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Effectiveness of Pressure Ulcer Protocols with the Braden Scale for Elderly Patients in the Intensive Care Unit: A Systematic Review

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Project Submitted in Partial Fulfillment

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Abstract

Each year, approximately 3 million people in the United States develop a pressure ulcer. Although a preventable complication, pressure ulcers are among the top 5 adverse outcomes in the acute care setting with the prevalence as high as 42% in the intensive care unit (ICU). The purpose of this systematic review was to evaluate the inclusion of the Braden Scale as part of a multicomponent pressure ulcer intervention protocol, or care bundle, to identify geriatric patients hospitalized in the ICU who were at risk for pressure ulcers. The Cochrane protocol guided this review; findings were reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis statement. Through a structured search strategy in 6 electronic databases, 409 studies were reviewed, of which 11 studies were analyzed and the data included in a literature review matrix for synthesis. Four key findings emerged from the data analysis: effective pressure ulcer prevention programs use a risk assessment, daily reassessment of risk, daily skin inspections, moisture removal strategies, nutritional support and hydration, and offloading pressure; the Braden Scale is effective in detecting pressure ulcer risk in the ICU; an evidence-based bundle is effective in preventing pressure ulcer development; and decreased risk for pressure ulcer development increases patient safety, improves quality of care, and reduces the overall cost of care. The findings from this project can result in positive change by providing the evidence to guide improvements in pressure ulcer protocols to increase the quality of care and decrease the incidence of pressure ulcers in the ICU.

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Section 1: Nature of the Project

Introduction

In the United States and internationally, pressure ulcers remain a formidable challenge for health care organizations. Despite advances in medicine and technology, pressure ulcers are listed as one of the top five most common causes of adverse patient outcomes (Elliott, McKinley, & Fox, 2008; Shahin, Dassen, & Halfens, 2009). Pressure ulcers are recognized as an indicator of nursing sensitive quality indicator as well as a patient safety outcome (Elliott et al., 2008; Shahin et al., 2009). Across countries, the prevalence ranges from 8.8% to 53.2%, and the incidence ranges from 7% to 71.6 % (Moore, 2010). Across health care institutions in the United States, the reported prevalence range from 0.4% to 38% in acute care settings, 2% to 24% in long-term care settings, and 0% to 17% in home care settings (Qaseem, Mir, Starkey, & Denberg, 2015). Although pressure ulcers are largely preventable, between 1995 and 2008, the incidence increased by 80% (Sullivan & Schoelles, 2013). With this increased incidence, largely attributed to more robust measurement, approximately 2.5 to 3 million people develop a pressure ulcer each year in the United States (Raetz & Wick, 2015; Sullivan & Schoelles, 2013).

Pressure ulcers have a deleterious effect on patient quality of life due to pain, depression, suffering, body image, prolonged healing, decreased mobility, loss of independence, increased incidence of infection and sepsis, unnecessary surgeries and increased length of hospital stay (Dorner, Posthauer, & Thomas, 2009; Moore, 2010; Reilly, Karakousis, Schrag, & Stawicki, 2007). In addition to the physical limitations and

psychological sequalae associated with pressure ulcers, they are also associated with increased morbidity and mortality. For example, patients with pressure ulcers carry a mortality risk that is 2 to 6 times higher than patients without pressure ulcers. Most notably, approximately 60,000 patients die each year from complications associated with pressure ulcers (Sullivan & Schoelles, 2013; Melter, 2011).

The cost of caring for patients with pressure ulcers exacts a heavy economic burden on health care organizations. In the United States, the average cost of care for treating a patient with a pressure ulcer during their hospital stay is $43,180 with cost of up to $70,000 for the treatment of a full-thickness pressure ulcer (Jenkins & O'Neal, 2010). In the intensive care unit (ICU), clinical care for patients with pressure ulcers is complicated by an increased workload, as much as 50% and impacts the budget by 5% (Compton et al., 2008). Some of the documented costs of additional resources required for managing patients with pressure ulcers include: high usage of various supplies, equipment, specialty beds, additional staffing requirements, nutrition support and extending the hospital stay (Chicano & Drolshagen, 2009). The extended hospital stay may range from 4 to 6 days leading to higher costs and blocking other patients from being admitted to the hospital (Theisen, Drabik, & Stock, 2011).

Due to projected demographic changes in the United States, the aging population of adults more than 65 years is expected to grow from 40 million in 2010 to 55 million in 2020 (an increase of 36% within a decade) pressure ulcer rates will likely increase (Nash, Reifsnyder, Fabius, & Pracilio, 2011; Padula, Osborne, & Williams, 2008). As many as 15% of adults 65 years and older will develop a pressure ulcer within 1 week of a

hospital admission and the most common sites are the sacrum and heel (Lyder & Ayello, 2007).

In 2008, the Centers for Medicare and Medicaid Services (CMS) decided to incentivize "good care" by changing the reimbursement policy for pressure ulcers (Young, Shen, Estocado, & Landers, 2012). In the acute care setting, there is additional financial compensation called a Medicare Severity-Diagnosis Related Group (MS-DRG) for care of severe pressure ulcers identified upon admission. However, with the reimbursement changes, these additional funds are no longer available for hospital-acquired pressure ulcers (Young et al., 2012). As such, the revision in reimbursement places an additional burden on health care organizations, more specifically nurses, for the early identification of high-risk patients and early intervention to prevent pressure ulcer formation. More specifically, the reimbursement restrictions have motivated health care organization to develop evidence-based, cost-effective strategies to prevent pressure ulcers.

Pressure ulcers are the result of localized tissue damage caused by patients who are unable to turn themselves to relieve pressure against a bony prominence (Nijs et al., 2008). Pressure ulcers may develop rapidly, within 4 to 6 hours it is therefore imperative nurses provide early identification for high risk patients, initiate evidence-based strategies and monitor pressure ulcer development (Raetz & Wick, 2015). The first step for pressure ulcer prevention is identification of high-risk patients. This task can be accomplished with the use of risk assessment tools. In the United States, the Braden Scale is the most commonly used risk assessment tool in numerous health care

organizations (Jochem & Weigand, 2014; Kring, 2007; Tescher, Branda, O Byrne, & Naessens, 2012). The Braden Scale has been found to be highly effective in predicting the magnitude of pressure ulcer risk among patients in general and critical care settings (Tescher et al., 2012).

Nearly 95% of pressure ulcers are preventable (Garcia-Fernandez, Pancorbo-Hidalgo, Agreda, & Torres, 2013) and empirical evidence suggests this is best accomplished by implementing multicomponent interventions (Raetz & Wick, 2015). Most multicomponent interventions include a risk assessment, support surfaces, repositioning the patient, mobilization, eliminating friction, nutritional support and managing moisture. When these interventions are "bundled" for implementation, they are more effective. The intervention also includes unit-based clinicians, multidisciplinary team members, monitoring records/documentation, staff education and standardizing clinical practices (Raetz & Wick, 2015). Other pressure ulcer interventions include incorporating care bundles/clinical guidelines based on current research evidence. In fact, care bundles have been effective in improving care delivery and patient outcomes (Jochem & Weigand, 2014; Whitlock, 2011).

Pressure ulcers are a centuries old health problem. For example, pressure ulcers were discovered on the buttocks of Egyptian mummies from circa 1000 BC (Casey, 2013). And in 1859, Florence Nightingale expressed concern that pressure ulcers reflect poorly on hospitals providing inadequate nursing care (Lyder & Ayello, 2007). Nurses can prevent pressure ulcers, but they are not responsible for pressure ulcer development, rather the presence of ulcers indicate a system breakdown in care delivery (Lyder &

Ayello, 2007). Despite scientific advances, the use of medical technology and the acknowledgement the implementation of comprehensive prevention programs can effectively reduce the pressure ulcer prevalence, pressure ulcers still occur among hospitalized patients (Cox, 2011).

Problem Statement

The problem that focused this project was pressure ulcers that are a preventable adverse patient event but continue to increase in prevalence. Although pressure ulcers are commonly encountered in various health care settings, critically ill people in the ICU have the highest prevalence (Qaseem et al., 2015). However, no systematic review of pressure ulcer prevention focused on the Braden Scale has been published since 2000 (Tayyib, Coyer, & Lewis, 2015).

PICOT Question

This project was a systematic review which evaluated pressure ulcer protocols using the Braden Scale for elderly patients in the ICU. The project problem statement and research question were developed from the evidence-based method called the PICOT question [Patient population/Problem, Intervention, Comparison, Outcome, and Type/Time] (Stillwell, Fineout-Overholt, Melnyk, & Williamson, 2010). The PICOT questions is a taxonomy used in evidence-based health care to formulate research questions (Stillwell et al., 2010). In this project, the PICOT questions components were defined as the following:

Population/ problem: Critically ill male and female patients (65 years and older) admitted to medical intensive care units and surgical intensive care units at risk for pressure ulcers.

Intervention: Risk assessment (Braden Scale) with multicomponent (three or more components) intervention strategy or protocol.

Comparison: Normal care methods reported in the identified research studies.

Outcome: Rapid and accurate risk assessment, effectiveness of the hospital intervention protocol, quality of care, cost reduction, incident and/or prevalence.

Type/**T**ime: A systematic review covering the January 2012 until December 2017.

Evidence-Based Significance of Problem

Hospital-acquired pressure ulcers are problematic for the health care system in the United States. Although pressure ulcers are largely viewed as preventable, between 1995 and 2008, their incidence increased by 80% (Sullivan & Schoelles, 2013). Each year, in the United States, approximately 2.5 to 3 million patients will develop a pressure ulcer including more than one million patients in the long-term care and acute care settings (Raetz & Wick, 2015; Sullivan & Schoelles, 2013). Although pressure ulcers are encountered in various health care settings, 33% to 50% of critically ill patients in the intensive care units are at high risk for pressure ulcers (Carino, Ricci, Bartula, Manzo, & Sargent, 2012).

The development of a pressure ulcer seriously impacts patients, including their quality of life, mobility, mood, and morbidity (Dorner et al., 2009; Moore, 2010; Reilly et

al., 2007). From a financial perspective, pressure ulcers exact a heavy burden on healthcare organizations. The annual cost to treat pressure ulcers in the United States range $500 to $ 70,000 depending on the severity of the ulcer (Young, Shen, Estocado, & Landers, 2012) which can lead to an estimated five to 11 billion dollars annually (Cox, Roche, & Gandhi, 2013). Others have estimated cost to care for patients with pressure ulcers as nearly $130,000 (Padula et al., 2016).

Under adverse conditions, pressure ulcers can develop within 1 hour (Sullivan & Schoelles, 2013; Tweed & Tweed, 2008). Prolonged pressure on the skin is the most important risk factor for development of pressure ulcers. Notably, a strong relationship exists between pressure ulcers, duration and intensity of pressure, and tissue response (Sayar et al., 2008). Increased pressure on the skin and subcutaneous tissue that exceeds capillary pressure and compromises blood flow resulting in ischemia, leads to the development of pressure ulcers (Peterson, Gravenstein, Schwab, Van Oostrom, & Caruso, 2013; Reilly et al., 2007).

Capillary pressure for healthy persons range from 10 to 30 mm Hg; however, capillary pressures are lower in persons with compromised health. Patients who experience prolonged interface pressure are more likely to develop a pressure ulcer (Peterson et al., 2013). More specifically, interface pressures are greatest around the sacrum, coccyx and ischial tuberosities. Higher pressure ulcer rates have been reported in these anatomical sites (Peterson et al., 2013). Other etiological factors contributing to pressure ulcers include shearing force and friction. Friction occurs when the patient is slid across the bed and incurs a superficial skin tear or abrasion. Shear occurs when a

patient's head is raised, and they slip down or a patient slides down in a chair (Reilly et al., 2007).

The Centers for Medicaid and Medicare recognize pressure ulcers as a quality measure (Peterson et al., 2013) and in 2008 they issued a mandate that they would no longer provide reimbursement for hospital-acquired Stage 3 or 4 pressure ulcers (Krupp & Monfre, 2015) which could have been prevented through evidence-based prevention guidelines (Cox, 2011). The anticipation of this change provided a great incentive for health care organizations to craft comprehensive pressure ulcer intervention programs to reduce the prevalence of pressure ulcers (Cox, 2011).

Preventive programs have been found to be effective in reducing prevalence within health care organizations. The first step in pressure ulcer prevention is to identify high risk patients (Kring, 2007). Traditionally, this has been accomplished through risk assessment tools (Cox, 2012). Of all the risk assessment scales in the literature, empirical evidence suggests the Braden Scale possesses the best sensitivity and specificity for predicting pressure ulcers among patients in the general setting and critical care patients (Cox, 2012; Tescher et al., 2012). In the United States, the Braden Scale is used in most acute care hospitals to identify people at risk for pressure ulcer development (Tescher et al., 2012).

Although most health care organizations recommend completing a risk assessment within 48 hours of patient admission, the decision to initiate pressure ulcer prevention protocol depends on clinical nursing knowledge and judgment (Joseph & Davies, 2013). As such, nurses are in a key position to mitigate the pressure ulcer

sequalae. Increasing the nursing staffs' knowledge about pressure ulcer etiology is a critical first step to preventing pressure ulcer development (Joseph & Davies, 2013).

Significance to Clinical Practice

All patients regardless of patient care settings are at risk for pressure ulcer development (Gage, 2015), however, patients admitted to intensive care units possess a higher risk of developing pressure ulcers due to risk factors inherently associated with being critically ill, such as limited mobility, comorbidities, circulatory abnormalities, sensory impairment and organ failure (Krupp & Monfre, 2015). Additionally, critical care units possess higher prevalence ranging from 9% to 42% (Cox, 2012). The development of pressure ulcers remains a formidable challenge because they are associated with staggering costs, increased length of hospital stay, morbidity and mortality (Peterson et al., 2013). In fact, managing hospital-acquired pressure ulcers is regarded as one of the highest expenses for facilities with costs ranging from $500 to $130,000 per patient (Padula et al., 2016) with more than $17 billion spent annually caring for pressure ulcers (Peterson et al., 2013). The presence of a pressure ulcer is associated with a two to fourfold increased mortality rate among older critically ill patients (Sayer et al., 2008). About 60,000 patients in the United States die each year from complications associated with pressure ulcers (Sullivan & Schoelles, 2013; Metler, 2011).

More than 100 risk factors contribute to the development of pressure ulcers, including advancing age, immobility, incontinence, alterations in nutritional intake, sensory deficits, multiple chronic conditions, and circulation abnormalities (Sullivan &

Schoelles, 2013; Tweed & Tweed, 2008). More specifically, patients admitted to the critical unit possess higher risk for pressure ulcers due to immobility, altered sensation, fluid loss, urinary and/or fecal incontinence and being physiologically compromised (Cox, 2011). Patients being in the critical care environment creates opportunities for pressure ulcer development due to the high acuity level and the specialized care the patients require (Tayyib et al., 2015). Local and systemic injuries lead to infections and sepsis associated with pressure ulcers contributing to increased length of hospital stay (Sayer et al., 2008). Within the critical care environment, clinical care for patients with pressure ulcers is complicated by an increased workload, as much as 50% and impacts the critical care budget by 5% (Compton et al., 2008). Overall, early patient identification and intervention using risk assessment tools and clinical judgement reduce the cost for managing pressure ulcers and improve the overall quality of care (Dorner et al., 2009).

Pressure ulcers are considered preventable adverse events that threatens patient safety (Tayyib et al., 2015). Since October 2008, The Commission on Medicare and Medicaid Services (CMS) has not provided financial reimbursement for hospital – acquired stage 3 or 4 pressure ulcers (Cox, 2011). Because pressure ulcers may develop quickly within 4 to 6 hours (Raetz & Wick, 2015) it is imperative to rapidly and accurately identify high risk patients and initiate intervention (Jochem & Weigand, 2014). Traditionally, this is accomplished using risk assessment tools. The goal of risk assessment is to accurately identify high risk patients and initiate aggressive interventions and to screen out patients not at risk who do not require intervention (Kring, 2007). In

the United States, the Braden Scale is the most widely used in various settings and it is recommended for use in in numerous clinical practice guidelines (Cox, 2012). The Braden Scale has been found to be reliable and valid as Bergstrom and his team first established predictive validity of the Braden Scale among critical care patients (Jochem & Weigand, 2014; Kring, 2007). Empirical evidence suggests that pressure ulcers could be prevented with the use of pressure ulcer guidelines or care bundles (Tayyib et al., 2015). Two components, frequent patient positioning and the use of pressure relieving devices are associated with reducing sustained pressure on tissue which protects tissue from ulceration (Bergstrom et al., 2013; Peterson et al., 2013). Although turning patients every two hours prevents ulcerations, nearly 90% of critically ill patients are not turned this often. For example, direct observation indicate that intensive care patients are turned two to six times each day as compared to the recommended 11 to 12 times (Winkelman & Chiang, 2010). Additionally, comprehensive multicomponent interventions have been shown to prevent pressure ulcers (Raetz & Wick, 2015; Tayyib et al., 2015). Some of the components include risk assessment, the use of support surfaces, repositioning patients, eliminating friction, addressing nutritional deficits and managing moisture (Raetz & Wick, 2015). That said, formal multicomponent interventions are essential in reducing the prevalence of pressure ulcers (Swafford, Culpepper, & Dunn, 2016).

Purpose and Goal

The purpose of this scholarly project was to address the question: Does risk assessment by use of the Braden Scale and multicomponent pressure ulcer preventive

programs reduce the prevalence of pressure ulcers among elderly patients (65 years and older)?

A goal represents the outcome desired by an organization after an action is completed. Goals can be defined and achieved using the SMART approach. SMART goals are specific, measurable, achievable, realistic and timely (Kelly, 2011). The goal of this systematic review was to evaluate the effectiveness of the Braden Scale as part of hospital pressure ulcer protocols implemented in ICU for geriatric people. Prevention strategies begin with early identification of high-risk patients (Qaseem et al., 2015) and general agreement suggests the most efficient method to accomplish this goal is through routine use of a risk assessment tool (Kring, 2007). When applied to patients, risk assessment tools can accurately identify at risk patients requiring aggressive care and specialized interventions, as well as to identify people not at risk (Kring, 2007).

Early intervention is a critical strategy to mitigate pressure ulcer development (Elliott, 2010; Kring, 2007; Tescher et al., 2012). Once risk has been identified, rapid intervention is recommended to prevent pressure ulcer formation. After comparing the effectiveness of risk assessment scales and preventive strategies for patients at risk for pressure ulcer development, The American College of Physicians derived clinical guidelines. These guidelines were based on published literature extracted from MEDLINE (1946 –February 2014, CINAHL (1998 – February 2014), The Cochrane Library, clinical trials and reference lists. A review of 26 studies yielded moderate – quality evidence that suggested multicomponent interventions were effective in improving skin integrity and preventing pressure ulcer development in acute and long-

term care settings (Qaseem et al., 2015). Similar findings were reported by Tayyib et al. (2015) who conducted a two-arm cluster randomized control trial to determine the effectiveness of a pressure ulcer prevention bundle versus standard care for critically ill patients in Saudi Arabia. Their results revealed the implementation of a pressure ulcer bundle significantly reduced the cumulative incidence of pressure ulcers in the intervention group (7.14%) as compared to the control group (32.86%).

Braden Scale

The Braden scale is available in multiple languages and widely used in most patient populations (Ayello, 2012). The Braden Scale has excellent inter-rater reliability ranging from 0.83 to 0.99; sensitivity ranges from 83% to 100% and specificity ranges 64% to 90% depending on the cut-point scores selected for predicting pressure ulcer risk (Ayello, 2012). The Braden scale for pressure sores reports a cumulative risk for developing pressure ulcers and is comprised of six subscales: 1) Sensory, 2) Moisture, 3) Activity levels, 4) Mobility, 5) Nutritional status, and 6) Friction and shear (Cox, 2012; Lyder & Ayello, 2007). The clinician selects a score ranging from 1 to 4 on the subscales (except friction/shear ranges from 1 to 3) based on the patient's physical and functional abilities. Afterwards, the clinician adds the numbers and achieves a summated score ranging from 6 to 23 that represents pressure ulcer risk. It is widely accepted a cutoff score of 18 indicates equalization between sensitivity and specificity, thus representing risk for pressure ulcer development (Cox, 2012). Additionally, clinicians can stratify pressure ulcer risk, such as 15 to 18 indicating mild risk, 13 to 14 indicating moderate risk, 10 to 12 indicating high risk, and 9 or less indicating very high risk (Cox, 2012).

In the United States, the expanding geriatric population, those people greater than 65 years of age, is expected to increase from 40 million in 2010 to 55 million in 2020 (an increase of 36% within a decade). As such, pressure ulcer rates will also increase (Nash, Reifsnyder, Fabius, & Pracilio, 2011; Padula, Osborne, & Williams, 2008). For example, as many as 15% of adults 65 years and older will develop a pressure ulcer within one week of a hospital admission and the most common sites are the occiput, ear, shoulder, scapula, elbow, pelvis, sacrococcygeal region, greater trochanter, ischial tuberosity, lateral malleolus and heel (Lyder & Ayello, 2007; Raetz & Wick, 2015).

Multicomponent Pressure Ulcer Interventions

Injuries to the skin or underlying tissue caused by pressure alone or accompanied by shearing lead to pressure ulcers (Raetz & Wick, 2015). Pressure ulcers may develop in as few as 4 to 6 hours (Raetz & Wick, 2015). Early identification of high-risk patients is the responsibility of clinicians. Then, early initiation of preventive measures and regularly monitoring for pressure ulcer development is a continuing responsibility. There is adequate evidence to suggest the implementation of a multicomponent intervention to prevent pressure ulcers (Raetz & Wick, 2015). Some multicomponent interventions including support surfaces, repositioning patients on a regular schedule, optimizing nutritional status, keeping skin moisturized, and avoiding friction have been found to be appropriate strategies pressure ulcer prevention (Raetz & Wick, 2015; Sullivan & Schoelles, 2013). Some additional recommendations include a multidisciplinary team, skin champions, evaluating the established hospital protocol and conducting ongoing staff training and education (Raetz & Wick, 2015; Sullivan & Schoelles, 2013). The

development of any effective pressure ulcer prevention program should be based upon up-to-date, high-quality evidence-based interventions to prevent pressure ulcers (Tayyib et al., 2015).

Project Question

The purpose of this project was to answer the following clinical practice question: How does use of the Braden Scale with the implementation of a multicomponent pressure ulcer intervention protocol reduce the prevalence of pressure ulcers?

Implication for Social Change

The development of a hospital-acquired pressure ulcer is widely acknowledged as a surrogate for high quality care among many health care organizations. Critical care patients possess a higher risk for developing pressure ulcers due to multiple risk factors such as inability to reposition themselves, hemodynamic instability, sensory impairment, comorbid illnesses, and altered nutritional status (Cooper, 2013; Elliott et al., 2008). Among all hospitalized patients, critical care patients possess pressure ulcer prevalence rates ranging from 14% to 42 % (Cox et al., 2013). It is anticipated by the year 2030, adults older than 65 years will comprise 19.3% of the total population which should likely lead to higher prevalence rates (Nash et al., 2011). Decreasing patient's risk for pressure ulcer development increases patient safety and reduces the cost of care. Morbidity caused by pressure ulcers increase the need for additional nursing care, resources and extends hospital stay. Additionally, each year in the United States, about 60,000 patients die due to complications associated with hospital-acquired pressure ulcers (Sullivan & Schoelles, 2013). Given that morbidity and mortality rates remain high, it is

imperative nurses develop and adhere to evidence-based interventions to mitigate the development of pressure ulcers.

Definition of Terms

The following definitions were used in this project:

Braden Scale: The clinically reliable and valid assessment tool to predict patients at risk for developing a pressure ulcer. The Braden Scale consists of six domains: sensory, perception, moisture, activity level, nutritional status, friction and shear (Department of Veterans Health Affairs, 2011).

Care bundle: Defined as a collection of evidence-based interventions and nursing measures to address high-risk clinical problems. Most care bundles include three to six components that are based on evidence from randomized control trials (RCTs) or systematic reviews (SRs). To maximize results, the interventions are administered simultaneously (Zuo & Meng, 2015)

Critically ill patients: Is defined as patients with high risk for actual or life-threatening health problems. Critically ill patients with higher acuity levels are viewed as being vulnerable, unstable, and complex which requires vigilant and skilled nursing care (American Association of Critical Care Nurses [AACN], 2016).

Multicomponent Intervention: For this project, the definition is a compilation of three or more evidence-based interventions included in a hospital pressure ulcer prevention protocol.

Geriatric or older adult: This is an adult age 65 years or older (Healthy People 2020, 2009).

Pressure Injury: A pressure injury is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury can present as intact skin or an open ulcer and may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, co-morbidities and condition of the soft tissue (National Pressure Ulcer Advisory Panel [NPUAP], 2016, para. 6).

Pressure Ulcer: Is the result of injury to the skin and underlying tissue caused by pressure, shear friction and/or combination of all three (Nijs et al., 2008).

Staging System Definitions:

Stage 1 Pressure Injury: Non-blanchable erythema of intact skin- Intact skin with localized area of non-blanchable erythema, which may appear differently in darkly pigmented skin. Presence of blanchable erythema or changes in sensation, temperature, or firmness may precede visual changes. Color changes do not include purple or maroon discoloration, these may indicate deep tissue pressure injury (NPUAP, 2016, para. 7).

Stage 2 Pressure Injury: Partial-thickness skin loss with exposed dermis-The wound bed is viable, pink or red, moist, and may also present as an intact or ruptured serum-filled blister. Adipose (fat) is not visible and deeper tissues are not visible. Granulation tissue, slough and eschar are not present. These injuries commonly result from adverse microclimate and shear in the skin over the pelvis and shear in the heel. This stage should not be used to describe moisture associated skin damage (MASD) including incontinence associated dermatitis (IAD), intertriginous dermatitis (ITD),

medical adhesive related skin injury (MARSI), or traumatic wounds (skin tears, burns, abrasions) (NPUAP, 2016, para. 8).

Stage 3 Pressure Injury: Full-thickness skin loss-Adipose (fat) is visible in the ulcer and granulation tissue and epibole (rolled wound edges) are often present. Slough and/or eschar may be visible. The depth of tissue damage varies by anatomical location, areas of significant adiposity can develop deep wounds. Undermining and tunneling may occur. Fascia, muscle, tendon, ligament, cartilage and/or bone are not exposed. If slough or eschar obscures the extent of tissue loss this is an Unstageable Pressure Injury (NPUAP, 2016, para. 9).

Stage 4 Pressure Injury: Full-thickness and tissue loss –Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage or bone in the ulcer. Slough and/or eschar may be visible. Epibole (rolled edges), undermining and/or tunneling often occur. Depth varies by anatomical location. If slough or eschar the extent of tissue loss this is an unstageable pressure injury (NPUAP, 2016, para. 10).

Unstageable Pressure Injury: Obscured full-thickness skin and tissue loss- Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. If slough or eschar is removed, a Stage 3 or 4 pressure injury will be revealed. Stable eschar (i.e. dry, adherent, intact without erythema or fluctuance) on the heel or ischemic limb should not be softened or removed (NPUAP, 2016, para. 11).

Deep Tissue Pressure Injury: Persistent non-blanchable deep red, maroon or purple discoloration-Intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle or other underlying structures are visible, this indicates a full thickness pressure injury (Unstageable, Stage 3 or 4). Do not use DTPI to describe vascular, traumatic, neuropathic, or dermatologic conditions (NPUAP, 2016, para. 12).

Friction: The mechanical force of two surfaces moving across each other causing abrasions or blisters (Melter, 2011).

Shearing: The mechanical force that is parallel to the skin causing damage to deep tissue (Melter, 2011).

Pressure: The force per unit exerted perpendicular to the plane of interest (NPUAP, 2012).

Assumptions

According to Grove, Burns and Gray (2013) assumptions are statements that are generally accepted as true, even though they have not been scientifically tested. The assumptions for this systematic review project include:

1. The implementation of evidence-based multicomponent interventions will improve patient outcome.
2. Care bundles are effective in improving patient outcomes within the critical care setting

Limitations

According to Grove et al. (2013) methodological and theoretical limitations are inherent restrictions or problems that limit generalizability of the study findings. The limitations for this systematic review project include:

1. Small samples sizes were included in the research studies which limits generalizability of the findings.
2. The project population was limited to male and females 65 years and older which restricts generalizability of the study findings to other populations.

Summary

This chapter presented and provided an overview of the physical, psychological and financial implications of pressure ulcers among geriatric people in ICU. Nurses are responsible for performing risk assessments on patients at risk for pressure ulcer development then collaborating with multidisciplinary team members and implementing evidence-based interventions. To maximize patient outcomes and mitigate the development of pressure ulcers, nurses must administer correctly identify high risk patients and implement the multicomponent evidence-based interventions and care bundles simultaneously. Given the high prevalence and adverse outcome of pressure

ulcer development, it is critical for nurses and multidisciplinary team members to be compliant with the hospital pressure ulcer prevention protocol.

Section 2: Background and Context

Introduction

This project was a systematic review designed to evaluate pressure ulcer protocols using the Braden Scale for elderly patients in intensive care units. The Cochrane protocol is recognized as an excellent resource for conducing systematic reviews (Grove, Burns, & Gray, 2013). The systematic review includes randomized controlled trials, non-randomized controlled trials, cohort studies, prospective, retrospective review, systematic reviews, pre-post intervention studies, before-and-after and experimental studies. The systematic review evaluated the effectiveness of implementing multicomponent evidence-based interventions in addition to the Braden Scale in decreasing the prevalence of pressure ulcer development. In today's healthcare environment prevalence monitoring is quite important (Black, Berke, & Urzendowski, 2012) to identify clinical problems. Systematic reviews provide the evidence to address the identified problems.

Literature Review Search Strategy

Studies were retrieved from six electronic databases -CINAHL, Medline, ProQuest, Google Scholar PubMed and Cochrane from January 2012 until December 2017. Two independent reviewers screened articles to determine their eligibility into the sample. The inclusion criteria included research studies that implement three or more interventions, male and female patients (65 years and older) without pressure ulcers upon admission to the critical care unit who remained for 24 hours or longer. The exclusion criteria were research studies that did not employ three or more interventions, patients with evidence of pressure ulcers upon admission to the critical care unit, patients who

were younger than 65 years old, and patients transferred from the critical care unit within 24 hours.

The terms used for the search included: *Pressure ulcers, Braden Scale, intensive care unit, randomized controlled trials, pressure ulcer prevention, pressure ulcer prevention protocol, multicomponent intervention, evidence-based intervention, systematic review, care bundle, pre-post study, before-after studies and experimental.* The Boolean terms "and" and "or" were used to combine terms during the literature search.

Pathophysiology of Pressure Ulcers and Risk Factors

Pressure ulcers are a common occurrence in a wide range of setting and their prevalence is regarded as a reflection of quality care of health care organizations (Terekeci et al., 2008). A pressure ulcer is the result of soft tissue being compressed against a bony prominence for an extended period leading to ischemia (Reilly et al., 2007; Terekeci et al., 2009). The NPUAP (2016) is the authoritative voice for treatment for pressure ulcers and they defined the following staging system for pressure ulcer development:

Stage 1 Pressure Injury: Non-blanchable erythema of intact skin- Intact skin with localized area of non-blanchable erythema, which may appear differently in darkly pigmented skin. Presence of blanchable erythema or changes in sensation, temperature, or firmness may precede visual changes. Color changes do not include purple or maroon discoloration, these may indicate deep tissue pressure injury (NPUAP, 2016).

Stage 2 Pressure Injury: Partial-thickness skin loss with exposed dermis-The wound bed is viable, pink or red, moist, and may also present as an intact or ruptured serum-filled blister. Adipose (fat) is not visible and deeper tissues are not visible. Granulation tissue, slough and eschar are not present. These injuries commonly results from adverse microclimate and shear in the skin over the pelvis and shear in the heel. This stage should not be used to describe moisture associated skin damage (MASD) including incontinence associated dermatitis (IAD), intertriginous dermatitis (ITD), medical adhesive related skin injury (MARSI), or traumatic wounds (skin tears, burns, abrasions) (NPUAP, 2016).

S*tage 3 Pressure Injury:* Full-thickness skin loss-Adipose (fat) is visible in the ulcer and granulation tissue and epibole (rolled wound edges) are often present. Slough and/or eschar may be visible. The depth of tissue damage varies by anatomical location, areas of significant adiposity can develop deep wounds. Undermining and tunneling may occur. Fascia, muscle, tendon, ligament, cartilage and/or bone are not exposed. If slough or eschar obscures the extent of tissue loss this is an Unstageable Pressure Injury (NPUAP, 2016).

Stage 4 Pressure Injury: Full-thickness and tissue loss –Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage or bone in the ulcer. Slough and/or eschar may be visible. Epibole (rolled edges), undermining and/or tunneling often occur. Depth varies by anatomical location. If slough or eschar the extent of tissue loss this is an Unstageable Pressure Injury (NPUAP, 2016).

Unstageable Pressure Injury: Obscured full-thickness skin and tissue loss- Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. If slough or eschar is removed, a Stage 3 or 4 pressure injury will be revealed. Stable eschar (i.e. dry, adherent, intact without erythema or fluctuance) on the heel or ischemic limb should not be softened or removed; and persistent non-blanchable deep red, maroon or purple discoloration-Intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle or other underlying structures are visible, this indicates a full thickness pressure injury (Unstageable, Stage 3 or 4). Do not use DTPI to describe vascular, traumatic, neuropathic, or dermatologic conditions (NPUAP, 2016). Nurses should conduct skin inspection upon admission and daily, focusing on high risk areas, namely, the ear, sacrum, coccyx, trochanter and heels (Cooper, 2013; Melter, 2011).

The literature includes information regarding risk factors contributing to the development of pressure ulcers however, most are categorized as extrinsic or intrinsic factors. Extrinsic factors include interface pressure, shear pressure, friction and moisture. The list of intrinsic factors includes the nutritional status, age, mobility status,

incontinence, circulatory factors and neurological conditions of the patient (Terekeci et al., 2009). Other risk factors associated with pressure ulcer development include gender, body mass index, length of stay, body temperature, C-reactive protein level, oxygenation, blood pressure, edema, nursing workload, APACHE II score and comorbid medical conditions. (Compton et al., 2008). Nijs and colleagues (2008) conducted a prospective research study to examine the risk factors associated with Grade 2 to 4 pressure ulcers 48 hours after an admission to a surgical intensive care unit. A few risk factors positively correlated with Stage 2 to 4 pressure ulcers, including a history of vascular disease, use of Dopamine, hemodialysis and mechanical ventilation. Using a retrospective, correlational design for 347 patients in a medical-surgical intensive care unit, Cox (2011) discovered additional risk factors served as predictors for pressure ulcers, including age, time spent in hospital, mobility, friction/shear, norepinephrine infusion and cardiovascular disease were all predictors of pressure ulcer development. Wilczwesil and colleagues (2012) reported that bowl management program, incontinence, use of support surfaces, steroid use and hypotension were all associated with pressure ulcer development among a sample of traumatic spinal cord injured patients in the intensive care unit.

Braden Scale

The first step in preventing pressure ulcer is early and accurate identification of high-risk patients. Most health care organizations and clinicians accomplish this task by using pressure ulcer risk assessment tools. In the United States, the Braden Scale is the most widely used across many health care settings and is the assessment tool of choice in most clinical practice guidelines (Cox, 2012). The Braden Scale is available in multiple

languages and used among various ethnicities in more than 30 countries (Ayello, 2012; Braden, 2012). The Braden Scale has excellent inter-rater reliability between 0.83 to 0.99; sensitivity ranges from 83% to 100% and specificity between 64% to 90% which is based on the established cut-point scores (Ayello, 2012). The Braden Scale is based on seven risk factors measured on six subscales: a) sensory, b) activity level, c) mobility, d) moisture, e) nutritional status, and f) friction/shear. Pressure ulcer risk is based on a score ranging from six to twenty-three, with lower scores reflecting higher risk. Most health care organizations and clinicians use a cut point of eighteen as the best balance between sensitivity and specificity, therefore, this score indicates risk for pressure ulcer development (Cox, 2012). On the other hand, some clinicians prefer stratification of pressure ulcer risk development with scores of 15 to 18 reflecting mild risk, scores of 13 to 14 reflect moderate risk, scores of 10 to 12 reflect high risk and 9 or less reflecting very high risk (Cox, 2012). The purpose of any pressure ulcer risk assessment is to identify high risk patients and for nurses to implement prevention strategies to mitigate pressure ulcer development. As such research indicates that use of the Braden Scale, nurses' clinical judgement and intervention strategies mitigate the risk factors associated with pressure ulcer development which enhances quality improvement efforts (Braden, 2012; Cox, 2012).

Multicomponent Evidence-Based Interventions as a Care Bundle

The development of pressure ulcers is a multifactorial complex process that involves many extrinsic and intrinsic factors. Although intervention studies have been conducted to prevent pressure ulcer development in different clinical settings; most

employed the use of a single intervention compared to standard care (Tayyib et al., 2015). However, evidence suggests multicomponent intervention is more effective in preventing pressure ulcer development (Tayyib et al., 2015).

To provide quality care and to improve patient outcome, the Institute for Healthcare Improvement (IHI) developed care "bundles' for health care providers. The basic concept for care bundles involves a set of evidence-based interventions, usually three to five, implemented together, yields a significantly better outcomes than when implemented individually (IHI, 2017). To maximize results, all interventions must be performed collectively and consistently (IHI, 2017) to the intended patient population.

Carino and colleagues (2012) developed a hospital –acquired pressure ulcer (HAPU) bundle to reduce the incidence of pressure ulcers in a mixed surgical and medical intensive care unit. After the researchers extensively reviewed the literature and evidence-based guidelines, they selected six interventions for the HAPU bundle: a) daily skin assessment [use of Braden Scale], b) patient repositioning, c) nutrition assessment, d) daily caloric intake, e) monitoring glucose levels, and f) use of support surfaces. The HAPU bundle was consistently implemented for 12 months to 167 patients in a mixed medical and surgical intensive care unit. Prior to the implementation of the HAPU bundle, the prevalence was 12.4% (21/169), however, after the implantation of the HAPU bundle the prevalence decreased to 6.1% (11/167). The researchers used a paired t-test which revealed a significant difference [p-value of 0.04].

An international study was conducted by Tayyib et al. (2015) used a two-arm cluster randomized control study to evaluate the effectiveness of a pressure ulcer

prevention bundle for critically ill patients in the intensive care unit. The researchers collected data from October 2013 until February 2014 from two Saudi Arabian tertiary hospitals. Patients were included in the study if they were 18 years or older and were expected to remain in the intensive care unit for longer than 24 hours. Patients were excluded from the study if they had an existing pressure ulcer, developed an ulcer within 24 hours or had a medical condition that would be worsened from implementation of care bundle. The pressure ulcer prevention bundle was based on the most recent international guidelines from European Pressure Ulcer Advisory Panel and NPUAP, 2009. The researchers included the following interventions in the pressure ulcer prevention bundle: a) risk assessment [Braden Scale], b) skin inspection, c) skin care, d) nutrition evaluation, e) patient repositioning, f) specialized mattress, g) staff training, and h) medical devices. For this study, randomization did not occur at the patient level, rather, the hospitals were randomized to either the intervention or control site by a computer. As such, one hospital served as the intervention site (n=70) and the other hospital served as the control site (n=70). Findings revealed pressure ulcer cumulative incidence was significantly different between the intervention group (7.14%, 5/70 patients) as compared to the control group (32.86%, 23/70 patients, X^2= 14.46, *df*=1, *p*< .001). The intervention group had significantly less Stage 1 and 2 pressure ulcer development (*U*= 1,976, *p*=.002, and *U*=2,172, *p*=.026, respectively). The researchers stated the findings from their study revealed a pressure ulcer bundle was effective within the sample and demonstrated an impressive reduction in the cumulative incidence of hospital-acquired pressure ulcers and total number of pressure ulcers per patients.

Mallah, Nassar, and Badr (2014) conducted a study to ascertain the efficiency of a multidisciplinary intervention and determine which component of the intervention was superior in predicting pressure ulcer development in a hospital in Lebanon. The researchers designed a prospective descriptive research study that utilized 6 months pre- and 6 months post-data. They collected data on 19 in patient units in a magnet designated hospital. The units included medical, surgical, oncology, bone marrow and five CCUs. There was a total of 486 participants surveyed from January 2012 until April 2013. The intervention program included: a) Braden Scale, b) Pressure ulcer staging per 2009 guidelines from NPUAP-EPUAP, c) 20 nurse champions, d), staff training, e) surveillance of pressure ulcer prevalence and f) the INTACT care bundle [incontinence, nutrition, turning, assessment, consultation and teaching]. Prior to implementation of the intervention, the average rate of hospital-acquired pressure ulcers within the first two quarters of 2012 was 6.63%. However, after implementation of the intervention, during the last quarter of 2012 and first quarter of 2013, the prevalence decreased to 2.09% and 2.47%. Additionally, there was a significant reduction from the first quarter to the last quarter $x^2 = 7.64$, $p = <0.01$. The researchers reported a few independent variables were significantly associated with pressure ulcer development: LOS, $t = 455$, $p = 0.032$, Braden scores on admission, $t = 4.55$, $p = 0.023$ and all the prevention strategies. After the eight components were placed in multiple logistic regression equation –only two components remained significant; the Braden Score OR= 1.187 (CI= 1.031 – 1.546, $p =$. 0.03) and skin care OR= .058 (CI= 0.036-0.092, $p = 0.04$) with an R_2 of 0.12. The researchers concluded the multidisciplinary approach was effective in decreasing the prevalence of pressure

ulcer development. Skin care management emerged as a strong predictor for pressure ulcer development, which is a cost-effective intervention administered by the nursing staff.

Swafford, Culpepper and Dunn (2016) evaluated the effectiveness of a 12-month hospital-acquired pressure ulcer prevention program in an adult intensive care unit from 2012 until the first quarter in 2013. The goal was to reduce pressure ulcer formation by 50%. The components included in their study: a) Braden scale, b) skin care regimen, c) fluidized repositioners, 5) silicone gel adhesive dressings and 6) staff /training. The researchers reported in 2011 which is prior to implementation of the pressure ulcer prevention program, there were 45 documented hospital-acquired pressure ulcers in 10% of patients with an aggregate cost of nearly $1.7 million dollars. Notably, in 2013, they reported 17 hospital-acquired pressure ulcers in 3% of patients which reflects a decrease of more than two-thirds (69%) as compared to 2011. The reduction exceeded their goal of 50%. These results potentially led to a financial savings of more than $1 million dollars in 2013. Although the incidence decreased during implementation of the pressure ulcer prevention program, the researchers stated there was also a decline in incidence of pressure ulcers in 2012 before implementation of the pressure ulcer prevention program which may have affected by the introduction of fluidized positioning, nurses heightened awareness and increased compliance to the pressure ulcer prevention program.

Nurses Knowledge of Pressure Ulcer Prevention

Although the challenges of prevention and managing pressure ulcers is best addressed using a multidisciplinary team approach, yet, pressure ulcer development is

considered a nursing sensitive quality indicator. The important role nurses serve in preventing ulcerations is clear as nurses, highly knowledgeable about pressure ulcer development, quickly identify and implement nursing interventions for high risk patients (Joseph & Davies, 2013). For example, IIesanmi, Abosede, & Adejumo (2012) conducted a descriptive study describing the knowledge level of pressure ulcer strategies among Nigerian nurses (n=111) using the Pressure Ulcer Knowledge Test. Most nurses were female (104, 84%), graduates of a diploma program (73, 66%) with 11-20 years' experience (49, 44%). The average age of the nurses was 23 ($\pm$ 0.93) years old. The researchers found 106 nurses (95.5%) correctly identified high risk patients, yet 78 nurses (70.3%) from the same sample scored lower than expected (<59% correct) on prevention intervention knowledge scores. Knowledge scores were not significantly impacted by clinical units (P=0.544) or between years of clinical experience (P>0.005). The researchers suggested one limitation to the study was this was the first time the Nigerian nurses ever participated in the Pressure Ulcer Knowledge Test and the lack of familiarity may have contributed to the low scores. Another international study conducted by Saleh, Qaddumi, & Anthony (2012) evaluated Jordanian registered nurses (n=220) knowledge level, clinical practice, and attitudes toward pressure ulcer prevention. Registered nurses from eight hospitals with baccalaureate and/or three years diploma graduates or master's degrees were randomly assigned to either an experimental or control group. The experimental group attended a pressure ulcer educational program that consisted of seven modules, whereas the control group did not receive education. A pressure ulcer knowledge test and practice tests, attitude and intention scales were administered to both

groups at the beginning and at the end of the educational component. Test results suggested that there was a significant difference between the group receiving the education component; pressure ulcer knowledge/treatment (P-0.002), registered nurses' attitude toward prevention and treatment (P=0.03) and registered nurses' intention towards prevention and treatment (P=0.001). Additionally, male nurses had higher pressure ulcer knowledge and practice scores (n=129, p=0.02), female nurses had higher intention scores (P=0.001) towards pressure ulcer prevention and treatment. More clinical experience in nursing improves attitudes (P=0.006) and intentions (P=0.007) towards pressure ulcer prevention and treatment. Findings also revealed possessing a degree from a university and educational training improved the nurse's attitudes (P=0.009) and their intentions (P=0.002) towards pressure ulcer prevention and treatment.

A descriptive, correlational study describing the relationships between knowledge, preventive care and nursing characteristics was conducted by Gallant, Morin, St-Germain, & Dallaire (2010). The researchers used a multi-level approach by including nurses representing 22 health care units and chart audits to monitor nursing care and extracted additional information. The researchers evaluated four domains: a) level of knowledge by clinical practice setting; b) length of time for an educational training session [sessions lasting 25 minutes, 1 hour or 7 hours]; c) nurses' perception regarding their level of knowledge; and d) knowledge about the Braden Scale. To ascertain knowledge level, nurses (n=256) completed the Pieper and Mott Pressure Ulcer Knowledge Test that includes 45 questions, including demographic data and professional

characteristics. Nurses employed in the medicine or nephrology departments ($p=0.05$) had higher levels of knowledge than any other specialty areas (cardiology, surgery, hematology, orthopedics and intensive care). In addition, longer training sessions were related to higher levels of knowledge ($p<0.0037$). Nurses who perceived they were more knowledgeable about pressure ulcer prevention and treatment did not have higher knowledge scores ($p<0.0001$). Results revealed that 96.88% of the nurses correctly answered questions concerning the Braden Scale. However, the chart audit results exposed wide variation in actual practice as compared to results from the Pressure Ulcer Knowledge Test. The researchers surmised the nurses had adequate training and knowledge, however, the information was not consistently translated into practice. Gunningberg, Lindholm, Carlsson, & Sjoden (2001) used similar methods to investigate Swedish registered nurses and nursing assistant's knowledge of risk, prevention, and treatment of pressure ulcers using a questionnaire and chart audits. The participants completing survey's included nurses (n=41) and nursing assistants (n=44+ working on four units in a hospital based orthopedic department. The nursing staff was comprised of mostly women (82%) and the median number of years for experience in nursing was seven for registered nurses and ten for nursing assistants. The researchers reported although most of the nurses reportedly performed risk assessments on patients with hip fractures, however, the risk assessments were not comprehensive. The most frequently reported intervention was turning patients. However, only 29% of the nursing staff reported using special mattresses/overlays for preventive measures. The researchers ascertained the nursing staff was not consistently following or implemented Swedish

quality guidelines regarding prevention and treatment of pressure ulcers. The researchers recommended the nursing staff knowledge and training pertaining to pressure ulcer risk, prevention and treatment could be improved.

Theoretical Framework

Donabedian (1988) developed a triadic model (structure + process = outcomes) to guide quality improvement efforts in providing the correct structures, to construct the appropriate processes, to achieve specific and measurable outcomes. As Donadebian's triad model can be applied to health care organizations to measure, evaluate and improve quality and patient safety, the research question is guided by this model.

In the model, structure represents characteristics of the setting in which care is provided. For this systematic review, care is delivered in MICU or SICU in various health care organization in the United States (Donabedian, 1988). The staff is highly qualified and consists of physicians and registered nurses providing 24-hour care for the patients. Process examines how the provider delivers care, through proper diagnosis and treatment. For this systematic review, process describes how the nursing staff rapidly implements pressure ulcer prevention intervention to prevent pressure ulcer development. Outcome refers to the goal of care, such as recovery and/or restoration of health (Huddleston, 2014). For the purposes of this systematic review, the goal of the outcome is decreasing the prevalence of pressure ulcers in the MICU and SICU. As such, this model is important to this systematic review since Donabedian's Triad Model evaluates quality of care and health care outcomes.

Clinical outcomes demonstrated the effectiveness of care and can be quantified or measured using indicators (White & Dudley-Brown, 2012). Outcomes help providers better understand the impact of care delivery and quality of care. Effective providers routinely evaluate care outcomes and use the data to improve their care delivery (White & Dudley-Brown, 2012). For this systematic review, the goal of care is the reduction in prevalence or pressure ulcers among critically ill patients 65 years and older.

According to McEwen and Willis (2011) concepts that explain, predict or describe a phenomenon about a target population are regarded as middle-range theories. Albert Bandura's Theory of Self-Efficacy or TSE (Bandura, 1977) was selected to also address the research question. The TSE is relevant to explain a person's ability to process information as well as their behavioral patterns and response to extrinsic factors (Bandura, 1977). During seminal studies, self-efficacy was closely aligned with the Social Cognitive Theory, however, other disciplines embraced the concepts, especially nursing. The fundamental underpinnings of the theory suggest cognitive processes are influenced in the acquisition and retention of new behavior patterns (Bandura, 1977, p. 191).

The guiding principle for Bandura's theory is that psychological processes, regardless of context, serves as a catalyst to create and strengthen expectations of self-efficacy. There are five relational statements associated with the theory: a) persons with high levels of self-efficacy are not affected by disappointment; b) persons with a strong degree of conviction will be successful regardless of their circumstances; c) persons with high levels of self-efficacy set lofty goals and persist in achieving their goals; d)

regardless of their anxiety level or angst, persons with higher levels of self-efficacy will proceed toward their goals and e) persons with successful outcomes will most likely repeat their performance.

Self-efficacy is conceptualized from four sources of information: a) performance accomplishment- describes a person's ability to successfully master a task; b) vicarious experience- watching others successfully perform a task bolsters confidence in a person; c) verbal persuasion- responding to lavish praise and/or compliments and d) emotional arousal- persons learn to move forward and accomplish their goals despite their fears and trepidation (Bandura, 1977).

Regardless of staffing issues, patient to nurse ratios, or time constraints, the overarching premise is the nurses with a higher level of self-efficacy will maintain high levels of compliance with the health care organization's pressure ulcer prevention protocol. Joseph and Davies (2013) suggested that nurses who are highly knowledgeable about pressure ulcer development quickly identify and implement interventions for high risk patients. Given the high incidence and numerous consequences associated with pressure ulcers, prevention is critical for critically ill patients. As such, early identification of high-risk patients by knowledgeable nurses is essential to reducing the prevalence of pressure ulcers among critically ill patients (Nijs et al., 2008) which is the fundamental guiding principle for this systematic review.

Summary

An adverse patient outcome, pressure ulcers are not only costly to health care organizations but also negatively impact quality of life for the patient and family and

increase morbidity and mortality (Chelluri, 2008). Between 15% to 20% of the typical health care organization budget is consumed by the ICU (Chelluri, 2008). Quality improvement projects in the ICU are effective in improving patient outcomes and decreasing costs. As such, the best strategy to address the risk for pressure ulcer development in the geriatric population receiving care in the ICU is for knowledgeable, highly skilled nurses to rapidly identify high-risk patients and to initiate early evidence-based interventions to mitigate ulcer development. This approach improves patient outcomes, increases safety and improves care delivery.

Section 3: Collection and Analysis of Evidence

Introduction

This project is a systematic review to evaluate pressure ulcer protocols using the Braden Scale for geriatric people in ICU using the Cochrane method (Higgins & Green, 2011). The report for the systematic review complies with the Preferred Reporting Items for Systematic Review and Meta-Analysis for Protocols (PRISMA-P) (Moher et al., 2009). Recognized as the leading resource for conducing systematic reviews, the Cochrane method (Grove, Burns, & Gray, 2013) guides a data synthesis of the literature to answer a research question to provide clinicians with the ability to make informed decisions about care delivery (Higgins & Green, 2011). A systematic review using following the Cochrane protocol includes reporting information about the study authors, background, objectives, method section [emphasis on types of studies, participants, interventions, outcome measures and search methods], data collection/ analysis, acknowledgements, references, tables/figures and supplementation information (Higgins & Green, 2011).

Methodology

The review process guided an evaluation of the effectiveness of multicomponent evidence-based interventions to reduce pressure ulcer prevalence rates, an important measurement of quality (Black et al., 2012). Six electronic databases, CINAHL, Medline, ProQuest, Google Scholar, PubMed and Cochrane, were search for research papers from January 2012 until December 2017. This systematic review included randomized controlled trials, control trials, quasi-experimental, pre-post studies and cohort studies.

The following key words and phrases were used to guide the search: *Pressure ulcer, Braden Scale, intensive care unit, randomized controlled trials, pressure ulcer prevention, pressure ulcer prevention protocol, multicomponent intervention, systematic review, care bundle, pre- and post-test, before and after, and experimental type studies*. Once the search identified the possible papers for inclusion, two reviewers independently screened the papers for inclusion to reduce the risk of bias.

The inclusion criteria admitted into the review those research studies that implemented three or more interventions, included male and female patients (65 years and older) without pressure ulcers upon admission into the critical unit remaining for more than 24 hours. The exclusion criteria consisted of studies that did not implement three or more interventions, patients with evidence of pressure ulcers upon admission to the critical care unit, patients younger than 65 years old, and patients transferred from the ICU within 24 hours.

The project leader conducted the literature review of research studies in the six databases, following the Cochrane protocol (Appendix A), and a masters prepared nurse served as the second reviewer. The search strategy with key words were shared with the second reviewer to ensure the comprehensive search was repeated in a substantially similar manner. On the first review of the identified papers, the abstracts were reviewed, and the studies selected met the inclusion criteria.

A project committee, consisting of Walden University School of Nursing faculty with interest and expertise in pressure ulcers guided the project, including approving the search strategy. After approval by the DNP Project Committee and Walden University

Institutional Review Board, the project commenced. The DNP project manuscript was approved by the committee members following multiple reviews with extensive revisions. The final project was orally presented to the committee members prior to approval and the subsequent publication in ProQuest.

Data Collection

The data collection process required a comprehensive literature review to identify relevant research studies. The Cochrane method was followed and the PRISMA provided the four-step process for paper section: a) identification, b) screening, c) eligibility and d) included guided this process. The studies included systematic reviews, randomized controlled trials, non-randomized controlled trials, cohort studies, prospective and retrospective reviews, pre-post intervention studies, before-after studies and experimental studies. The data was abstracted for analysis from the included studies. The expected goal was to determine the effectiveness of pressure ulcer prevention protocols to reduce the prevalence for geriatric people receiving care in the ICU.

Data Analysis

The data analysis included two parts. First, the full text papers reviewed for inclusion but were excluded are listed with the exclusion rational in Appendix B. For the research studies included in the review, the data was extracted and organized in a literature review matrix in Appendix C. The team leader completed one review and the team member completed the second review. Importantly, each paper was evaluated for quality of the research methods and the strength of the findings using the AACN

hierarchy system presented in Appendix D. This system facilitates the comparison of studies to permit the identification of the strongest evidence.

The AACN (2009) evidence leveling system uses alphabets with the highest level of evidence representing by the letter A and the lowest level M. Level A includes meta-analysis of multiple controlled studies or meta-synthesis of qualitative studies with results that consistently support a specific action, intervention or treatment. Level B includes well designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention or treatment. Level C includes qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled studies with inconsistent results. Level D includes peer-reviewed professional organizational standards, with clinical studies to support recommendations. The lowest Level M represents manufacturer recommendations. This review focused on data abstraction for research studies classified as Level A, B, and C.

Summary

This project is a systematic review to evaluate pressure ulcer protocols using the Braden Scale for geriatric people in ICU. The review uses the Cochrane method, the leading resource for conducing systematic reviews. The report for the systematic review complies with the PRISMA-P. The review includes reporting information about the study authors, background, objectives, methods, data collection strategy, analysis process, acknowledgements, references, tables/figures and supplementation information. The method described in the section will guide the data synthesis from the research literature

to answer the proposed research question. The results provide clinicians with the ability to make informed decisions about care delivery.

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Section 4: Findings and Recommendations

Introduction

Hospital-acquired pressure ulcers are widely recognized as an indicator of the quality nursing care and are largely preventable adverse events (Chaboyer et al., 2016). Critically-ill patients are at higher risk of developing pressure ulcers, due to multiple comorbidities, reduced mobility, and sedation that interferes with their independence (Ozyurek & Yavuz, 2015). Hospital-acquired pressure ulcer prevalence is highest in the ICU (0.4% to 38%) as compared to long-term care settings (2% to 24%) and home care settings (0% to 17%). Infections, including sepsis, are also associated with hospital-acquired pressure ulcers. Because of these factors prevention and treatment requires numerous resources including nursing care, nutrition support, additional supplies specialty care equipment and devices (Chicano & Drolshagen, 2009). This care adds an additional 4.31 days to a typical hospitalization (Zuo & Meng, 2015).

In the United States, the average cost for managing a pressure ulcer is $43,180 with cost reaching $70,000 for treating a full-thickness pressures (Jenkins & O'Neal, 2010). This is one reason the Centers for Medicare and Medicaid Services (CMS) issued a mandate in 2008 to discontinue payment for hospital-acquired pressure ulcers. Furthermore, in October 2014, CMS issued a 1% reimbursement penalty for low performing hospitals regarding higher than average hospital-acquired pressure ulcer rates (Padula et al., 2016). These CMS policy changes strongly encouraged health care organizations to adopt evidence-based interventions to prevent pressure ulcers.

The first step in pressure ulcer prevention is to accurately identify patients at risk and require early treatment (Kring, 2007). Most hospitals in the United States use the validated risk assessment tool called the Braden Scale; reported to have a high predictive ability for critically-ill patients (Kring, 2007). The cornerstone intervention studies to measure pressure ulcer prevention is the single intervention compared to usual care (Tayyib et al., 2015). However, contemporary evidence indicates care bundles, those programs with three to five concise evidence-based interventions, create a synergistic effect with the "bundle" of interventions which maximize outcomes (Downie, Perrin, & Kiernan, 2013). The purpose of this systematic review was to address the question: Does risk assessment by use of the Braden Scale and multicomponent pressure ulcer prevention programs reduce the prevalence of pressure ulcers among elderly patients (65 years and older) in the intensive care units? This review followed the Cochrane protocol (Higgins & Green, 2011), see Appendix A, and the results are reported in compliance with the PRISMA-P (Moher et al., 2009).

Summary and Evaluation of Findings

Search Results

The PRISMA 2009 table included a four-step process: a) identification, b) screening, c) eligibility and d) included guided this process. The database search yielded 461 research studies and four additional studies were obtained. After removing 56 duplicate titles, 409 research titles remained. Two hundred seventy-two research titles were excluded from through the title review. Then, the two reviewers screened 137 abstracts excluding an additional 91 studies. Finally, the two reviewers review the full

paper for forty-six studies for eligibility and excluded 35 for various reasons (Appendix B). Eleven studies were included for data abstraction and analysis into a literature matrix (Appendix C).

Data Analysis and Synthesis

Although many strategies, interventions, and technological advances are reported in the literature in the recent decade to prevent pressure ulcer development, the pressure ulcer prevalence among critical patients continues to rise (Sullivan & Schoelles, 2013) from 14% to 42% (Cox, 2011). Each year approximately 2.5 million patients develop a pressure ulcer and the cost to care for them range from $500 to more than $130,000 with aggregate cost reaching $11 billion. In 2008, the Centers for Medicare and Medicaid services discontinued financial reimbursement for Stage 3 and 4 hospital-acquired pressure ulcers. This mandate prompted health care organizations to develop evidence-based interventions for hospital-acquired pressure ulcer preventions. While most researchers discussed strategies employing the use a single intervention, my systematic review focused on studies that employed use of multicomponent evidence-based interventions or care bundles for pressure ulcer prevention strategy. The research studies that focused on multicomponent evidence-based interventions revealed a reduction in prevalence among pressure ulcers which improves patient outcomes and reduces health care costs.

Padula et al. (2016) conducted a retrospective observational cohort study to ascertain the longitudinal impact of changes in CMS policy and adoption of Quality Improvement (QI) interventions on hospital-acquired pressure rates. The researchers'

hypothesized that changes in CMS policy along with adoption of QI interventions will lead to decreased pressure ulcer rates. The study included 25 QI interventions grouped into four domains: leadership, staff, information technology, and performance and improvement comprised the pressure ulcer prevention bundle. Administrative data were gathered from 55 UHC hospitals from 2007 to 2012: namely, age, gender, length of stay, admission to intensive care unit, case-mix index and medical or surgical status. The researchers were not granted permission to access patient-level data. They used two-level mixed effected Poisson regression models to regress hospital-acquired pressure ulcer rates over time by QI interventions and changes in CMS policy. The researchers' first model studied the fixed effect of each of the 25 QI interventions on hospital-acquired pressure ulcer rates while their second model studied the effect size of only statistically significant QI interventions on hospital-acquired pressure ulcer rates controlling for significant covariates and CMS reimbursement policy changes. Finding from this study revealed that hospitals adopting the QI interventions for pressure ulcer prevention experienced a 27% reduction (-1.86 cases/quarter; p=0.002) fewer hospital-acquired pressure ulcer cases per quarter. The CMS reimbursement policy changes were associated with a greater reduction (-11.32 cases/quarter; p<0.001) hospital-acquired pressure ulcer cases – a more than 100% decrease. Other findings suggest that most patients who developed hospital-acquired pressure ulcers were elderly, male, had an extended hospital stay, were either admitted to intensive care unit or surgical services and had a higher case-mix index. In summary, the researcher's concluded hospital-acquired

pressure ulcer rates were significantly lower following CMS reimbursement policy changes (Padula et al., 2016).

Tayyib and Coyer (2016) conducted a systematic review to evaluate the effectiveness of a single intervention designed to reduce the incidence and prevalence of hospital-acquired pressure ulcers in intensive care units. The review included randomized controlled trials, quasi-experimental comparative studies, nonrandomized studies, before and after studies with adult participants 18 years and older in the intensive care unit. Most of the studies (n=14) were randomized controlled trials, one was post-test only with three group comparisons, three were pre-post experimental studies, and six were two-group quasi-experimental studies. This was a global study comprised of intensive care patients (n=6,566). The researchers' findings revealed no studies examined the contribution of risk and skin assessment as a strategy to reduce hospital-acquired pressure ulcers. One study evaluated the effectiveness of polarized light used daily for 10 minutes to reduce the incidence of hospital-acquired pressure ulcers on the sacrum and heel *(p*=.196) despite a significant decreased in incidence when Stage 1 pressure ulcers were excluded (*p*=.019). Three studies reported the effectiveness of a prophylactic silicone foam dressing to decrease the incidence of sacral hospital-acquired pressure ulcers. The overall effect size across studies was 0.12 (95% CI: 0.05 – 0.29; *p* <.00001) suggesting that hospital-acquired pressure ulcer incidence of sacral area decreased after application of the dressing (Tayyib & Coyer, 2016).

Tayyib and Coyer (2016) included a single study that focused on a nutritional strategy described as the "intervention diet" was significantly associated with reduction

of hospital-acquired incidence (p=.05). The researchers also included another single study that showed improvement with 2-hour repositioning using a 2-person turn team. Six studies evaluated the effectiveness of a variety of pressure –relieving support surfaces. However, only one study results suggested that alternating mattress can significantly lower the incidence of hospital-acquired pressure ulcers Stage 2 or greater as compared to the foam overlay mattress (p=.038). On the other hand, one study compared the effectiveness of two viscoelastic mattresses, one compared two layers, whereas the second was composed of three layers. No significant differences were found in the incidence between the groups (p=.44). The researchers' surmised that although this review evaluated different types of support surfaces, it was challenging to determine the most effective support surface in the absence of effective sample sizes, diverse selection of available products and inconsistency in the use of pressure ulcer staging systems as an outcome measure. They also acknowledged a few study limitations such as the lack of pooled data from different research designs and settings could be potential sources of heterogeneity and could affect this systematic review findings. The researcher's included other limitations, such as different pressure ulcer staging criteria, small sample size, and lack of randomization. That said, no conclusions were made regarding the effectiveness of these intervention strategies to prevent hospital-acquired pressure ulcers in the intensive care unit (Tayyib & Coyer, 2016).

Qaseem et al. (2015) compared the effectiveness of a single intervention to reduce the incidence of pressure ulcers and developed clinical guidelines for practitioners. In addition, the researchers completed another systematic review of multicomponent

interventions for preventing hospital-acquired pressure ulcers. The researchers' graded the quality of evidence and strength of recommendations by using American College of Physicians (ACP) clinical practice guidelines grading system. Moderate-quality evidence showed there was no significant difference in diagnostic accuracy between the Braden, Cubbin and Jackson, and Norton and Waterlow scales. The researchers studied several interventions individually because pooling of studies was not practical due to methodological limitations and clinical diversity of the studies. The researchers reported that Static (moderate-quality evidence) and alternating air (low-quality evidence) mattress or overlays reduced pressure ulcer incidence compared to standard hospital mattresses. The researchers reported one study yielded low quality evidence and showed no difference in Stage 2 to 4 pressure ulcers between a multicomponent electronic decision-support system (1.8% vs. 2.1%; RR, 0.85 [95% CI, 0.23% to 3.10]. On the other hand, the researchers reported moderate-quality evidence was derived from a review of 26 studies showed that multicomponent interventions improved skin care and reduced pressure ulcer rates in both acute and long-term care settings. The researchers reported four studies revealed significant cost saving using the multicomponent approach. Of note, the researchers reported a 548 –bed hospital in Florida estimated annual cost savings of approximately $11.5 million as a result of statistically significant reduction in pressure ulcer prevalence (Qaseem et al., 2015).

Qaseem et al. (2015) postulated three recommendations from their review: a) ACP recommended clinicians should perform a risk assessment to identify patients who are at risk of developing pressure ulcers [Grade: weak recommendation, low-quality

evidence]; b) ACP recommended that clinicians should choose advanced static mattresses or advanced static overlays in patients who are at an increased risk of developing pressure ulcers [Grade: strong recommendation, moderate-quality evidence]; c) ACP recommended not using alternating air-mattress or alternating air-overlays in patients who are at increased risk of developing pressure ulcers (Grade: weak recommendations, moderate-quality evidence). Data on the efficacy of many of the interventions came only from single studies and further research into comparative effectiveness was warranted. However, multicomponent interventions are increasingly becoming the standard of care for prevention of pressure ulcers (Qaseem et al., 2015).

Members of the leadership team at a 560-bed tertiary and quaternary medical center observed an increase in the prevalence of pressure ulcers and developed a multidisciplinary quality improvement program to reduce the pressure ulcer prevalence (Cano et al., 2015). Committee members completed a retrospective chart review covering 2 years, designed an evidence-based hospital protocol, and conducted staff education. The committee replaced all inpatient support surfaces, encouraged repositioning, focused on skin care (managing moisture) and added a Wound, Ostomy, Continence (WOC) nurse. Early results were impressive, the prevalence decreased from 11.7% (Stage 2 to 4 ulcers) to 2.1%. However, a few quarters later the prevalence rose to 5.1% which prompted re-education for staff and consequentially led to a reduction of 2.8% for 10 consecutive quarters. The researchers concluded the integration of the quality improvement program, implementation of evidence-based practices, the use of

evidence-based products and staff education are necessary to improve hospital-acquired pressure ulcer rates and sustainability of results (Cano et al., 2015).

Gillespie et al. (2014) conducted a systematic review and identified three randomized controlled studies and one economic study including participants from acute and long-term care settings. Two studies discussed the 30-degree tilt vs. 90-degree were pooled using random effects model ($I^2 = 69\%$) (252 participants). There was no difference in the risk of developing a Stage 1 or 2 pressure ulcer between 30-degree tilt and standard 90-degree; however, this comparison is at risk of a Type II error due to the lack of statistical power (pooled RR 0.62, 95% CI 0.10 to3.97, P=0.62, very low-quality evidence). The third study was a cluster randomized trial where participants were randomized between 2-hourly and 3-hourly positioning on standard hospital mattresses and 4-hourly and 6-hourly repositioning on viscoelastic foam mattresses. The risk ratio for pressure ulcers with 2-hourly repositioning compared to 3-hourly repositioning on a standard mattress was not significant (RR 0.90, 95% CI 0.69 to 1.16, very low-quality evidence). Regardless of category of pressure ulcer the risk ratio for pressure ulcers was associated with a significant reduction and no difference between 4-hourly repositioning and 6-hour repositioning on viscoelastic foam (RR 0.73, 95% CI 0.53 to 1.02, very low-quality evidence). The cost effectiveness study compared 3-hourly repositioning using the 30-degree tilt with standard care consisting of a 6-hourly repositioning using the 90-degree lateral rotation overnight. The intervention was reported to be cost saving compared with standard care (nursing time cost per patient EURO 206.6 vs. EURO 253.1, incremental difference EURO -46.5; 95% CI: EURO -1.25 to EURO 74.60.

Although results derived from repositioning and position were not impressive, the researchers stated this does not mean these interventions are ineffective since all comparisons were grossly underpowered. They recommended future trials should include larger number of participants and more studies should be conducted in the acute care setting (Gillespie et al., 2014)

Sullivan and Schoelles (2013) conducted a systematic review to review evidence regarding multicomponent interventions for preventing pressure ulcers and to examine the importance of contextual aspects of programs that aim to reduce hospital-acquired pressure ulcers. The researchers included research studies that employed multicomponent pressure ulcer interventions combined with training and education, targeted adult populations and reported pressure ulcer rates 6 months after implementation. Twenty-six studies (18 acute care, 8 long-term care) met the inclusion criteria. Study designs included mostly time series, assessments of changes before, during and after implementation of the intervention. Other designs include randomized, controlled trials, a controlled before-and-after, and a nurse-focused quality improvement intervention. Of the twenty-six studies, 9 were high quality, 14 were moderate-quality, and 3 were low quality. The results reported most organizations educated and trained staff (96%), developed or revised their protocols for assessment and documentation of wounds (96%) performed quality audits and provided feedback to staff (81%), adopted the Braden Scale (61%) and redesigned documentation processes and reporting (58%). Statistically significant reductions in pressure ulcer rates were reported in 11(42%) of 26 studies (mean reduction, 82% [range 67% to 100%]. Although 13 studies pressure ulcer rates did

not reach statistical significance, 5 reported improvements in both pressure ulcer rates and process-of-care measures. The researchers reported that moderate-strength evidence from 26 implementation studies suggest the integration of individual interventions in pressure ulcer prevention could lead to reduction in pressure ulcer rates (Sullivan & Schoelles, 2013).

Niederhauser et al. (2012) examined evidence that supported the combined use of interventions to prevent pressure ulcer in acute care and long-term care facilities. Twenty-four studies were identified that described comprehensive pressure ulcer prevention programs. Twenty studies described single-site interventions and four described multisite interventions. All the reviewed studies used a longitudinal one-group pre- and post-test design. No randomized controlled trials were reported. Although most studies reported positive outcomes from their pressure ulcer interventions P-values which assess statistical significance were rarely reported. Eleven studies reported a decrease in prevalence over the course of the study period, whereas two programs reported no significant changes. The researchers stated despite the number of studies showing benefit results, caution should be used when interpreting results. Foremost, the level of evidence was weak, there was no randomization to interventions or control group. Additionally, the description of methods and data collection was frequently omitted (Niederhauser et al., 2012)

Swafford et al, (2016) assessed the effectiveness of a formal, year -long hospital-acquired pressure ulcer prevention program in an adult intensive care unit, with a goal of achieving at least 50% reduction in incidence. The hospital-acquired pressure ulcer

prevention program was planned during 2012, and the following interventions were implemented in a combined medical/surgical 14 bed intensive care unit. The hospital-acquired pressure ulcer prevention program included the Braden Scale, a revised skin-care protocol, fluidized repositioners, silicone adhesive dressings along with face-to-face staff education.

Prior to implementing the prevention program in 2011, 45 hospital-acquired pressure ulcers were reported among 10% of patients. After implementation of the prevention program, the overall incidence decreased to 17 (3%) of patients representing a decrease of 69% which exceeded the goal of 50% reduction. The researchers surmised a comprehensive, proactive, collaborative ulcer prevention program based on staff education and adherence to protocol for patient care was an effective approach to reduce the incidence of hospital-acquired pressure ulcers in the intensive care units (Swafford et al., 2016).

Anderson et al. (2015) examined the effectiveness of a universal pressure ulcer prevention bundle (UPUPB) applied to intensive care unit patients combined with proactive, semiweekly wound, ostomy and continence (WOC) nurse rounds. The research design was a quasi-experimental pre and post intervention study in which each phase included different participants. The preintervention represented usual care, including 31 interventions initiated based on patient risk (i.e., Braden Scale score) in which WOC nurses received referrals for high-risk patients. While the standard guidelines included the same interventions as UPUPB, the two guidelines differed in length, complexity, number of interventions, and accessibility. The prevention bundle

mnemonic was SAFTER and was comprised of a) Skin care products; b) Skin assessments; c) Floating heels off the bed; d) Early identification of sources of pressure injuries using and e) patient repositioning. Three hundred twenty-seven participants comprised the sample, including 181 pre and 146 post intervention participants. The mean age was 62.17 (17.12) SD, n=195 (56.6%) male and n=132 (40.4%) female. Sixty-seven (9%) were in the medical/surgical intensive care units (Anderson et al., 2015).

Anderson et al. (2015) reported composite adherence scores to 5 prevention interventions were not significantly different for the 2 phases (Phase 1: 4.34 $\pm$ 1.40 [mean $\pm$ SD] and Phase 2: 4.65 $\pm$ 2; t (250.074) = -1.549, P=.123). Statistically significant differences did occur for repositioning (Phase 1: 792 $\pm$ 0.236 vs. Phase 2: 0.852 $\pm$0.207; t (325) = -2.441, P=.015) and elevation of heels (Phase 1: 0.116 $\pm$ 0.184 vs. Phase 2: 0.205 $\pm$ 0.227; $_{t276.666}$ = -3.819, P<.001). Interventions in the electronic health record that did not significantly change were use of skin care products (1.79 $\pm$ 1.21 vs. 1.96 $\pm$ 1.75), conducting skin assessments (0.66 $\pm$ 0.215 vs. 0.68 $\pm$ 0.207), and pressure distribution surfaces (0.98 $\pm$ 0.188 vs. 0.95 $\pm$ 1.39). Based on the results of this study, the researchers recommended the implementation of UPUPB with semi-weekly WOC nurse rounds in intensive care units was effective in decreasing pressure ulcer occurrences (Anderson et al., 2015).

Armour-Burton et al. (2013) reported the implementation of a multidisciplinary healthy skin project decreased the prevalence of hospital-acquired pressure ulcers in the surgical progressive care unit from a mean of 4.85% to 0% for 17 quarters. The surgical progressive care unit was a 41-bed unit with a mean daily census of 36 patients. The unit

was staffed with 65 registered nurses and 20 nursing assistants who received comprehensive evidence-based training on hospital- acquired pressure ulcers. The Healthy Skin Project included three components: involvement of unit-based wound liaison nurse, staff education and training nursing assistances to allow for early detection. Other aspects of the Healthy Skin Project included skin assessment, Braden Scale, use of pressure reducing mattresses, dressings, nutrition assessments, and 2-hour patient repositioning. The researchers concluded a multidisciplinary pressure ulcer prevention program was efficacious in reducing the occurrence of hospital-acquired pressure ulcers (Armour-Burton et al., 2013).

After measuring a hospital-acquired pressure ulcer prevalence of 27%, (Kelleher, Moorer, & Makic, 2012) conducted a quality improvement program to decrease the prevalence. The quality improvement program was implemented in a 17-bed surgical intensive care unit over a period of 36 months. The average age of patients with hospital-acquired pressure ulcers was 57.9 $\pm$ 16.7 years, with a mean Braden Scale score of 13 $\pm$ 1.2 (range, 9-17). The fundamental underpinnings of the quality improvement was to associate interventions with the subscales of the Braden Scale. The interventions also included peer-to-peer interaction, collaboration with skin care champions and WOC nurse. Of note, during the implementation phase, the use of prevention surfaces increased 92%, repositioning increased 30%, nutrition assessment increased 77% and moisture management increased 100%. After the implementation phase, hospital-acquired pressure ulcer prevalence declined and eventually was reported as 0% for three consecutive quarters (Kelleher et al., 2012).

Implications

Since the population at risk for developing pressure ulcers is expected to increase exponentially due to factors such as aging, chronic condition, diabetes and obesity (Grove et al., 2013) it is imperative that health care organizations implement effective evidence-based strategies to prevent pressure ulcer development. There is promising evidence that evidence-based pressure ulcer prevention programs using multicomponent interventions or care bundles rather than a single intervention are effective in reducing the prevalence of hospital-acquired pressure ulcers (Cano et al., 2015; Gray-Siracusa & Schrier, 2011; Qaseem et al., 2015; Zuo & Meng, 2015). More specifically, a care bundle is a structured approach consisting of three to five evidence-based interventions that should be implemented collectively to maximize patient outcome (Gray-Siracusa & Schrier, 2011). Collaboration from members of multidisciplinary teams also played a role in implementing pressure ulcer prevention programs; namely critical nurses, skin care champions, WOC nurses, dieticians and physicians. As previously discussed, hospital-acquired pressure ulcers adversely impact patients, family members, stakeholders and the health care organization in the United States. Care for hospital-acquired pressure ulcers ranges from $500 to $130,000 per patient with an aggregate total of $11 billion every year. Generalized findings from this systematic review suggested health care organizations that adopted multicomponent evidence-based pressure ulcer prevention programs reported a reduction in pressure ulcer prevalence.

Project Strengths and Weaknesses

Several strengths were identified in this systematic review such as the large number of randomized controlled trial studies and systematic reviews (both listed under inclusion and exclusion index). Most of the randomized controlled trials and systematic reviews empirical data and P- values which strengthened the study results. However, there were few studies ranked Level A evidence which may serve as a concern to clinicians and intensive care nurses. A high number of studies were published within the past five years indicating the increasing level of interest in this topic. Although emerging evidence suggest that multicomponent interventions reduced the pressure ulcer prevalence, this inclusion criteria functioned as a limitation. This requirement limited the number of studies for inclusion which was viewed as a weakness. Additional inclusion criteria may have functioned as a limitation including focusing only on patients in the medical and surgical intensive care units in the United States. As such, the study results were not applicable to a global healthcare setting.

Future research related to pressure ulcer prevention development should be continued to improve patient safety, deliver high quality care and improve patient outcomes. The DNP graduate is adequately prepared to address the complex health problems facing our health care system. That said, DNP-led quality improvement projects should be encouraged and properly funded to investigate and solve health care issues facing our patients. Since pressure ulcer development continues to persist nationally and internationally (Garcia-Fernandez et al., 2013) future research studies should include patients residing in the United States and other countries to develop

multicomponent evidence-based intervention to prevent pressure ulcers within high risk patients.

Significance to Nursing Practice

Patients admitted to intensive care units are at a higher risk for developing pressure ulcers due to several factors, hemodynamic instability, immobility, decreased sensation, altered nutritional status, use of vasoactive medications and sedatives (Elliott et al., 2008). Pressure ulcer prevention is largely viewed as a nursing responsibility and a marker of quality care (Elliott et al., 2008). Prevention and treatment for pressure ulcers is expensive ranging from $500 to $130,000 per patient and increased the intensive care unit budget by 5% (Compton et al., 2008; Padula et al., 2016). Caring for patients with pressure ulcers increased the nurses' workload by 50% (Compton et al., 2008). The impact of advancing age, deleterious physical and psychological sequalae and financial burden of managing pressure ulcers adversely impacts patients, family members, healthcare organizations and stakeholders.

The healthcare system is faced with numerous challenges as the community, stakeholders and insurers demand improvements in care delivery. There are more than three million nurses in diverse settings who interface with patients daily (Institute of Medicine [IOM], 2011). This intimate view and front-line contact with patients provides nurses the opportunity to make serious changes in the health care system. More specifically, hospital-based nurses must be competent, possess excellent clinical expertise and clinical decision-making skills. There is increasing confidence that DNP graduates

possess the tools to solve the complicated problems facing our health care system (Zaccagnini & White, 2011) to improve patient outcomes.

Significance to Social Change

Effective pressure ulcer prevention programs consist of risk assessment, daily reassessment of pressure ulcer risk, daily skin inspections, managing moisture, nutritional support and hydration and offloading pressure (IHI, 2017). There is convincing evidence that evidence-based multicomponent intervention programs are effective in preventing pressure ulcer development which lead to lower pressure ulcer prevalence. Decreasing the risk factors for pressure ulcer development increases patient safety, improves quality of care delivery and reduces the cost of caring for them. Moreover, health care organizations regard evidence-based multicomponent intervention programs as an effective and efficient approach to reduce pressure ulcer rates in the intensive care units. Findings from this systematic review has the potential to improve care delivery, reduce variation in clinical practice and reduce pressure ulcer prevalence.

Declaration of Conflict of Interest

The project leader and the second reviewer have no declared conflicts of interest. This systematic review was undertaken to fulfill the requirements for the Doctor of Nursing practice program final scholarly project.

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Summary and Conclusions

Pressure ulcer development is a complex multifactorial process that can rapidly develop within one hour (Sullivan & Schoelles, 2013). Critical care patients are a vulnerable population and possess a higher risk of developing pressure ulcers than patients admitted to a general ward. Pressure ulcers adversely affect patients due to increased pain, prolonged healing, loss of independence and depression (Sullivan & Schoelles, 2013; Melter, 2011). Additionally, patients with pressure ulcers carry a mortality rate that is two to six times higher than patients without pressure ulcers. Each year, nearly 60,000 patients die from complications associated with pressure ulcers (Sullivan & Schoelles, 2013; Melter, 2011)

Of all the hospital-acquired conditions, hospital-acquired pressure ulcers are the most expensive with medical costs ranging from $500 to $130,000 per patient (Padula et al., 2016). Given recent changes in CMS financial reimbursement, health care organizations have placed the adoption of evidence-based pressure ulcer protocols as a high priority. Consequentially, accurate identification of risk factors for pressure ulcers and implementing evidence-based prevention strategies can lead to reductions in pressure ulcer prevalence which promotes positive health outcomes (Cox, 2011). This task is best accomplished with use of the Braden Scale which has been found to be possess high predictability of pressure ulcer risk among patients in all settings. In summary, research studies suggest evidence-based multicomponent interventions which include a risk assessment (Braden Scale) and three to five evidence-based interventions is effective in improving patient outcomes.

Section 5: Dissemination Plan

Introduction

Nurses, clinicians and health care professionals are encouraged to incorporate findings from this systematic review into their daily clinical practice to improve patient outcomes. Initially, an abstract will be submitted to Sigma Theta Chapter Phi Nu Chapter to share results with members through an education activity. Additionally, an abstract will be submitted for publication in Wound, Ostomy and Continence peer-reviewed nursing journal for wide dissemination to guide health care professionals in their clinical decision making. Eventually, my goal is to submit a poster presentation for the 2019 Sigma Theta Tau Biennial Convention and the 2019 Southern Nursing Research Society conference.

Analysis of Self as a Scholar

Scholars are regarded as individuals who are highly knowledgeable about a topic. That said, the amount of time, dedication and research I spent with this scholarly project enhanced my knowledge about the topic of pressure ulcers. I am now viewed as a specialist in pressure ulcers and health care professionals seek my expertise to prevent and manage pressure ulcers.

Analysis of Self as a Practitioner

The United States healthcare system is plagued with patients with complex, chronic health problems that have not been resolved by conventional approaches (Zaccagnini & White, 2011). However, DNP graduates are being recognized as health care professionals who will incorporate evidence-based strategies into their clinical

practice and provide solutions to these challenging health issues (Zaccagnini & White, 2011). Two of my personal goals have been to provide optimal care to my patients and achieve the terminal degree in my profession. The synthesis of knowledge and experience gained from my DNP program has helped me become a better practitioner which in turn allows to me deliver high, quality care to my patients.

Analysis of Self as a Project Developer

Historically, clinical decisions were made based on traditional medical practices, however DNP graduates are taught to make clinical decisions based on empirical evidence (Zaccagnini & White, 2011) that improves care delivery and patient outcomes. As such, DNP graduates are also taught how to asses and evaluate programs, protocols and practices to make improvements when warranted. The fundamental purpose of this systematic review was to evaluate current pressure ulcer prevention programs and determine their relevance and effectiveness. The second reviewer and I followed the protocol as directed in order to produce a high-quality improvement project. Research findings from this project will be shared with health care professionals for them to discuss the need to make changes and/or improvements in their care delivery which will be beneficial to the nursing profession and patient care.

Summary

In summary, pressure ulcers exact a heavy burden on patients, families, health care organizations and the overall health economy (Elliott, 2010). Reimbursement changes from the CMS in 2008, motivated health care organizations to adopt evidence-based pressure ulcer prevention strategies to reduce pressure ulcer prevalence.

Identification of vulnerable, at risk patients is the first step and this can be accomplished with use of a risk assessment tool such as the Braden Scale. Accordingly, there is strong empirical evidence that multicomponent evidence-based pressure ulcer protocols are effective in preventing pressure ulcer development (Ackroyd-Stolarz, 2014). In summary, results from this systematic review suggests that implementation of the evidence-based multicomponent pressure ulcer prevention protocol is effective in reducing the pressure ulcer prevalence which improved patient safety, care delivery, and patient outcomes.

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Appendix A: The Cochrane Protocol

Background

Objectives

Method Section

-Types of Studies: systematic reviews, randomized control trials, cohort studies and before and after studies

-Types of participants: male and female elderly patients (65 years and older) without pressures ulcers in the medical and surgical intensive care unit for 24 hours or longer.

-Types of intervention: use of Braden Scale and evidence-based multicomponent protocol (3 or more components)

-Type of outcome measure: prevalence rate

-Search methods: The following combination of key words and phrases were used: pressure ulcers, Braden Scale, intensive care unit, pressure ulcer prevention, pressure ulcer prevention protocol, multicomponent intervention, evidence-based intervention, systematic review, care bundle, randomized controlled trials, pre-post studies, before and after studies and experimental

Date Collection/Analysis: will included a comprehensive review and include research studies that meet the inclusion criteria; namely, systematic reviews, randomized control trials, control trials, cohort studies, pre-post, before and after studies and experimental. The sole outcome for the systematic review is the documentation of prevalence rates to determine the effectiveness of pressure ulcer prevention

protocols in the medical and surgical intensive care unit

Acknowledgements

References

Tables and figures

-PRISMA-2009 flow diagram

-Exclusion table

-Inclusion table

Appendix B: Research Studies Excluded

Author, Year, Reference	Title of Study	Rationale for Exclusion
Chou et al. (2013)	Pressure ulcer risk assessment and prevention: A systematic comparative effectiveness review	No use of Braden Scale- no data or description of patients
Krupp & Monfre (2015)	Pressure ulcers in the ICU patient: An update on prevention and treatment	Does not meet inclusion criteria – does not provide patient information; no outcomes measure –PU prevalence rate
Twersky et al. (2012)	A randomized, controlled study to assess the effect of silk-like textiles and high absorbency adult incontinent briefs on pressure ulcer prevention	Used nursing home patients
Myers (2017)	Prevention of heel pressure injuries and plantar flexion contractures with use of a heel protector in high-risk neurotrauma, medical and surgical intensive care units: A randomized controlled trial	Does not meet inclusion criteria used < 3 components; did not separate findings by units
Park & Park (2017)	The efficacy of viscoelastic foam overlay on prevention of pressure ulcer injury in acutely ill patients	Non-US population; patients were treated in neuro/pulm/oncology wards; single intervention
Bergstrom et al. (2013)	Turning for ulcer reduction: A multisite randomized clinical trial in nursing homes	Used nursing home patients
Coladonato et al. (2012)	Prospective, nonrandomized controlled trials to compare the effect of silk-like fabric to standard hospital lines on the rate of hospital-acquired pressure ulcers	Does not meet inclusion- single intervention study
Tayyib et al. (2015)	A two-armed cluster randomized control trial to determine the effectiveness of a pressure ulcer prevention bundle for critically ill patients	Non-US population
Chaboyer et al.	The effect of a patient centered care	Non-US population

(2016)	bundle intervention on pressure ulcer incidence (INTACT): A cluster randomized trial	
Webster et al. (2011)	Pressure ulcers: Effectiveness of risk-assessment tools. A randomized controlled trial (the ULCER trial)	Did not use the Braden Scale; study did not occur in an ICU setting; non-US population
Ozyurek & Yavuz (2015)	Prevention of pressure ulcers in the intensive care unit	Single intervention study; non-US population
Coyer et al. (2015)	Reducing pressure injuries in critically ill patients by using a patient skin integrity care bundle (INSPIRE)	Non-US population; did not use the Braden Scale
Tayyib et al. (2016)	Implementing a pressure ulcer prevention bundle in an adult intensive care	Non-US population
Gray-Siracusa & Schrier (2011)	Use of an intervention bundle to eliminate pressure ulcers in critical care	The study setting was a 27-bed cardiovascular and coronary unit
Evans et al. (2011)	Reducing pressure damage: Care bundles and collaborative learning	No P values were provided; non-US population; pediatric and maternity participants
Zuo & Meng (2015)	A care bundle for pressure ulcer treatment in intensive care units	Non-US population; no discussion of patient data
McInerney (2008)	Reducing hospital-acquired pressure ulcer prevalence through a focused prevention program	This study exceeds time limit requirement
Guihan et al. (2014)	Comparing multicomponent interventions to improve skin care behaviors and prevent recurrence in veterans hospitalized for severe pressure ulcers	Spinal cord injury patients participated in this study; used < 3 components
Walsh & Plonczynski (2007)	Evaluation of a protocol for prevention of facility-acquired heel pressure ulcers	This study exceeds time limit requirement
Yap et al., (2016)	An evidence-based cue-selection guide and logic model to improve pressure ulcer prevention in long term care	Population was in long term care

Hall & Clark (2016)	A prospective, descriptive, quality improvement study to investigate the impact of turn-and-position devices on incidence of hospital-acquired sacral pressure ulcers and nursing staff time needed for repositioning patients	Single intervention study
Yap & Kennerly (2011)	A nurse-led approach to preventing pressure ulcers	No discussion of patient data; no statistical data was provided to discuss improvement
Thorpe (2015)	Pressure ulcer prevention in intensive care	Non-US population; no use of Braden Scale
Cooper (2013)	Evidence-based prevention of pressure ulcers in the intensive care unit	Used < 3 components
Esperanza et al. (2012)	Pressure ulcers in the intensive care unit: New perspectives on an old problem	Included patients in a Cardiothoracic ICU
Slowikowski & Funk (2010)	Factors associated with pressure ulcers in patients in a surgical intensive care unit	Single intervention study
Catania et al. (2007)	PUPPI: The pressure ulcer prevention protocol interventions	Study exceeded time limit requirements for this study
Dutra et al. (2015)	Using transparent polyurethane film and hydrocolloid dressings to prevent pressure ulcers	Single intervention study; non-US population
Cowan et al. (2012)	Enhancing Braden pressure ulcer risk assessment in acutely ill adult veterans	Did not employ any interventions
Ranzani et al. (2016)	The challenge of predicting pressure ulcers in critically ill patients: A multicenter cohort study	Non-US population
Black et al. (2012)	Pressure ulcer incidence and progression in critically ill subjects	Single intervention study in a 12-bed Cardiovascular ICU
Cox (2011)	Predictors of pressure ulcers in adult critical care patients	Does not meet inclusion due to no evidence of intervention
Edger (2017)	Effect of a patient-repositioning device in an intensive care unit on hospital-acquired pressure injury occurrences	This study occurred in a Neonatal ICU

	and cost: A before-after study	
Smith et al. (2013)	A retrospective, nonrandomized, before-and-after study of the effect of lines constructed of synthetic silk-like fabric on pressure ulcer incidence	Uses < 3 components
Mallah et al. (2014)	The effectiveness of a pressure ulcer intervention program on the prevalence of hospital acquired pressure ulcers: Controlled before and after study	Non-US population
Fike (2013)	Pressure ulcer prevention in the intensive care unit: A case study	Case studies were not included in this systematic review

Appendix C: Research Studies Included

Author(s) / Year	Method / Research Design	Age Group	Intervention	Outcomes / Results	LOE
Padula et al. (2016)	Quantitative. Hospital-level retrospective observational cohort.	18-30; 31-50; 51-64; ≥ 65	25 QI interventions across 4 domains: leadership, staff, information technology, performance and improvement.	Pressure ulcer prevention protocol led to a 27% reduction or 1.8 few HAPU cases per quarter	A
Tayyib & Coyer (2016)	Qualitative. Systematic review (included RCT, quasi-experimental, before-after and comparative studies	Adult ICU with 18 years and older	Risk Assessment; foam dressings, polarized light therapy, repositioning, use of support surfaces and education.	Statistically significant effect of a silicon foam dressing reduced HAPU incidence in critically ill patients.	A
Swafford et al. (2016)	Quantitative, chart review. Quality improvement program	Mean age in 2011: 51.9 / 2012: 50.5 / 2013: 59	Braden Scale, skin care protocol, fluidized repositioners, silicone adhesive dressings and staff education	Incidence of HAPUs was decreased by 69% (n=17; 3% of patients in 2013 vs n=45, 10% of patients in 2011).	B
Anderson et al. (2015)	Quantitative, chart review. Quasi-experimental, pre-/post-intervention design	Mean age was 62.71 (17.12) SD	Prevention Bundle included Braden Scale, skin emollients, skin assessments, heel protection, repositioning	The incidence of HAPU decreased from 15.5% to 2.1%. Multivariate logistic regression model showed a significant reduction in HAPU (p <. 0.01).	B
Cano et al. (2015)	Quantitative. Multi-disciplinary quality improvement program.	80.7% were 50 years or older	Braden scale, support surfaces, skin assessment, repositioning, skin barrier products, WOC nurse	By second quarter, HAPU dropped to 2.6% and remained between 1% -2% for 9 consecutive quarters.	B
Qaseem et al. (2015)	Quantitative.	Not listed	Braden scale, specialized	Three recommendations	B

	Systematic review.		mattresses, repositioning, dressings, barrier creams, staff education	were developed for physicians; multicomponent interventions are increasingly becoming the standard of care for prevention of pressure ulcers.	
Gillespie et al. (2014)	Quantitative. Cochrane Database of Systematic reviews: 3 RTC and 1 economic study	No specific age listed, however, they referred to adults.	Repositioning, support surfaces, viscoelastic foam mattress	The risk ratio for developing pressure ulcers was compatible with a large reduction and no difference between 4-hourly repositioning and 6-hourly repositioning on viscoelastic foam (RR0.73, 95% CI o.53 to 1.02, very low-quality evidence).	B
Armour-Burton et al. (2013)	Qualitative. Quality Improvement program with chart reviews.	No descriptio n of patients	Braden Scale, skin assessments, use of pressure reducing mattress, 2-hour repositioning	After implementation of Healthy Skin Project, the prevalence rate decreased from a mean of 4.85% to 0% for 17 of 20 quarters	B
Sullivan & Schoelles (2013)	Quantitative. Systematic Review with 26 studies (18 acute & 8 long-term care). Time series, RCT, and focused reviews.	No descriptio n age groups or participant s	Braden scale, support surfaces, repositioning, moisture management, nutritional assessments	24 studies reported some improvements in pressure ulcer rates. Statistical significance resulted in 11 (42%) of 26 studies. Of the 13 studies not reaching statistical significance, 5 reported improvements in both pressure ulcer rates and process-if-care	B
Kelleher et al. (2012)	Quantitative. Quality improvement project with chart review.	Mean ages were by quarters, ranging from 53.3 to 60.7	Braden Scale, moisture prevention, skin assessment, support surfaces, and nutrition assessments	The highest prevalence rates was 27% however, after implementation of interventions, HAPR rates reported 1% for 3 consecutive quarters	B
Niederhau ser et al.	Quantitative.	No age groups	Braden Scale, skin assessment,	11 studies saw a decrease in prevalence	C

(2012)	Systematic Review	were reported	repositioning schedule, pressure-reducing mattress, nutrition assessments, heel protectors skin care products and incontinence management	rates; 2 studies reported no improvements in prevalence rates; P-Values were not reported. Of note, this is an international review, however data from US was clearly delineated.	

Appendix D: Levels of Evidence

AACN Evidence – Leveling System	Description of the Criteria for the Level	Number of Studies
Level A	Meta-analysis of multiple controlled studies or meta-synthesis of qualitative studies with results that consistently support a specific action, intervention or treatment	2
Level B	Well-designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention or treatment	8
Level C	Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results	1
Level D	Peer-Reviewed professional organizational standards, with clinical studies to support recommendations	0
Level E	Theory-based evidence from expert opinion or multiple case reports	0
Level M	Manufacturers' recommendations only	0

Appendix E: PRISMA 2009 Flow Diagram