. Continue to reposition an individual when placed on any support surface.
9. Use a breathable incontinence pad when using microclimate management surfaces.
10. Use a pressure redistributing chair cushion for individuals sitting in chairs or wheelchairs.
11. Reposition weak or immobile individuals in chairs hourly.
12. If the individual cannot be moved or is positioned with the head of the bed elevated over 30°, place a polyurethane foam dressing on the sacrum.
13. Use heel offloading devices or polyurethane foam dressings on individuals at high-risk for heel ulcers
14. Place thin foam or breathable dressings under medical devices.

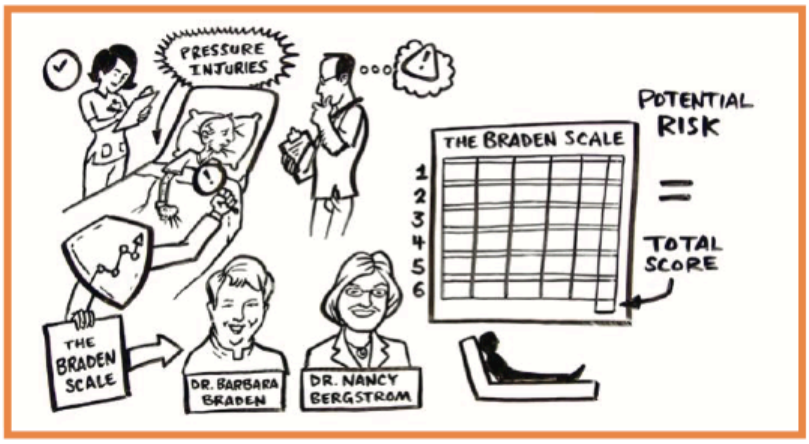
EDUCATION

1. Teach the individual and family about risk for pressure injury
2. Engage individual and family in risk reduction interventions

Appendix O
Braden Education Flier

The Braden Scale Education Video

smith&nephew
Supporting healthcare professionals for over 150 years



Why you need the Braden Scale whiteboard video:

- An engaging video that explains the Braden Scale
- Focuses attention on the Braden subscale scores which initiates the preventive plan of care
- A brief 9.5 minute presentation
- Captures the attention of the viewer in a compelling way

Why is the Braden Scale important?

- Develop a specific plan of care for Pressure Ulcer/Injury Prevention based on the Braden subscale scores. As a result, a personalized plan of care will focus attention on a patient's specific wound prevention needs

After watching the Braden Scale video the learner will be able to:

- Use the Braden Scale to identify patients at risk
- Discuss the relevance of the subscale scores and their importance in determining appropriate prevention interventions for a patient
- Use the subscale scores to develop and initiate and individualized plan of care for each patient's specific wound prevention needs

Remember—determining the Braden Scale scores is not enough—a plan of care is essential!

Smith & Nephew, Inc.
Fort Wort, TX 76109
USA

www.smith-nephew.com

Customer Care Center
1-800-876-1261
T 727-392-1261
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PVBE-05-0617-UE

Appendix P
Supplies Needed for DNP Project

Product	**Acquisition**	**Utilization**
Roll out flier	Created by DNP Student	To all staff: notification of project intent
Informational Letter to Stakeholders	Created by DNP Student	To explain process and purpose of project
IRB Documents	Completed by DNP Student	Human subject protection
Email to stakeholders	Drafted by DNP Student and sent to all directly involved parties	To define all stakeholder roles in project
Quality Assurance reports	Quality Assurance Manager	To guide intervention and outcome measurement
Educational Materials	AHRQ Toolkit	To teach involved clinical team appropriate use of Braden Scoring
CCDS Draft	Created by DNP Student	Based on AHRQ Sample Care Plan
Educational: Recognition and Assessment of Pressure Ulcer Prevention Slide Deck with pre-test fort knowledge and perception	Created by DNP Student	To educate staff on appropriate pressure ulcer prevention tactics and need
Summary of practice change recommendations	Created by DNP Student	To educate staff on practice change recommendations as set forth in PU guideline
Visual reminders for incentive: fliers	Created by DNP Student	Visual cue for project adherence
Kick-off agenda	Created by DNP Student	Clarify steps and motivate team members

Appendix Q
Barriers and Facilitators Table

Category	Stakeholder	Description of Barrier	Mitigation of Barrier
Population	Patients/all staff	Need to protect patient autonomy and dignity	Innovative prevention methods such as structured repositioning activities, allowance of education to promote patient choice
	Physicians	Decreased physician champion availability	Continue APN involvement and utilize wound champions to offset MD involvement where possible
	All staff and administrative leaders	Varied level of comfort with electronic charting and decision-making tools	Integration of education and accessibility of wound champions for assistance
Educational	Administrative leaders/employer	Financial/employer support of PU related educational activities limited	Utilization of free or sponsored educational activities
	Administrative leaders/staff	Time for PU related educational activities limited	Integrate PU education into other structured meeting times and events, resume multidisciplinary meetings, CCDS goal is to decrease time spent
Structural/Resources	Administrative leaders/staff	Staff time limited related to patient load	Integrate clinical practice guideline recommended practices into daily routines via CCDS, share responsibility of new tasks among staff
	Governmental/ administrative leaders	Lack of electronic resources for clinical decision support or cueing	Design CCDS tool and attempt maximization of current electronic resources
	Administrative leaders	Leadership time limited related to workload	Utilize designated wound champions and

			wound-certified NP when needed
Organizational	Clinical leaders/staff	Care coordination among staff crucial but often under or inappropriately communicated	CCDS tool and automatic alerts to improve automatic communication

Note. APN = Advanced Practice Nurse; PU = pressure ulcer; CCDS = computerized clinical decision support

Appendix R
DNP Essentials for This Project

Essential I: Scientific Underpinnings for Practice

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

Essential VIII: Advanced Nursing Practice

American Association of Colleges of Nursing (2006). The essentials of doctoral education for advanced nursing practice. Retrieved from: http://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf