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Enhancing the Braden Scale Pressure Ulcer Risk Assessment in Long-Term Care Facilities: A Cohort Study

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Enhancing the Braden Scale Pressure Ulcer Risk Assessment in Long-Term Care

Facilities: A Cohort Study

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PRESSURE ULCER PROJECT OUTLINE:

Abstract

Chapter I: Introduction

    A. Background and Significance

    B. Study Goals

    C. Problem Statement

    D. Project Aim/Purpose

    E. Clinical Questions

    F. Conceptual Framework

Chapter II: Literature Review

    A. Search Method

    B. Braden Scale

    C. Age

    D. Comorbidities

    E. Support Surfaces

    F. Multifaceted Interventions

    G. Past Interventions

    H. Systematic Review

    I. Risk Factors

    J. Deficiencies in Past Studies

Chapter III: Methodology

    A. Project Design

    B. Sample

Appendix C: Informed Consent Waiver

Appendix D: Committee Request Form

Appendix E: Proposal Approval

Appendix F: Letter of Support

Appendix G: Final Approval Form

Abstract

The development of pressure ulcers remains challenging as they are associated with overwhelming costs, pain and suffering, prolonged hospitalization, and morbidity and mortality. In the United States, the Braden scale is the most widely used risk assessment tool among all healthcare organizations to identify high-risk individuals for pressure ulcer development. The objective of risk assessment is to detect high-risk patients, implement immediate interventions, and evaluate patients not at risk who do not require intervention. The purpose of this cohort study is to determine the pressure ulcer predictability of the Braden score in comparison to the Braden score with additional predictor factors. Predictor factors explored in this research incorporate those described in current literature as pressure ulcer risk factors: age, gender, comorbidities, and history of previous pressure ulcer. This study utilized an observational cohort research design to appraise the effectiveness of an intervention based on evidence and data. Logistic regression statistical analysis was applied to establish how successful Braden total scores were in a pressure ulcer predictive model with and without the addition of additional predictor factors. A separate relative risk model was tested using only the most applicable predictor factors correlated with pressure ulcer prevalence in this model without the Braden score in an effort to cultivate the most relative model. The research was conducted solely at Symphony of Lincoln Park in Chicago, Illinois. All patient records from January 2020 through July 2020 were reviewed and identified to attain data recorded on the data collection sheet of patients who developed pressure ulcers during that time frame along with the same number of patients who did not develop pressure ulcers but were classified as at-risk as evidenced by a Braden score of 18 or less, resulting in a total of 119 adult long-term care residents. The general assumption from this analysis was that a logistic regression model of pressure ulcer development

in long-term care residents indicated 9 predictors able to determine a statistically significant risk of pressure ulcer development. Specifically, the analysis suggested high risk Braden total scores (mean=15), history of pressure ulcer, anemia, limb paralysis, osteoporosis, malnutrition, incontinence, CHF, Alzheimer's, and DM2 can be predictive of the development of pressure ulcers in long-term care residents. The analysis integrated a predictive model using binary logistic regression, which revealed that the Braden total score alone was accurately able to predict 75.6% (76.6% subjects that did develop pressure ulcers were accurately predicted and 74.5% of subjects which did not develop pressure ulcers were accurately predicted in the Braden score only model). Adding the presence of history of pressure ulcer, anemia, limb paralysis, osteoporosis, malnutrition, incontinence, CHF, Alzheimer's, and DM2 was able to accurately predict 98.3% (96.9% with PU, 100% without PU). More research is needed to substantiate these findings and investigate contemporary risk assessment methods, with the ultimate objective of reducing the incidence of pressure ulcers.

Keywords: risk assessment, Braden scale, cohort study, pressure ulcers, long-term care, predictor factors

Enhancing the Braden Scale Pressure Ulcer Risk Assessment in Long-Term Care

Facilities: A Cohort Study

Pressure ulcers have continually challenged prevention efforts in long-term care facilities nationwide. A pressure ulcer is defined as a localized injury to the skin and/or tissue as a consequence of continuous pressure, friction, or shear over a bony prominence (Yap, Kennerly, Bergstrom, Hudak, & Horn, 2017). Therefore, reducing exposure to pressure by turning and repositioning patients with compromised mobility is a fundamental component in prevention. Even with healthcare advances, pressure ulcer prevalence remains notably sizable and makes up the third most costly ailment (Yap et al., 2017). Increased cost is associated to wound supplies, debridement or other procedures, specialty mattresses, and hospitalizations.

Pressure ulcers have a detrimental consequence on patient quality of life due to pain, depression, suffering, infection, prolonged treatment, decreased mobility, loss of independence, and increased length of hospitalization (Raetz & Wick, 2015). In supplement to the physical and psychological limitations related to pressure ulcers, they also increase morbidity and mortality (Raetz & Wick, 2015). Nearly all pressure ulcers are avoidable and research indicates implementation of multicomponent interventions helps prevent them (Raetz & Wick, 2015). Multicomponent interventions include a risk assessment (Braden scale), repositioning, staff education, monitoring records/documentation, reducing friction and shear, incontinence care, nutrition assistance, and support surfaces. To accomplish these interventions, support from unit-based clinicians and multidisciplinary team members is required (Raetz & Wick, 2015).

Many older adults suffer from numerous illnesses, frailty, and injury, resulting in the relocation to long-term care facilities. Immobilization, or lying in bed for prolonged periods of time, assists with the progression of pressure ulcers. Pressure ulcers are normally supplemented

by complications including pain, depression, and infection, prompting further health decline with extended agony, longer hospitalization, premature mortality, and increased cost (Jaul, Barron, Rosenzweig, & Menczel, 2018).

Pressure ulcers are painful and hindering, but fundamentally avoidable. Pressure ulcers reduce quality of life and can even lead to premature expiry. (Yap et al., 2017). Additional adverse effects of pressure ulcers include high treatment costs with up to $130,000 per patient (Etafa, Argaw, Gemechu, & Melese, 2018). Most recently, Centers for Medicare and Medicaid Services included pressure ulcers as one of three sentinel events for long-term care; therefore, the development of a pressure ulcer or decline can lead to financial fines with a maximum of $10,000/day in long-term care facilities (Etafa et al., 2018). These costs do not account for the pain and suffering frequently linked with these ulcers.

Preventive interventions have been found to be efficient in reducing pressure ulcers within healthcare associations. The initial phase in pressure ulcer prevention is to recognize high-risk patients. This is usually accomplished through the utilization of the Braden scale. Research suggests out of all risk assessment skills, the Braden scale retains the greatest sensitivity and specificity for predicting pressure ulcers among patients in the acute and long-term care setting (Cox, 2012). In the United States, the Braden scale is the most widely used risk assessment tool among all healthcare organizations to identify high-risk individuals for pressure ulcer development (Cox, 2012). Nursing staff are highly recommended to complete a risk assessment within 24 hours of patient admission. Pressure prevention initiation ultimately depends on the nurse to decide and introduce protocol based on clinical knowledge and understanding. Increasing staff member awareness regarding pressure ulcer physiology is a necessary step to preventing pressure ulcer development (Cox, 2012).

Study Goal

The goal of this project is to examine the Braden scale and determine if enhancing the scale by adding significant predictor factors improves the predictability of pressure ulcer development. The results of this project will enhance awareness of pressure ulcer risk factors and the risk assessment instruments used to assess for them, with a definitive goal of decreasing the prevalence of pressure ulcers.

The purpose of recognizing additional risk factors is to provide an opportunity for health care professionals to quickly identify at-risk patients and implement interventions based on individual risk. Individualized pressure ulcer risk assessment tools provide an opportunity to measure accurate risk so resources, such as specialty beds and mattresses, may be conserved for patients at high risk and reduce unnecessary resources and costs on those who do not require them. Research is necessary to enhance current risk assessment tools to identify specific patients at greatest risk.

The initial step to prevent the development of pressure ulcers is to distinguish who is most at risk, with the fundamental aim to implement useful prevention measures. In order to comprehend an organization's pressure ulcer frequency, it is imperative to recognize their patient populations level of risk for pressure ulcers. Risk assessment tools that determine pressure ulcer risk should predict patients at risk and patients not at risk for pressure ulcer development. Introducing pressure ulcer prevention policies for high-risk patients, rather than all patients, will heighten the applicable use of resources.

Problem Statement

With an aging population, the prevalence and frequency of wound complications is continuing to increase (Etafa et al., 2018). Preventing pressure ulcers is one of the most

significant challenges health care employees encounter on a daily basis (Armstrong et al., 2008). The development of pressure ulcers remains challenging as they are associated with overwhelming costs, pain and suffering, prolonged hospitalization, and morbidity and mortality. The problem that directed this project was pressure ulcers are fundamentally avoidable but continue to exist, especially in the long-term care and in vulnerable populations, such as Alzheimer's patients. In the long-term care population, especially with frail patients, there is a higher degree of functional and cognitive impairment amongst Alzheimer's patients coinciding with immobility, creating a greater risk for pressure ulcer development (Jaul & Meiron, 2017). Patients with Alzheimer's disease are often incapable of reacting to pain or discomfort by repositioning themselves and communicating with staff effectively to express discomfort (Warner-Maron, 2015). In older adults, specifically those in long-term care facilities, it can take merely hours for a pressure injury to present, making prevention interventions difficult (Raetz & Wick, 2015). Since pressure ulcers progress within hours, it is crucial to rapidly recognize and identify high-risk patients and initiate intervention.

Bedsores, also identified as pressure or decubitus ulcers, are painful, take months to heal, and for various patients, never do, leading to increased morbidity and mortality rates (Etafa et al., 2018). The ailment has become so severe that treating pressure ulcers is now a substantial burden on the healthcare system (Etafa et al., 2018). An estimated 2.5 million pressure ulcers are treated in the United States each year, totaling $11 billion yearly to health care costs (Etafa et al., 2018). However, even while pressure ulcers are becoming a more common problem, insurance reimbursement for treatment is not becoming simpler. In 2007, the Centers for Medicare and Medicaid Services added acquired pressure ulcers to the list for treatment costs that will not be reimbursed (Etafa et al., 2018). This leads to an increasing weight of costs on facilities and

patients.

There is limited research on enhancing the Braden scale risk assessment by examining additional risk factors for pressure ulcer development among long-term care patients. Risk screening tools are impractical if they are not pertinent to the population being assessed, do not accurately take into account major risk factors, are utilized inconsistently, and are recorded inaccurately (Thomas, 2001). This may insinuate that the literature on which contemporary preventive intervention measures are centered could be out-of-date. Research is required to confirm that additional risk factors are taken into consideration, so that appropriate treatment interventions can be initiated.

Project Purpose

The purpose of this cohort study is to determine pressure ulcer predictability of the Braden score in comparison to the Braden score with additional predictor factors. Predictor factors examined in this project include those identified in current literature as significant pressure ulcer risk factors: age, gender, comorbidities (Alzheimer's disease, congestive heart failure, fecal and urinary incontinence, malnutrition, osteoporosis, diabetes mellitus, fracture, limb paralysis, cerebrovascular accident, anemia, and malignancy), and history of a previous pressure ulcer.

Clinical Questions

Does reliance on the Braden scale have the capability to accurately predict the risk of pressure ulcers for each individual patient?

Is the combination of predictor variables and the Braden scale a more accurate indicator for at-risk patients in the long-term care setting?

Conceptual Framework

The conceptual framework utilized for this project to facilitate transformation and evaluate literature embraces, "The Helping Art of Clinical Nursing" adopted by Ernestine Wiedenbach in 1963. This particular model emphasizes nursing as the identification of a patient's need for help through exhibiting signs and symptoms and determining the patient's aptitude to treat the discomfort or if the patient has a need for help (Wiedenbach, 2016). Help can incorporate care, education, and guidance (Wiedenbach, 2016). The essential factors correlated with nursing philosophy are a regard for life; regard for the dignity, autonomy, and individualism of each person; and a tenacity to act on philosophies (Wiedenbach, 2016). The art of nursing embraces understanding a patient's needs, developing plans intended to improve a patient's ability, and focusing the plan of care to progress the patient's condition (Wiedenbach, 2016).

Key concepts of Ernestine Wiedenbach's theory include *the patient*, any person obtaining help; *a need-for-help*, any measure required by the patient that has the ability to repair or lengthen the ability to cope with health; *the nurse*, a functioning human being; *knowledge*, incorporates all that has been observed and learned; *judgment*, represents the nurse's ability to make sound decisions; and *nursing skills*, carried out to accomplish a patient-focused resolution (Wiedenbach, 2016).

This study is based on the concept that rapid pressure injury identification and prevention will decrease nursing care burden and progress health outcomes. The ultimate goal comprises of recognizing a patient's need for help required by the patient or family that has the possibility to restore factors that influence health and wellness. Rapid identification of high-risk patients is an essential assessment task to be completed by the nurse in order to reduce pressure ulcer prevalence, which is primary objective for this project.

Literature Review

Search Method

A search was conducted on CINAHL, limited to data published within the last 10 years, using the search field headings *pressure ulcer OR pressure ulcers OR bed sore OR bed sores OR decubitus ulcer OR decubitus ulcers.* This generated over 9,000 results. A second row of key words were combined to narrow down the search using the terms *Braden Scale OR risk assessment.* This yielded over 1,600 results. A third row was added using the term *long-term care.* This yielded 93 results. Additional measures used to narrow the search included limiting search to adults 65+ years and in the English language. Within the available 93 results, all abstracts were scrutinized and the most pertinent articles were integrated. An additional search was conducted using PubMed, again limited to data from the last 10 years, English language, and age 65+. Search terms included *pressure ulcer OR pressure ulcers OR "bed sore" OR "bed sores" OR bedsore OR bedsores OR decubitus ulcer OR decubitus ulcers AND mattress OR mattresses.* This yielded 100 results. The primary objective in the appraisal of abstracts was to locate research information on the cost, resources, and interventions nursing homes and hospitals are utilizing and whether risk assessment tools can help prevent pressure ulcers, decrease costs, and increase recognition. An evidenced based research table was created for the most applicable reviews and included the, author, year of publication, study objectives, methods/design, sample size, variables measured, instrumented used, statistics for data analysis, and study findings. The data is presented from most recent to oldest year of publication. See Table 1: Evidence-Based Table on Pressure Ulcer Prevention & Intervention.

Pathophysiology of Pressure Ulcers

Pressure ulcers, similarly referred as pressure sores, decubitus ulcers and bedsores, are localized injuries of the skin or tissue that appear over bony regions caused by friction, shear, or

pressure (Zuo & Meng, 2015). Warner-Maron (2015) defines six pressure ulcer stages:

> *Stage I pressure ulcers* have intact skin with nonblanchable erythema of a localized area, normally over a bony prominence. *Stage II pressure ulcers* are characterized by partial thickness dermis loss; they present as shallow, open ulcers without slough or as intact or open/ruptured serum-filled or serosanguinous-filled blisters. Stage *III pressure ulcers* experience full thickness tissue loss; slough may be present, and, although subcutaneous fat may be visible in these ulcers, bone, tendon, and muscle are not exposed. *Stage IV pressure ulcers* have full thickness tissue loss with exposed bone, tendon, or muscle; in addition, slough or eschar may be present. *Unstageable ulcers* are characterized by full thickness skin or tissue loss with unknown depth due to the fact that the ulcers are completely concealed by slough and/or eschar. *Suspected deep tissue injury* experience a localized area of discolored intact skin or a blood-filled blister caused by induced soft tissue damage.

Braden Scale

The Braden Scale for Predicting Pressure Sore Risk was developed by Barbara Braden and Nancy Bergstrom in 1987 (Braden, 2012). The Braden scale is a widely used instrument with six subscales used by health care workers to examine risk factors present that are correlated with pressure ulcer development (Cox, 2012). Cox (2012) discovered the Braden scale is not only the most commonly used risk assessment tool, but has been found to be reliable and valid among high-risk patients. Critical care patients are at greater threat for the emergence of pressure ulcers compared to patients in other units of the hospital. In an attempt to prevent pressure ulcers from emerging, risk for development of pressure ulcers must be assessed continuously. One study appraised the analytical validity of the Braden scale by exhausting 4 years of information

from electronic health records (Hyun et al., 2013). With over 7,000 critical care patients in the ICU, the Braden scale displays inadequate predictive rationality and poor precision in distinguishing patients at risk of pressure ulcers emerging (Hyun et al., 2013). The authors recommended additional research is required to conclude the effectiveness of the Braden scale in critically ill patients in the ICU.

One of the most challenging extents of the Braden scale for nurses in all healthcare organizations is evaluating a patient with an existing or history of a pressure ulcer and determining that patient's actual risk for developing an additional ulcer (Warner-Maron, 2015). Therefore, a patient may be considered low or no risk for pressure ulcer development despite the presence of an already existing ulcer. Within this circumstance, the nurse must use their clinical knowledge and judgment in combination with the patient's risk assessment score to establish their actual risk for pressure ulcer development. To accurately determine a patient's risk, nurses must have the capability to recognize the six domains in the Braden Scale, analyze the risk, and use clinical judgment to initiate intervention based on the patient's actual risk (Warner-Maron, 2015). Deciding that a patient is at low or no risk for pressure ulcer development despite already having an actual pressure ulcer is an indication nurses may be concentrating exclusively on the Braden scale questions without formulating their own precise and accurate assessments of the patient's risk (Warner-Maron, 2015). In this instance, if a patient's Braden scale is analyzed incorrectly or if the nurse doesn't take into account additional predictor factors, pressure prevention implementation policies may be hindered.

The Braden scale has exceptional reliability varying from 0.83 to 0.99; sensitivity varying from 83% to 100% and specificity ranges 64% to 90% contingent on the cutoff scores chosen for predicting pressure ulcer risk (Ayello, 2012). The Braden scale details an accumulative risk for

developing pressure ulcers and is encompassed of six domains: sensory, moisture, activity levels, mobility, nutritional status, and friction and shear. The clinician chooses a score varying from 1 to 4 on the domains, with the exception friction and shear ranges from 1 to 3 established on the patient's physical and functional capabilities (Cox, 2012). Then, the clinician adds all scores from each domain to attain an overall score ranging from 6 to 23 that signifies pressure ulcer risk (Cox, 2012). It is generally acknowledged a cutoff score of 18 suggests uniform sensitivity and specificity, therefore demonstrating risk for pressure ulcer development (Cox, 2012).

Furthermore, clinicians can modify pressure ulcer risk, such as 15 to 18 signifying mild risk, 13 to 14 signifying moderate risk, 10 to 12 signifying high-risk, and 9 or less signifying very high-risk (Cox, 2012). Cox (2012) found the Braden scale was correlated with lower specificity and positive predictive value, demonstrating a propensity to overanalyze pressure ulcer development. This signifies the Braden scale failed to sufficiently discern risk degree, resulting in the application of excessive and costly preventive interventions. Ultimately, the Braden scale score attained upon admission is critical from a healthcare perspective, as it permits rapid identification of risk and immediate implementation of prevention policies.

Age

In the elder population, most patients with pressure ulcers are women, as a result of their increased longevity over men (Kirman, 2020). Life expectancy of older adults has drastically increased due to enhanced living situations and developed health care (Jaul et al, 2018). In comparison with increased longevity, many older adults suffer from comorbidities, frailty, and disability, resulting in hospitalizations and transfer to long-term care (Jaul et al., 2018). The older adult tends to display weakened functional capacity (Jaul et al., 2018). Immobility results in the development and presence of pressure ulcers. Persistent chronic diseases can also contribute to

immobility and weight loss, resulting in increased likelihood for pressure ulcers (Jaul et al., 2018). Advanced age is a risk factor in pressure ulcer development as skin tends to be drier, increasing susceptibility for skin breakdown and slow cell regeneration (Jaul et al., 2018). Several pressure ulcer research studies suggest a strong positive association amongst older age and the development of pressure ulcers (Jaul et al., 2018). This indicates the older adult population is more vulnerable to the development of pressure ulcers as a consequence of changes correlated with the aging process (Jaul et al., 2018).

Comorbidities

Recognizing the effect of comorbidities is necessary to comprehend the development of pressure ulcers. Comorbidities are described as the coexistence of multiple chronic diseases in the same patient (Jaul et al, 2018). Currently, 81% of Americans over 65 have more than one chronic condition, while long-term care patients have the highest rate of pressure ulcer development (Jaul et al, 2018).

Diabetes results in a deficiency of sensory awareness from diabetic neuropathy, contributing to bone distortion and destruction, non-healing wounds, and ulcers, particularly in relation to the foot (Jaul et al, 2018). Diabetes also increases the risk for dry skin, increasing the risk for pressure ulcer development (Jaul et al, 2018). *Incontinence* can be either due to advanced disease or adverse effects of medications (Jaul et al, 2018). In a study of pressure ulcers among nursing facility patients, fecal and urinary incontinence was associated with pressure ulcer development (Jaul et al, 2018). For at-risk older adults in long-term care, continence assessment tools are beneficial. *Malnutrition* is expressed as insufficient consumption of calories and protein, producing sarcopenia (Jaul et al, 2018). Malnutrition results in reduced muscle, frailty, and immobilization (Jaul et al, 2018). Patients with malnutrition are susceptible to pressure

ulcers due to muscle atrophy from the reduction of subcutaneous tissue (Jaul et al, 2018). *Congestive Heart Failure* increases the risk of pressure ulcers due to structural changes of the skin from edema or dehydration (Jaul et al, 2018). Patients with a history of *cerebrovascular accidents (*CVA) are at risk for immobilization, falls, and injury, further increasing the risk for pressure ulcers, hospitalizations, and disability (Jaul et al, 2018). *Anemia* assumes the risk for tissue ischemia due to the lack of red blood cells supplying oxygen to the body, further contributing to pressure ulcer development. (Jaul et al., 2018). *Hip fractures* are typically due to osteoporosis, which is correlated with pressure ulcer rates, specifically in the acute and long-term setting (Jaul et al, 2018). Loss of bone mass and density may lead to *osteoporosis*, permitting risk of bone fragility and fracture (Jaul et al, 2018). *Limb Paralysis* may generate deterioration of the skin resulting in thinning and increasing the risk for pressure ulcers (Bhattacharya & Mishra, 2015). Thinning of the skin predisposes the skin to the friction and shear forces patients experience when being repositioned (Bhattacharya & Mishra, 2015). Patients with *malignancy* are at risk for pressure ulcers. It is necessary for health care professionals to control their pain and encourage ambulation in the long-term care setting (Chen, 2017).

In *Advanced Dementia,* the tendency towards being disabled and immobile contribute to increased susceptibility of pressure ulcer development (Jaul et al, 2018). Patients with advanced dementia frequently possess altered sensory awareness, including the incapacity to perceive pressure, pain, or aching from lying in one site for a long period of time (Warner-Maron, 2015). Patients with advanced dementia may additionally be incapable of reacting to the discomfort by repositioning themselves or they may be incapable of effectively communicating with a staff member to express discomfort. Furthermore, patients with advanced dementia may experience continence, nutrition, and swallowing difficulties. Research suggests patients who

experience rapid weight loss are more likely to develop pressure ulcers due to nutritional deficiencies (Warner-Maron, 2015).

Support Surfaces

Pressure-alleviating support surfaces such as overlays, mattresses, and sacral cushions are used to help prevent pressure ulcer development. A systematic review examined the efficacy in ulcer exhibition and the magnitude to which pressure-alleviating support surfaces diminish the prevalence of pressure ulcers compared with ordinary support surfaces (McInnes et al., 2015). It included randomized controlled trials that evaluated the results of any support surface for prevention of pressure ulcers, and only direct wheelchair pressure was excluded. McInnes et al. (2015) discovered foam substitutes to ordinary hospital mattresses decrease the prevalence of pressure ulcers in individuals at risk (McInnes et al., 2015). The authors concluded that individuals at greater risk should use advanced specification foam mattresses rather than the standard hospital, although the ladder is more cost effective (McInnes et al., 2015).

Multifaceted Interventions

Niederhauser et al. (2012) conducted a systematic review that described the multifaceted interventions to prevent pressure ulcers in long-term care facilities. Pressure prevention best practices, clinician education, monitoring and feedback, skin care teams, and cueing were the recurrent factors utilized in the initiation and application of prevention programs (Niederhauser et al., 2012). Of the 6 studies reporting pressure ulcer incidence rates, five reported a decrease in rates (Niederhauser et al., 2012).

There is sufficient evidence to propose the implementation of a multifaceted intervention to prevent pressure ulcers (Raetz & Wick, 2015). Interventions including support surfaces, repositioning based on facility protocol, maintaining nutritional status, and avoiding friction and

shear have been found to be suitable approaches for pressure ulcer prevention (Raetz & Wick, 2015). Additional suggestions include a multidisciplinary team, wound team, evaluating the facility protocol and enduring staff preparation and education (Raetz & Wick).

Past Interventions

Recent pressure ulcer prevention interventions in long-term care have tackled the issue of dependable care delivery by using modern approaches of cueing to warrant timely and consistent turning and repositioning of patients. Cueing supports storage of the frequently arranged task of repositioning in staff recall and strengthens recollection in the occurrence of distracting incidents (Yap et al., 2017). Various cueing constituents include safety and care checklists where the CNA turns patient, detects skin condition, raises heels, and documents care. The emphasis of care reveals changes in skin condition by turning each encounter with the patient. Music inspires all staff contribution in encouraging movement of patients. Nursing staff are dispersed to patients who need additional assistance. TURN TEAMS remind staff of prevention knowledge through education. This continuing process assists as a visual cue to increase alertness, influence, and reinforce education (Yap et al., 2017).

Systematic Review

Preventing increases in pressure ulcer rates are important not only to protect patients from harm but to reduce costs of caring for them. Studies that implemented initiatives to prevent pressure ulcers in long-term care settings report a decrease in rates at least six months after implementation were selected. A systematic review included 59 prevention studies that addressed impaired mobility, nutrition, and skin health (Sullivan & Schoelles, 2013). The authors established that using support surfaces, regularly repositioning the patient, enhancing nutritional status, and conditioning skin are suitable strategies for prevention. In 18 studies of prevention

programs, interventions in care settings included moisture management, mechanical means of

reducing friction and shear, nutritional assessments, hydration, and repositioning (Sullivan &

Schoelles, 2013). The implementation of a multicomponent strategy diminishes pressure ulcer

incidence, increased fixated communication among caregivers, and improved clinician

performance (Etafa et al., 2018). In the long-term care setting, the use of multiple interventions

led to reductions in prevalence of pressure ulcers from 28.3% to 9.3% (Sullivan & Schoelles,

2013).

Risk Factors

Intrinsic risk factors for development of pressure ulcers include diabetes, smoking,

malnutrition, sustained immobility, and fractures (Yap et al., 2017). Extrinsic factors include

restraints, lack of repositioning with staff guidance, and poor skin hygiene. Despite a number of

new dressings and treatments accessible for management, none has been proven to have a

substantial advantage over the other. The simple principles include maintaining perfusion and

hygiene of the wound and finding advances to decrease prevalence among vulnerable patients

 (Boyko, Longaker, & Yang, 2018). Despite maintaining adequate prevention measures, pressure

ulcers may progress if ample risks factors are present (Boyko et al., 2018).

Deficiencies in Past Studies

Prevention and management of pressure ulcers involve patient repositioning, usually

accomplished by caregivers physically turning bedbound patients every 2 hours. Turning patients

consistently is a labor-intensive and time-consuming method, which places caregivers at

jeopardy for workplace injuries and does not prevent occurrences, even when harshly

implemented. Limitations of applying pressure ulcer prevention measures include staffing, time,

and financial resources. In many circumstances, long-term care facilities are understaffed and

staff may not have the time to take extra initiatives to turn patients at high-risk every 2 hours or reassess wounds during each turn. Facilities also have limited funds and resources for wound care supplies, specialized mattresses, and incontinence care products. The high rate of staff turnover in long-term care facilities is a worry when endorsing a new practice for refining a present one. Turnover is likely to impact quality of care by interfering with continuity of care and diminishing the standard of care. Development of an appropriate pressure ulcer prevention program as well as interpretation of all functioning limitations prior to implementation into the clinical setting is often a barrier to progression.

There is limited research on enhancing the Braden scale risk assessment by examining additional risk factors for pressure ulcer development among long-term care patients. Braden (2012) reported a worthy predictive validity in long-term care, with sensitivity of 79%, specificity of 74%, 54% predictive value of a positive test, and 90% predictive value of a negative test. However, a prospective cohort study found the Braden scale has restricted predictive capability in long-term care. At a score of 18, the sensitivity of the scale was 100%, but the specificity was merely 34% (Chen, Shen, & Liu, 2016).

Methods

Project Design

Internal Review Board (IRB) approval for this cohort study data analysis as an exempt study (no personal identifying information to be documented) was obtained by DePaul University on June 12, 2020. As an exempt cohort study, no informed consent was required. This cohort study in the long-term care setting from January-July 2020 will investigate the differences between Braden scores and additional predictor factors in patients with and without pressure ulcers. This project is intended to examine pressure ulcer predictability of the Braden score

compared to the Braden score with additional predictors factors. Predictor factors explored in this study include those described in current literature as substantial pressure ulcer risk factors: age, gender, comorbidities, and history of previous pressure ulcers.

This study utilized an observational cohort research design. A cohort study is appropriate to appraise the effectiveness of an intervention based on evidence and data. This type of research design permits the researcher to evaluate the incidence of pressure ulcer development. A cohort study allows for large samples in patients who share a common characteristic, such as risk for pressure ulcers. Logistic regression statistical analysis was applied to establish how successful Braden total scores were in a pressure ulcer predictive model with and without the addition of additional predictor factors. A separate relative risk model was tested using only the most applicable predictor factors correlated with pressure ulcer prevalence in this model without the Braden score in an effort to cultivate the most relative model. The results of this cohort study heighten the current understanding of pressure ulcer risk factors and risk assessment instruments and provides focus for impending studies, with a fundamental purpose of reducing the prevalence of pressure ulcers.

Sample

The research was conducted solely at Symphony of Lincoln Park in Chicago, Illinois. All patient records from January 2020 through July 2020 were reviewed and identified to attain data recorded on the data collection sheet of patients who developed pressure ulcers during that time frame along with the same number of patients who did not develop pressure ulcers but were classified as at-risk as evidenced by a Braden score of 18 or less. Exclusion criteria includes patients without documentation of a pressure ulcer within the 6-month span and Braden score >18. Over 400 electronic patient records from Symphony of Lincoln Park from January 2020

through July 2020 were examined to acquire data recorded on the data collection sheet until all patients who developed pressure ulcers during the specified timeframe were known and residents in the same facility but did not develop pressure ulcers during that timeframe were documented, resulting in a total of 119 adult long-term care residents.

Setting

The facility is a post-acute long-term nursing home located in Chicago, Illinois. This facility was selected because they have a wound team that rounds on patient's daily to assess the outcome of treatment and they have a profound concern for improving patient outcomes. Symphony's PointClickCare Risk Management Reports were assessed to attain the records of all those who developed pressure ulcers during the selected dates of January 1st, 2020 to July 1st, 2020. This resulted in 64 cases with pressure ulcers. Symphony's admission records were examined to acquire records of patients admitted between the same time frame but who did not develop pressure ulcers and whose Braden Scores were less than 18. This resulted in 55 subjects without pressure ulcers

Population

Symphony of Lincoln Park is comprised of skilled-nursing and long-term care nursing facility in Chicago, Illinois. The elderly in general are at higher risk for developing pressure ulcers, particularly if they have trouble ambulating. This is owed to complications such as mobility, frailty, poor nutrition and hydration, poor blood perfusion, incontinence, and communication. Subsequently, with a lack of adequate staffing, incontinence and wound care remain a large factor in the prevalence of pressure ulcers. In this research study, all patients who developed a pressure ulcer within the specified time frame and those who did not but have a Braden score <18 will be included in the data.

Measurement

The data collection tool (see Appendix B) was established by the researcher to measure pressure ulcer predictability of the Braden score in comparison to the Braden score with additional predictor factors. Data was collected using the top 11 diagnoses identified in the literature review along with age, gender, and history of previous pressure ulcer. PointClickCare, which is the facility's primary documentation system, was accessed. Medical information previously recorded and collected within the patient system was reviewed, beginning with residents who developed a pressure ulcer during the indicated timeframe. Then, residents were examined from the same time period, dismissing those who were recognized as having developed pressure ulcers. The patient records were assessed and only the non-identifying data listed on the data collection sheet was collected. Data from the collection tool was inputted onto Excel and stowed on a secure file. The finalized data collection sheets, as well as Excel spreadsheets were kept in a locked file at Symphony of Lincoln Park. Logistic regression was applied to examine how predictive Braden scores are with and without the addition of predictor factors. Predictor variables include demographic data (age and gender), comorbidities, and history of a previous pressure ulcer.

Data Collection

Non-identifiable data was documented from the electronic medical record onto the data collection tool and then onto an Excel spreadsheet, converted onto an SPSS data file. Data was gathered using the data collection tool. Data from the patient electronic health records was examined using the predictor factors identified in the data collection tool (see Appendix B). Data from the patient records was examined using the top 11 diagnoses identified in the collection tool. These diagnoses were described as binary categorical variables with no (not present) coded

as 2 and yes (diagnosis was present) coded as 1. A diagnosis or documented history of previous

pressure ulcer was also reported and included a categorical independent variable (yes=1, no=2).

Age, gender, and total Braden Scale were also recorded. Age was reported through continuous

scale variables. Gender was reported as a categorical variable (female=1, male=2). Total Braden

Scale was reported as continuous scale variables. Incident report records were examined to

obtain data of all patients who developed pressure ulcers while residing at the long-term care

facility from January 2020-July 2020. An additional search within the database was examined to

obtain records of patients within same time period but did not develop pressure ulcers and whose

Braden scores were less than 18. A score of >18 indicates no risk of pressure ulcers; 15-18

indicates mild risk; 13-14 is indicates of moderate risk; 10-12 indicates high risk; and less than

≤9 indicates very high risk.

The outcome variable was reported as a dichotomous variable (did not develop a pressure

ulcer was recorded as 1, and did develop a pressure ulcer was coded as 2). The prevalence of

pressure ulcers was classified by any diagnosis of pressure ulcers that was validated by

comprehensive skin and wound evaluations by a licensed nurse or wound care specialist.

Data Analysis

Descriptive statistics, such as examining the standard deviation, mean and ranges for age

and total Braden scores were reported for the total sample in addition to the outcome groups of

those who did versus did not develop a pressure ulcer. Frequencies were reported for gender,

history of previous pressure ulcer, and prevalent comorbidities (Alzheimer's disease, congestive

heart failure, fecal and/or urinary incontinence, malnutrition, osteoporosis, diabetes mellitus,

fracture, limb paralysis, cerebrovascular accident, anemia, and malignancy). The frequencies of

these diagnoses were conveyed for the total sample as well as each of the two outcome groups

(those who did develop versus those who did not). Bivariate analysis was conducted to investigate distinctions between patients with and without pressure ulcers. Variances between groups with consideration to scale variables were tested using independent samples t-tests statistics. Independent sample t-tests were applied to observe for differences between group means for age and total Braden scores. Differentiation amongst groups with regard to categorical variables was examined with Chi-squared and Mann-Whitney U Statistics. Non-parametric statistics, such as Chi-square and Mann-Whitney U statistics, were analyzed to investigate differences between the two outcome groups for gender, history of previous pressure ulcers, and each medical diagnosis. The data was scrutinized comparing differences between those that did develop a pressure ulcer and those that did not develop a pressure ulcer within adult long-term care patients.

Logistic regression analysis was utilized to establish how effective a pressure ulcer predictive model was using Braden total scores with and without the inclusion of other medical factors identified in the literature review. Whether a patient did or did not develop a pressure ulcer was the binary categorical dependent variable. Independent variables (Braden total scores and specified predictor factors) that were projected to have a noteworthy relationship with pressure ulcers were computed in the logistic regression model. Goodness of Fit statistics (-2 log likelihood) were tested for every model and classification tables were inspected for how precisely the model was able to calculate pressure ulcer cases Considerable differences in the models were investigated to conclude if the identified diagnosis or other predictor factors enhanced the predictive validity of the Braden score.

Ethical Considerations

All research activities were free from coercion or unwarranted impact. The cohort study did not involve inspection or recording of any patient. Data that was retrieved from the chart was de-identified and an alphanumeric code was used to during data collection to maintain anonymity. The researcher used password-protected computers, which was stored in a locked cabinet at the investigator's home. The study did not cause any distress, injury, or harm when implemented. Prior to study implementation, approval from the DePaul University and Institutional Review Board (IRB) was obtained, along with a letter of support for data collection from Symphony of Lincoln Park.

The researcher of this project has fulfilled the required training on human subjects' protection through the Collaborative Institutional Training Initiative (CITI) program. The CITI training was completed April 1, 2020 and included information on privacy and confidentiality, federal regulations, assessing risk, informed consent, conflicts of interest, and reporting requirements in social and behavioral research.

Assumptions

Assumptions to be met for logistic regression analysis incorporate representative sample, no empty cells, and multicollinearity. Representativeness of the subjects was met due to the sample size (n>100) and comparatively random selection of subjects. Subjects were chosen to contain all patients that developed pressure ulcers from January 2020 to July 2020 and then randomly from each of the same months among patients that did not develop pressure ulcers but had Braden scores 18 or less, until over 100 total subjects were attained. Independence was met because there were no repeated measures and all data collected was from individual participants.

Results

Characteristics of the Sample

The total sample included 88 female (73.9% of sample) and 31 male subjects (26.1% of total sample). Age of subjects in the total sample ranged from 52 years of age to >99 years of age, with the mean total sample age of 78 years and standard deviation 11.2. Age and numerical variables are described for the entire sample in table 3. Fifty-five (46.2%) residents did have a previous history of pressure ulcers. Sixty-four residents (53.8%) had no history of previous pressure ulcers. Sixty-one (51.3%) had a diagnosis of Alzheimer's disease. Thirty-one (26.1%) had a diagnosis of congestive heart failure. Sixty-five (54.6%) had a diagnosis of fecal and urinary incontinence. Fifty-two (43.7%) had a diagnosis of malnutrition. Sixty-eight (57.1%) had a diagnosis of osteoporosis. Fifty-one (42.9%) had a diagnosis of diabetes mellitus type 2. Thirty-four (28.6%) had a diagnosis of previous or current fracture. Twenty-two (18.5%) had a diagnosis of cerebrovascular accident. Sixteen (13.4%) had a diagnosis of limb paralysis. Thirty-six (30.3%) had a diagnosis of malignancy. Sixty-four (53.8%) had a diagnosis of anemia.

Comparison of Groups

Comparison of the residents who did develop pressure ulcers versus those residents who did not develop pressure ulcers are shown within Table 4 and Table 5. Table 4 describes the means and standard deviation of other numerical variables for both groups (with/without pressure ulcer) as well as two-tailed t-test results for substantial differentiations between means of the scale variables (age, total Braden scale). The average age of residents with PU was 78.5 years (see Table 4). The average age of residents without PU was 77.4 years. The difference in mean ages of residents within the two groups was 1.1 years, which was not statistically significant (p= 0.590). Total Braden scores averaged 15.2 for those with PU, and 16.2 for residents without PU; the mean difference (1) is statistically significant (p= 0.015)

Table 5 examines the differences between groups (those with vs. those without pressure ulcers) in the sample regarding the frequency of demographic and medical factors. Comparison between groups was assessed using Chi-square statistic and the level of significance of this test is reported for each factor. Gender distribution of the sample includes 88 females (47 with PU, 41 without PU), and 31 males (16 with PU, 15 without PU). The difference in gender distribution as a whole among those residents that did develop pressure ulcers and those that did not was not statistically significant ($p= 0.778$). The total sample (119 residents) had 55 (46.2%) with previous pressure ulcers documented in their chart. All fifty-five residents developed a pressure ulcer (87.3%). Sixty-four (53.8%) of residents without history of PU, 8 developed a PU (12.7%). The group difference is statistically significant ($p= 0.000$). Please see Table 5 for each diagnosis (Alzheimer's disease, congestive heart failure, fecal and urinary incontinence, malnutrition, osteoporosis, DM2, fracture, cerebrovascular accident, limb paralysis, malignancy, and anemia) and the consequent frequencies and group differences of these diagnoses in the total sample. Those diagnoses that determined statistically significant differences between groups were: Alzheimer's ($p= 0.000$), CHF ($p= 0.008$), incontinence ($p= 0.000$), malnutrition ($p= 0.000$), osteoporosis ($p= 0.000$), DM2 ($p= 0.001$), limb paralysis ($p= 0.018$), and anemia ($p= 0.000$).

Regression Analysis

Logistic regression was begun by entering the total Braden score as a predictor variable in step one and "developed pressure ulcer" as the dependent variable. Goodness of Fit statistics (-2 log likelihood) were tested for every model and classification tables were inspected for how precisely the model was able to calculate pressure ulcer cases. Please see Table 6 for Logistic regression analysis results. Model 1 (Braden only) accurately classified 75.6% of the total sample (76.6% accuracy in the PU group and 74.5% in the no PU group). Secondly, predictor

facts (age, gender, history of PU) were entered in step one of a separate LR model). Age, gender, and history of previous pressure ulcer in a predictive model by themselves could accurately classify 95% of total sample (93.8% with PU were correctly classified and 96.4% without PU were correctly classified). Thirdly, total Braden scores was entered into step one of the same model (model 2) and the three predictor factors (age, gender, total Braden) was entered in step two (model 2). The total Braden + age, gender, and history of previous pressure ulcer could predict 100% of total sample (100% yes PU groups, 100% no PU). Next a separate LR model (model 3) was run with significant variables (Alzheimer's, CHF, incontinence, malnutrition, osteoporosis, DM2, fracture, CVA, limb paralysis, malignancy, and anemia). This model was able to predict 95.8% of total sample (96.9% yes PU, 94.5% no PU). Within the same model (3), Total Braden was entered into step one along with the diagnoses in step two. Total Braden + medical diagnoses were able to predict 97.5% of total sample (96.9% yes PU, 98.2% no PU). Lastly, within the same model, all predictors factors (gender, history of PU, and medical diagnoses) were added in step 3. The predictor factors alone were able to predict 99.2% of total sample (98.4% yes PU, 100% no PU).

The relative risk (see Table 7) of history of pressure ulcers is projected with an odds ratio of 7.1 (95% *CI* 3.881-13.031, *p*= 0.000), indicating a resident with a history of previous pressure ulcer is 7 times more likely to develop pressure ulcers than those who do not have a history of pressure ulcer. Other relative risks: Alzheimer's odd ratio 3.617 (95% *CI* 1.695-7.721, *p*= 0.001), CHF odds ratio 3.296 (95% *CI* 1.331-8.163, *p*= 0.008), incontinence odds ratio 11.489 (95% *CI* 4.864-27.139, *p*= 0.000), malnutrition odds ratio 20.870 (95% *CI* 7.618-57.173, p= 0.000), osteoporosis odds ratio 5.250 (95% *CI* 2.386-11.552, *p*= 0.000), DM2 odds ratio 5.250 (95% *CI*

1.584-7.420, *p*= 0.001), limb paralysis odds ratio 4.418 (95% *CI* 1.188-16.432, *p*= 0.018), and anemia odds ratio 8.711 (95% *CI* 3.804-19.950, *p*= 0.000).

Discussion

The purpose of this cohort study is to determine pressure ulcer predictability of the Braden Scale total score on the development of pressure ulcers in long-term care residents, to conclude if the addition of other predictor factors to these Braden total scores enhance the model's predictability of pressure ulcer development in long-term care residents, and to determine if predictor factors alone are able to determine development of pressure ulcers. Predictor factors examined in this project include those identified in current literature as significant pressure ulcer risk factors: age, gender, comorbidities (Alzheimer's disease, congestive heart failure, fecal and urinary incontinence, malnutrition, osteoporosis, diabetes mellitus, fracture, limb paralysis, cerebrovascular accident, anemia, and malignancy), and history of a previous pressure ulcer.

The general assumption from this analysis was that a logistic regression model of pressure ulcer development in long-term care residents indicated 9 predictors able to determine a statistically significant risk of pressure ulcer development. Specifically, the analysis suggested high risk Braden total scores (mean=15), history of pressure ulcer, anemia, limb paralysis, osteoporosis, malnutrition, incontinence, CHF, Alzheimer's, and DM2 can be predictive of the development of pressure ulcers in long-term care residents. The analysis integrated a predictive model using binary logistic regression, which revealed that the Braden total score alone was accurately able to predict 75.6% (76.6% subjects that did develop pressure ulcers were accurately predicted and 74.5% of subjects which did not develop pressure ulcers were accurately predicted in the Braden score only model). Adding the presence of history of pressure

ulcer, anemia, limb paralysis, osteoporosis, malnutrition, incontinence, CHF, Alzheimer's, and

DM2 was able to accurately predict 98.3% (96.9% with PU, 100% without PU). The nine-factor

model summary -2 Log likelihood statistic suggested a good fit of the model to the data (Table

7). This analysis maintains the concept the addition of 9 additional predictor factors to the

Braden total scores will enhance the model's predictability of pressure ulcer development in the

long-term care population.

Implications and Recommendations for Practice

Several noticeable implications are implied from the analysis of data from this cohort

study. The total Braden Score, while still able to accurately predict 75.6% of the cases in the

study, was only able to accurately predict 76.6% of those with pressure ulcers. This suggests that

the Braden score alone may not be the most accurate prediction model of pressure ulcer risk.

With the addition of medical diagnoses and history of PU, the logistic regression can predict

almost 100% of cases, allowing nurses and other healthcare staff to take quicker action. This

study assessed only some of what was projected to be the greatest predictors of pressure ulcers

classified in the literature. More research is necessary to validate the findings of this study in a

larger populace. If the nine-factor pressure ulcer predictive model can be validated on a larger

scale through other studies, it could exemplify momentous clinical development in pressure ulcer

risk assessment. Preventing pressure ulcers is important not only to protect patients from injury

but also reduce costs of caring for them. Morbidity caused by pressure ulcers can result in

increased use of costly resources and longer hospitalization. Research cohort studies may help

stimulate behavioral change by the healthcare professional and support an overall reduction in

the incidence and prevalence of pressure ulcer development. Studies have been conducted that

report interventions eliciting changes across a series of concepts; such as knowledge of pressure

ulcer prevention, classification, compliance with clinical guidelines, and risk assessment. Research and education in prevention may produce positive changes in the knowledge and clinical behaviors of individuals, leading to enhanced compliance with evidenced-based practice and pressure prevention.

The development of pressure ulcers remains challenging as they are associated with overwhelming costs, pain and suffering, prolonged hospitalization, and morbidity and mortality. Because pressure ulcers are considered preventable by CMS, they are no longer reimbursing healthcare organizations for acquired pressure ulcers past stage 2 (Etafa et al., 2018). Since pressure ulcers progress within merely hours, it is crucial to rapidly recognize and identify high- risk patients and initiate intervention. Risk assessment is accomplished through utilization of the Braden scale. The objective of risk assessment is to detect high-risk patients, implement immediate interventions, and evaluate patients not at risk who do not require intervention.

This research project is significant, as it emphasizes the importance of mutual understanding among health care providers and other interdisciplinary team members in conveying research and reliable interventions that address risk assessment, documentation, patient and clinician education, and research-based intervention protocols. Prevention requires input among all staff members, including teams involved in developing and implementing the care design. To achieve this, high quality prevention involves operational exercises that stimulate cooperation and collaboration, along with proficiency.

Conclusion

In conclusion, this study does insinuate support for the concept that medical factors and diagnoses can enhance the Braden Scale in a pressure ulcer predictive model. Findings from this

study indicate that recognizing patients with history of previous PU and specific diagnoses (anemia, limb paralysis, osteoporosis, malnutrition, incontinence, CHF, Alzheimer's, and DM2) may be better able to identify long-term care patients at high risk of pressure ulcers than current Braden risk assessment scores alone. More research is needed to substantiate these findings and investigate contemporary risk assessment methods, with the ultimate objective of reducing the incidence of pressure ulcers.

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Table 1: Evidence-Based Table on Pressure Ulcer Prevention & Intervention

Author and Year	Methods (Design, Sample Size, Setting, Human Subjects Issues)	Study Variables or Constructs Measured or Variables Controlled for by Researchers	Instruments and Statistics Used to Measure the Constructs	Study Findings
Etafa, Argaw, Gemechu, and Melese (2018)	A self-reported institutional board based cross-sectional study design was retained to assemble data from staff nurses working in six selected public hospitals.	The research conveyed that the important variables with the presence of pressure ulcers include: longer periods of hospitalization, limited sensory perception, and friction and shearing forces.	A questionnaire was used for data collecting. Part two of data gathering includes the pressure ulcer attitude test tool. The validity of instruments was evaluated by nursing educators. Research recognized the main obstacles for nurses to establish pressure ulcer prevention practice, which include lack of time, inadequate staffing, and uncooperative patients.	The study insinuates nurses have negative attitudes to pressure ulcer prevention. Heavy workload and inadequate staffing, deficiency of resources and equipment, and insufficient education were between the chief barriers acknowledged in the study.
Yap, Kennerly, Bergstrom, Hudak, and Horn (2017)	Randomized intervention trial over the span of 12 months in long-term care.	N/A	Musical selections were played over the facility system every 2 hours during the morning and afternoon. Changes in care processes. Prevention effect: pressure ulcer prevalence and incidence. Performance stability: repositioning and brief care, safety, early identification and documentation of skin changes.	Facility occupants were 45% less probable to develop a new pressure ulcer. Musical cues prompt staff teams to inspire or support all occupants to oblige to TURN TEAMS to reduce facility-acquired pressure ulcers.
Chen, Shen, and Liu (2016)	Meta-analysis was conducted in the PubMed database.	N/A	Instruments include sensitivity and specificity.	Evidence showed the Braden scale has adequate predictive validity and low predictive specificity for pressure ulcers in long-term care residents.
McInnes et al. (2015)	Randomized controlled trials and quasi-randomized trials. Any patient or setting which measure pressure ulcer occurrence. Systematic review.	Key variables include: age, sex, risk of pressure ulcer development, area of existing ulcers.	Grades of new pressure ulcers, incidence of new pressure ulcers and secondary outcomes (costs, comfort level, quality of life). Data was obtained by one review author and tested by another. Estimates from comparable research were combined for meta-analysis.	Foam substitutes to standard hospital foam mattresses reduce the incidence of pressure ulcers.

Table 1 continued

Author and Year	Methods (Design, Sample Size, Setting, Human Subjects Issues)	Study Variables or Constructs Measured or Variables Controlled for by Researchers	Instruments and Statistics Used to Measure the Constructs	Study Findings
Zuo and Meng (2015)	Review of ICU literature from 2000 to 2005.	N/A	Utilized the 2009 international pressure ulcer prevalence survey.	Exhausted obtainable data into five central areas imperative for pressure ulcer prevention: risk assessment, skin assessment, support surfaces, nutrition, and repositioning. Additional conclusions are desired to validate the efficacy of the care bundle.
Hyun et al. (2013)	Data from electronic health records of patients admitted to ICU between January 1, 2007 and December 31, 2010 were removed from the data. The setting for this study was a 3 adult ICU.	Patients who had a pressure ulcer at the time of admission were excluded, thus permitting inclusion solely of patients who acquired a pressure ulcer during the hospital stay. Patients whose ICU stay was shorter than 3 days was excluded.	Predictive validity was measured by using sensitivity, specificity, positive predictive value, and negative predictive value. A total of 7790 patients were included in the analysis with a limit score of 16 on the Braden scale. Python Software Scripts were used for data formulation and exploration.	The Braden scale shows inadequate predictive validity and poor precision in discerning intensive care patients at risk of pressure ulcers developing.
Sullivan and Schoelles (2013)	Systematic review. All studies of multicomponent interventions aimed at pressure ulcer prevention in adults were included. 26 studies were included, three RCTs, 22 time-series designs.	Key variables of successful implementation were the simplification and standardization of pressure ulcer explicit interventions and documentation, immersion of multidisciplinary teams and management, designated skin champions, on-going staff education, and feedback.	Study quality was assessed using the 19-item SQUIRE with emphasis on: intervention depiction, alterations in the care and delivery course and patient outcome measures, study limitations, and purpose for changes between perceived and anticipated outcomes. Complications from hospital-acquired pressure ulcers produce 60,000 deaths and illness yearly in the United States.	Sufficient evidence proposed that implementing multicomponent interventions for pressure ulcer prevention in acute and long-term care settings could improve the practices of care and reduce pressure ulcer rates.

Table 1 continued

Author and Year	Methods (Design, Sample Size, Setting, Human Subjects Issues)	Study Variables or Constructs Measured or Variables Controlled for by Researchers	Instruments and Statistics Used to Measure the Constructs	Study Findings
Cox (2012)	Comprehensive review of the literature concentrating on the predictive value of the complete Braden scale score and individual subscale scores in defining pressure ulcer risk in the critical care population.	Braden scale subscales: sensory perception, moisture, activity, mobility, nutrition, and friction and shear.	Instruments involved electronic database such as CINAHL and MEDLINE. In the critical care population, predictive validity reported 83% sensitivity, 64% specificity with a NPV of 85% and PPV of 61% based on a cutoff score of 16.	Research indicates that critically ill patients who develop pressure ulcers are classified as at risk by the Braden scale and that most of the patients who did not develop pressure ulcers were also classified as at risk.
Niederhauser et al. (2012)	A systematic review of the literature describing multifaceted pressure ulcer prevention programs was performed. Articles were included if they portrayed an intervention applied in acute care setting or long-term care facilities, included more than 1 intervention element, involved a multidisciplinary team, and contained evidence about conclusions associated to the intervention.	N/A	N/A	Developing literature including multidisciplinary interventions to prevent pressure ulcers. 9 studies reported decreased prevalence rates at the end of the programs. Of the 6 studies reporting pressure ulcer incidence rates, 5 conveyed a decline in incidence rates.

Table 2: Pressure ulcer study sample demographics

	Total sample n=	% Sample	Missing cases from sample
Female	88	73.9%	-
Male	31	26.1%	-
Previous PU	55	46.2%	0
Alzheimer's disease	61	51.3%	0
Congestive heart failure	31	26.1%	0
Fecal and urinary incontinence	65	54.6%	0
Malnutrition	52	43.7%	0
Osteoporosis	68	57.1%	0
Diabetes Mellitus Type 2	51	42.9%	0
Fracture	34	28.6%	0
Cerebrovascular Accident	22	18.5%	0
Limb Paralysis	16	13.4%	0
Malignancy	36	30.3%	0
Anemia	64	53.8%	0

Table 3: Total sample variable descriptive statistics

Variable	N	Mean	Median	Std. Deviation	Minimum	Maximum
Age	119	78.0168	77	11.17350	52	99
Total Braden score	119	15.6471	16	2.23071	10	22

Table 4: Comparison of mean differences between groups

Variable	Mean Yes PU	Mean No PU	Mean Diff	T	Sig. (2 tail) p
Age	78.5	77.4	1.1	.540	.590
Total Braden score	15.2	16.2	-1	-2.476	.015

Table 5: Differences between groups for predictor variables

Total sample= 119 Yes PU= 64 No PU= 55	Total sample n=x/% sample	Yes PU n/% this group	No PU n/% this group	Chi-Square Statistic	Sig P.
Gender: Female Male	88/73.9% 31/26.1%	47/74.6% 16/25.4%	41/71.9% 15/26.3%	.079	.778
Previous PU Yes PU No PU	55/46.2% 64/53.8%	55/87.3 8/12.7%	- 56/98.2%	87.885	.000
Age 50-59 60-69 70-79 80-89 90+	10/8.3% 12/10% 46/38.7% 30/25.2% 21/17.7%	5/8% 4/6.4% 24/38.2% 21/33.4 9/14.4%	5/9% 8/14.2% 22/38.7 9/16.1% 12/21.2%	32.895	.812
Total Braden Score ≤9 10-12 13-14 15-18 >18	- 10/8.3% 24/20.2% 76/63.9% 9/7.5%	- 9/14.3% 20/31.8% 25/39.7% 9/14.3%	- 1/1.8% 4/7.1% 51/89.5% -	39.778	.000
Yes Alzheimer's **No** Alzheimer's	61/51.3% 58/48.7%	42/66.7% 21/33.3%	19/33.3% 37/64.9%	11.436	.001
Yes CHF **No** CHF	31/26.1% 88/73.9%	23/36.5% 40/63.5%	8/14% 48/84.2%	7.027	.008
Yes Incontinence **No** Incontinence	65/54.6% 54/45.4%	51/81% 12/19%	14/24.6% 42/73.7%	35.100	.000
Yes Malnutrition **No** Malnutrition	52/43.7% 67/56.3%	46/73% 17/27%	6/10.5% 50/87.7%	44.687	.000
Yes Osteoporosis **No** Osteoporosis	68/57.1% 51/42.9%	48/76.2% 15/23.8%	20/35.1% 36/63.2%	18.030	.000
Yes DM2 **No** DM2	51/42.9% 68/57.1%	35/55.6% 28/44.4%	16/28.1% 40/70.2%	10.142	.001
Yes Fracture **No** Fracture	34/28.6% 85/71.4%	22/34.9% 41/65.1%	12/21.1% 44/77.2%	2.285	.131
Yes CVA **No** CVA	22/18.5% 97/81.5%	16/25.4% 47/74.6%	6/10.5% 50/87.7%	3.897	.048
Yes Limb Paralysis **No** Limb Paralysis	16/13.4% 103/86.6%	13/20.6% 50/79.4%	3/5.3% 53/93%	5.611	.018
Yes Malignancy **No** Malignancy	36/30.3% 83/69.7%	24/38.1% 39/61.9%	12/21.1% 44/77.2%	3.447	.063
Yes Anemia **No** Anemia	64/53.8% 55/46.2%	49/77.8% 14/22.2%	15/26.3% 41/71.9%	28.911	.000

Table 6: Logistic regression analysis results of models

Model and Step	Variable Name	% Total Cases Correctly Classified	% Yes PU Correctly Classified	% No PU Correctly Classified	Model -2 log Likelihood	Model Chi-Square Statistic	Sig. p
1/1	Total Braden	75.6%	76.6%	74.5%	117.694	46.593	.000
2/1	Age, Gender, History of PU	95%	93.8%	96.4%	22.363	141.925	.000
2/2	Total Braden + Age + Gender + History of PU	100%	100%	100%	.000	164.288	.000
3/1	+ Alzheimer's + CHF + Incontinence + Malnutrition + Osteoporosis + DM2 + Fracture + CVA + Limb Paralysis + Malignancy + Anemia	95.8%	96.9%	94.5%	44.350	119.937	.000
3/2	Total Braden Score + Alzheimer's + CHF + Incontinence + Malnutrition + Osteoporosis + DM2 + Fracture + CVA + Limb Paralysis + Malignancy + Anemia	97.5%	96.9%	98.2%	38.981	125.307	.000
3/3	+ Gender + History of PU + Alzheimer's + CHF + Incontinence + Malnutrition + Osteoporosis + DM2 + Fracture	99.2%	98.4%	100%	14.091	150.197	.000

+ CVA + Limb Paralysis + Malignancy + Anemia					

Table 7: Relative risk of pressure ulcers by predictors

	Odds Ratios	95% CI	Sig. p
Braden Total Scores	-	-	-
Gender	1.125	0.496-2.554	.778
Age	-	-	-
History of PU	7.111	3.881-13.031	.000
Alzheimer's	3.617	1.695-7.721	.001
CHF	3.296	1.331-8.163	.008
Incontinence	11.489	4.864-27.139	.000
Malnutrition	20.870	7.618-57.173	.000
Osteoporosis	5.250	2.386-11.552	.000
DM2	3.429	1.584-7.420	.001
Fracture	1.877	0.825-4.270	.131
CVA	2.722	0.982-7.543	.048
Limb Paralysis	4.418	1.188-16.432	.018
Malignancy	2.150	0.951-4.861	.063
Anemia	8.711	3.804-19.950	.000

Appendix A

Braden Scale for Predicting Pressure Sore Risk

BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK

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

SENSORY PERCEPTION ability to respond meaning-fully to pressure-related discomfort	1. Completely Limited Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of con-sciousness or sedation. OR limited ability to feel pain over most of body	2. Very Limited Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	3. Slightly Limited Responds to verbal com-mands, but cannot always communicate discomfort or the need to be turned. OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	4. No Impairment Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort..				
MOISTURE degree to which skin is exposed to moisture	1. Constantly Moist Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	2. Very Moist Skin is often, but not always moist. Linen must be changed at least once a shift.	3. Occasionally Moist: Skin is occasionally moist, requiring an extra linen change approximately once a day.	4. Rarely Moist Skin is usually dry, linen only requires changing at routine intervals.				
ACTIVITY degree of physical activity	1. Bedfast Confined to bed.	2. Chairfast Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	3. Walks Occasionally Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair	4. Walks Frequently Walks outside room at least twice a day and inside room at least once every two hours during waking hours				
MOBILITY ability to change and control body position	1. Completely Immobile Does not make even slight changes in body or extremity position without assistance	2. Very Limited Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	3. Slightly Limited Makes frequent though slight changes in body or extremity position independently.	4. No Limitation Makes major and frequent changes in position without assistance.				
NUTRITION usual food intake pattern	1. Very Poor Never eats a complete meal. Rarely eats more than ⅓ of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IV's for more than 5 days.	2. Probably Inadequate Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR receives less than optimum amount of liquid diet or tube feeding	3. Adequate Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs	4. Excellent Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION & SHEAR	1. Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction	2. Potential Problem Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	3. No Apparent Problem Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.					

Total Score

Appendix B

Data Collection Tool

1) What is your gender?

      1. Male

      2. Female

2) What is your age group?

      1. 50-59

      2. 60-69

      3. 70-79

      4. 80-89

      5. 90 and above

3) History of previous pressure ulcer?

      1. Yes

      2. No

4) Total Braden score 24 hours prior to pressure ulcer (circle one):

      1. >18 (no risk)

      2. 15-18 (mild risk)

      3. 13-14 (moderate risk)

      4. 10-12 (high risk)

      5. ≤9 (very high risk)

5) Circle number of medical conditions present

      1. Alzheimer's disease

      2. Congestive heart failure

      3. Fecal and/or urinary incontinence

      4. Malnutrition

      5. Osteoporosis

      6. Diabetes mellitus

      7. Fracture

      8. Cerebrovascular accident

      9. Limb paralysis

      10. Malignancy

11. Anemia

Appendix C

Informed Consent

Per CITI guidelines, it is presumed research will be permitted without obtaining consent from families of the memory care patients, as the focus relies on medical chart reviews and analysis of existing data. Data collection involves no more than minimal risk to the patients and the waiver will not adversely affect the rights and welfare of the participants.

Appendix D

Committee Request Form

DePaul University
School of Nursing
Doctor of Nursing Practice Program (DNP)
Evidence-Based Scholarly Leadership Project
Request Form for Appointment of Doctoral Committee

Date: January 29, 2020

Student Name (s): Rachel Deutsch

DNP SLP Topic: Pressure Ulcer Prevention

Please appoint the following faculty members to the Doctoral committee for the above name student. Each of these faculty members has been contacted by the student (s) and signatures indicate agreement and willingness to serve on this committee. By singing this form, the committee member verifies that no conflict of interest exists.

JOSEPH D. TARIMAN, PHD, ANP-BC, FAAN	*Joseph D. Tariman*	02-04-20
Name of the DNP Committee Chair	Signature	Date
SHANNON D. SIMONOVICH, PHD, RN	*Shannon D. Simonovich*	04-05-2020
Name of the DNP Committee Member	Signature	Date
Christina Lattner DNP, ANGP-C ANP-BC	*Christina Lattner DNP*	4/6/2020
Name of the DNP Committee Member	Signature	Date
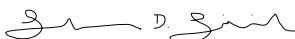
Appendix E
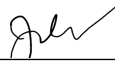
Proposal Approval

Proposal Approval Form

DePaul University
School of Nursing
Doctor of Nursing Practice Program
DNP Project Proposal Approval Form

DNP Student Name: Rachel Deutsch

DNP Project Title: **Enhancing the Braden Scale Pressure Ulcer Risk**

Assessment in Long-Term Care Facilities: A Cohort Study

The student(s) successfully developed a high quality DNP project proposal, which represents the students' intellectual ability, knowledge in the subject area, and contributions to nursing. Thus, the DNP project committee members have approved the project to move on to the next process.

DNP Scholarly Project Proposal Approval

_____   05 / 23 / 2020
DNP Committee Chair Signature   Date

_____   05 / 26 / 2020
Committee Member Signature   Date

_____   05 / 23 / 2020
Committee Member Signature   Date

Doc ID: 831892420f6a7bffcf4f49f3e83acc8a86164502

Appendix F

Letter of Support

Director of Nursing
Symphony of Lincoln Park
1366 W. Fullerton Ave
Chicago, IL 60614   <mark>**CONSENT DOCUMENT**</mark>
DePaul University

Enhancing the Braden Scale Pressure Ulcer Risk Assessment in Long-Term Care Facilities: A Cohort Study

Dear Nellia & To Whom It May Concern:

Introduction:
- I am beginning the implementation of research at DePaul University with a focus of earlier pressure ulcer identification and recognition.
- The purpose of this cohort study was to determine the pressure ulcer predictability of the Braden score in comparison to the Braden score with additional predictor factors. Preventing pressure ulcers is important not only to protect patients from injury but also reduce costs of caring for them.
- Research and education in prevention may produce positive changes in the knowledge and clinical behaviors of individuals, with a definitive objective of decreasing the prevalence of pressure ulcers.
- Your facility would be a desirable site for this research as I have conducted wound care at this specific facility and know how prevalent and debilitating pressure ulcers are in long-term care facilities.

Research Model
- I will be using existing electronic health record data to determine the predictability of the Braden Scale.
- Research finds Braden Scale lacks predictability as it categorizes patients as high risk who might not actually be and doesn't assist us to establish what specific interventions are required based on that score.

Objectives
- Lessen charting and documentation burden for nurses
- Improve health outcomes
- Prevent pressure injury through earlier recognition and intervention management

Description of Study Procedures
- The research would necessitate access to electronic health records beginning August 16th, 2020 to December 16th, 2020. I would be the main researcher at the site and would require a temporary login for the four-month span. In that four-month span, I presume to be at the facility 3-4 times per week for 4 hours per day.
- No disruption among staff or patients is expected.

Confidentiality
- No name or identifying information will be written on any of the data collection forms. The research is entirely patient protected, meaning all participants can assume no

inspection or recording is taking place, and information associated to research will not be shared, such as their medical record.

- The primary researcher will ensure confidentiality by eliminating all classifying data from the documents and detach any connections in regards to the subjects.

Risks

- There are no reasonably anticipated or expected risks.

Benefits:

- Exposure to free research education on pressure ulcer prevention recognition.

Results

- Results of the study will be presented at a final dissertation with an opportunity for the public to attend. The study findings will provide the facility with more accurate prediction, restructure clinical workflow, diminish burnout and advance care.

Consent

- By signing this form, you indicate you are giving the primary researcher, Rachel Deutsch, permission to conduct research as described above for the dates of August 16th, 2020 to December 16th, 2020; permitting access to electronic health record, and authorize entry 3-4 days per week for a maximum of 4 hours per day.

Facility Participant's Name (print): *Nelia Gonzales* Date:
Facility Participant's Signature: Date: 05 / 20 / 2020

Sincerely,
Rachel Deutsch, RN, BSN
DNP Student

Appendix G

Final Approval Form

DEPAUL UNIVERSITY

College of Science and Health
Office of Advising and Student Services
1110 W Belden Ave. Suite 400, Chicago, IL 60614
Phone: (773) 325-8490
CSHGraduation@depaul.edu

Approval of Proposal for Final Project

Please enter the information below, and return via email to CSHGraduation@depaul.edu - Attn: Associate Director of Graduate Student Services or in person to McGowan South, Suite 400.

Student Name: Rachel Deutsch	DePaul ID: 1935580

Program:
Graduate School of Nursing

☐ Final Project	☐ Thesis	✔ Dissertation/DNP Project

The department has approved a proposal submitted by the above student and has granted permission for the student to begin work on the project described in that proposal.

Title: *Please note the character limit to appear on your official transcript is 70 including spaces between words.*

Enhancing the Braden Scale Pressure Ulcer Risk Assessment in Long-Term Care Facilities: A Cohort Study

The project is to be conducted in the manner described in the proposal with the following exceptions and/or conditions:

Committee Member	Signature	Date
Dr. Shannon Simonovich	Shannon D. Simonovich, PhD, RN	
Dr. Christina Lattner	Christina M. Lattner DNP	4/22/2021

Committee Chair or Program Director	Signature	Date
Dr. Joseph Tariman	Joseph D. Tariman, PhD, ANP-BC, FAAN	04-22-2021

Revised September 2016