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PRESSURE INJURY RISK ASSESSMENT IN CRITICAL CARE

Optimization and Evaluation of a Pressure Injury Risk Assessment Tool for use in the Critical Care Setting

by

RHONDA S. SULLIVAN PHD, MSN, MBA, CWON, LNCC

A DNP PROJECT

Submitted in partial fulfillment of the requirements for the Degree of Doctor of Nursing Practice to The School of Graduate Studies of The University of Alabama in Huntsville

HUNTSVILLE, ALABAMA
2018
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R Sullivan 5/31/18
Student Signature Date
DNP PROJECT APPROVAL FORM

Submitted by Rhonda S. Sullivan in partial fulfillment of the requirements for the degree of Doctor of Nursing Practice and accepted on behalf of the Faculty of the School of Graduate Studies by the DNP project committee.

We, the undersigned members of the Graduate Faculty of The University of Alabama in Huntsville, certify that we have advised and/or supervised the candidate on the work described in this DNP project. We further certify that we have reviewed the DNP project manuscript and approve it in partial fulfillment of the requirements for the degree of Doctor of Nursing Practice.

[Signatures]

Committee Chair

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College of Nursing, Dean

Graduate Dean
ABSTRACT
The School of Graduate Studies
The University of Alabama in Huntsville

Degree: Doctor of Nursing Practice         College: Nursing

Name of Candidate: Rhonda S. Sullivan

Title: Optimization and Evaluation of a Pressure Injury Risk Assessment Tool for use in the Critical Care Setting

Pressure injuries are "reasonably preventable" with evidence-based care (Centers for Medicare and Medicaid, 2015). Risk assessment is the cornerstone of evidence-based pressure injury prevention (Moore & Cowman, 2014). In the United States, the Braden Scale for Predicting Pressure Ulcer Risk (Braden Scale) is the most common pressure injury risk assessment tool. Conversely, the Braden Scale lacks adequate validation in the critical care setting, omits important predictors of pressure injury risk for critically ill patients, and may be too cumbersome for timely and effective employment in this high acuity unit (Deng, Yu, & Hu, 2017). The project addresses this gap through optimization of the Norton Pressure Sore Risk Assessment Scale (Norton Scale) for use in the critical care setting. A video simulated patient scenario was used by critical care nurses (CCN) and certified wound care nurses (CWCN) at the project site to evaluate the optimized Norton Scale (oNS) for usability, interrater reliability, and its ability to predict pressure injury risk among patients with critical illness. The oNS proved to be an easy to use, critical-care specific risk assessment tool that demonstrated optimal reliability, predictive validity, and interrater reliability among CCNs at the project site.
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To all of the nurses at University of Alabama in Birmingham Hospital, I thank you for your willingness to take time out of your busy day to participate in my project, from inception to fruition. Your contribution to this work will not be in vain. I promise to contribute to the
nursing profession by disseminating the results of this project, where appropriate, to positively impact the care of patients at risk for pressure injuries.
DEDICATION

All praise and thanks to God, who gave me the strength to persevere through this long journey of hard work, lassitude, and doubt. Thank you for giving me the faith, patience, tenacity, and determination to complete what I started.

This scholarly paper is dedicated to my greatest supporter; my beloved husband, Tyrone K. Sullivan. You have foregone your own educational and professional pursuits so that I and our daughters could achieve our goals. This aspiration has become a reality because of your selfless sacrifice bolstered by your love, support, and guidance. Thank you for being whatever I needed, when I needed it. I love you!

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TABLE OF CONTENTS

List of Charts and Tables.........................................................................................39
List of Figures...........................................................................................................56
SECTION I: DNP PROJECT
 I. Identification of the Problem.................................................................................12
   A. Background........................................................................................................12
   B. Purpose.............................................................................................................13
   C. PICOT...............................................................................................................14
   D. Objectives.......................................................................................................14
 II. Review of the Evidence.........................................................................................14
   A. Search Strategy ...............................................................................................14
   B. Braden Scale for Predicting Pressure Ulcer Risk.............................................15
   C. Norton Scale for Assessing Risk of Pressure Ulcers.......................................15
 III. Conceptual Framework.......................................................................................16
 IV. DNP Project Methodology..................................................................................17
   A. Project Plan.....................................................................................................17
   B. Phase One......................................................................................................18
     a. Reliability.....................................................................................................18
     b. Interrater reliability......................................................................................20
     c. Utility..........................................................................................................20
     d. Usability......................................................................................................21
   C. Phase Two......................................................................................................21
     a. Tool identification.......................................................................................22
b. Optimization.................................................................22

D. Phase Three.................................................................23
   a. Implementation..........................................................23
   b. Evaluation.................................................................25

V. Program Outcomes..........................................................25
   A. Sociodemographics..........................................................25
      a. Gender.................................................................26
      b. Age.................................................................26
      c. Nursing education......................................................26
      d. Experience.............................................................26
      e. Proficiency............................................................27

   B. Risk Assessment B (Braden Scale)..........................................27

   C. Risk Assessment N (optimized Norton Scale)...............................28
      a. Reliability............................................................29
      b. Interrater reliability..................................................30
      c. Predictive validity.....................................................30
      d. Usability..............................................................30-32
      e. Preference...........................................................32

VI. Implications for Practice....................................................33

VII. Cost.............................................................................34

VIII. Descriptions of Materials Developed.....................................34
      a. Simulated patient scenario video......................................34
      b. Letter of invitation......................................................35
c. Qualtrics® questionnaire...........................................................................35

d. Sociodemographic questionnaire...............................................................36

e. Risk assessment N....................................................................................36

f. Risk assessment B....................................................................................36

g. Ease of use questionnaire........................................................................36

h. Preference questionnaire........................................................................36

SECTION II: DNP PROJECT PRODUCT

I. Professional Journal Selection.................................................................36

II. Conference Presentation.........................................................................37

Charts...........................................................................................................40-55

Chart 1: Gender ..........................................................................................40

Chart 2: Age ...............................................................................................41

Chart 3: Nursing Education.........................................................................42

Chart 4: Specialty Experience......................................................................43

Chart 5: Proficiency.....................................................................................44

Chart 6: Mean Braden Scores.................................................................45

Chart 7: Mean oNS Scores.........................................................................46

Chart 8: oNS Reliability............................................................................47

Chart 9: oNS Interrater Reliability............................................................48

Chart 10: oNS Relevance.................................................................49

Chart 11: oNS Effectiveness.................................................................50

Chart 12: oNS Ease of Use.................................................................51

Chart 13: oNS Minimal Steps.................................................................52
DNP PROJECT

I. Identification of the Problem

Background

A pressure injury is localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device (National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance, 2014). Pressure injuries occur because of intense and/or prolonged pressure or pressure in combination with shear (National Pressure Ulcer Advisory Panel et al., 2014). The tolerance of soft tissue for pressure and shear can be impacted by several factors including microclimate, nutrition, perfusion, co-morbid conditions, or condition of the soft tissue (National Pressure Ulcer Advisory Panel et al., 2014).

Pressure injuries represent a major burden of illness and reduce the quality of life of those afflicted. More than 2.5 million people in the United States develop pressure injuries each year (National Pressure Ulcer Advisory Panel et al., 2014). Pressure injuries are associated with pain, amputation, sepsis, and increased morbidity and mortality (Centers for Medicare & Medicaid Services, 2013). More than 60,000 patients die each year because of pressure injuries.

Pressure injuries represent an enormous financial burden to individual healthcare organizations and the healthcare care industry (Agency for Healthcare Research and Quality, 2012). The annual cost of pressure injuries in the United States is $9.1-$11.6 billion (National Pressure Ulcer Advisory Panel et al., 2014). The cost of care for a single pressure injury ranges between $500 to 70,000 and is associated with a five-fold increase in the patient’s length of stay (National Pressure Ulcer Advisory Panel et al., 2014). Pressure injuries increase the hospital’s readmission rates and are associated with variety of reimbursement and other financial penalties.
Pressure injuries are also associated with 17,000 lawsuits each year with judgements as high as $312 million (National Pressure Ulcer Advisory Panel et al., 2014; Leaf Healthcare, 2014).

In 2008, the Centers for Medicare and Medicaid halted reimbursement for hospital-acquired stage 3 and stage 4 pressure injuries. The rationale for this change was that pressure injuries are “reasonably preventable” with evidence-based care (Centers for Medicare and Medicaid, 2015). This directive, coupled with a vast body of evidence outlining the components of evidence-based pressure injury prevention (PIP), have resulted in significant reductions in the incidence of hospital-acquired pressure injuries (HAPI) throughout the continuum of care. Conversely, HAPI incidence in the critical care setting remains as high 53.4% (National Pressure Ulcer Advisory Panel et al., 2014). This is associated with a pervasiveness of immobility, debility, altered perfusion and oxygenation, and critical illness; all of which are associated with pressure injury development.

Pressure injury risk assessment is a crucial aspect of determining the relative risk of patients and the need for preventative intervention. Use of a risk assessment tool is recommended by many national and international guidelines as the foundation of pressure injury prevention. Although twenty-six pressure injury risk assessment tools have historical use in the critical care setting; no risk assessment scale exists in the United States for exclusive use among patients in the critical care setting.

**Purpose**

The purpose of this project was to optimize the Norton Scale for Assessing Risk of Pressure Ulcers (Norton Scale) for use in the critical care setting and evaluate its usability,
interrater reliability, and ability to predict pressure injury risk among nurses in the critical care setting.

**PICOT**

Among critical care nurses, does the optimized Norton Scale (oNS) predict pressure injury risk, improve usability, and increase interrater reliability, as compared to the Braden Scale?

**Objectives**

This project had three objectives. The first objective was to identify nursing challenges associated with using the Braden Scale for pressure injury risk assessment in the critical care setting. The second objective was to optimize the Norton Scale to address deficiencies associated with use of the Braden Scale in critical care. The third objective was to evaluate whether the oNS could predict pressure injury risk, improve usability, and increase interrater reliability among CCNs.

**II. Review of the Evidence**

**Search Strategy**

A literature search of CINAHL, Medline, PubMed, and Scopus were conducted using the key words, (1) pressure ulcer or pressure injury; (2) risk assessment tools or scales; (3) intensive care unit or critical care or critical care unit; (4) validity or reliability; (5) sensitivity and specificity; and (6) adult patients or adults; published in scholarly peer-reviewed journals, in English, between 2010 and 2017 yielded 1686 records. Limiters included the addition of the following key words, (1) not pediatric or paediatric; (2) not long-term care; and (3) not home health care. The resulting 212 results articles were screened and 123 were excluded due to
irrelevance to the project focus. Thirteen duplicates were removed. The remaining 76 sources were reviewed in detail.

**Braden Scale for Predicting Pressure Ulcer Risk**

The project site currently uses the Braden Scale for pressure injury risk assessment in their critical care units. Braden Scale scores are recorded for each patient on admission and once a shift thereafter. The Braden Scale is one of the best known and most widely used pressure injury risk assessment tools (Hyun et al., 2013; Kim, Choi, Lee, & Kim, 2013). The Braden Scale was introduced by its authors Barbara Braden and Nancy Bergstrom in 1987 for patients in general wards (Bergstrom, Braden, Laguzza, & Holman, 1987; Kim et al., 2013). It includes six risk categories; sensory perception, moisture, activity, mobility, nutrition, and friction and shear. Five categories of risk are rated on an ordinal scale from 1 (most impaired) to 4 (least impaired). Friction and shear, the remaining item, is rated on an ordinal scale from 1 (problem) to 3 (no problem). The total score ranges from 6 to 23 points with lower total scores representing a higher risk for the development of pressure injuries.

The Braden Scale is the only pressure injury risk assessment instrument that is readily used in the United States. Its use spans all settings, including critical care. Conversely, use of the Braden Scale in the critical care setting has several limitations. These include questionable reliability, low interrater reliability, and the complexity of subscale scoring that complicates usability (Moore & Cowman, 2015).

**Norton Scale for Assessing Risk of Pressure Ulcers**

The Norton Scale, the first scale for assessing the risk of pressure injuries, was introduced by Doreen Norton in 1962 (Norton, McLaren, & Exton-Smith, 1962). Based on clinical experience and discussions with her colleagues, five primary risk factors; physical condition,
mental condition, activity, mobility and incontinence were included in the instrument (Norton et al., 1962). These risk categories are scored on an ordinal scale of 1 (most impaired) to 4 (least impaired) with a maximum total score of 20 points. Low total scores represent an increased pressure injury risk.

The Norton Scale includes components that are subjective in nature and is limited in its ability to assess known pressure injury predictors associated with critical illness, such as oxygenation and perfusion. Conversely, optimization of the Norton Scale by addressing these deficiencies can increase the efficiency of pressure injury risk assessment among nurses in the critical care setting, as evidenced by accurate identification of at-risk patients, increased interrater reliability, and improved usability with the Norton Scale (proposed tool) as compared to the Braden Scale (current tool).

### III. Conceptual Framework

The conceptual framework for this project was the Systems Model by Betty Neuman. Neuman’s approach to nursing is a comprehensive system-based model that centers on how patient systems respond to potential or actual stressors and how nurses use prevention intervention to reduce patient stressors and facilitate system wellness. This theory highlights the role of nursing in perceiving and responding to patient stresses to facilitate health and wellness. Neuman’s theory defines health as “the condition in which all parts and subparts are in agreement with the whole of the person” (Peptrin, 2016). It views nursing as the "actions which assists individuals, families and groups to maintain a maximum level of wellness” (Peptrin, 2016).

Within the Systems Theory, each patient system has distinctive and complex characteristics that are part of a larger dynamic structure. Within the theory, a human being or
total person is a layered, multidimensional client system with a normal line of defense that can be disrupted by known and unknown environmental stressors. Neuman explains environment as the totality of the internal and external forces which surround a person and with which they continually interact (Peptrin, 2016). Wellness is achieved when the patient stays on a continuum of available energy to support and stabilize the system (Peptrin, 2016). Conversely, when the patient is unable to achieve this level of wellness; the nurse can employ primary, secondary, and tertiary prevention to facilitate a return to system stability and wellness.

The Systems Model assumes that the interconnection of patient and nurse perceptions will influence development of the plan of care. Prevention is the primary intervention in the Systems Model. Primary prevention emphasizes early intervention as a means of keeping stressors and the stress response from having a detrimental effect on the body. It includes health promotion and maintaining wellness.

This project aligned with Betty Neuman’s Systems Model in the following ways. The project recognized the complexity of the patient with critical illness. Relevant risks that may present as stressors or inhibitors to health and wellness are identified. Those identified risks were then addressed through optimization of the Norton Scale. Nurses were then able to employ the oNS as a means of primary prevention to promote health and maintain wellness among patients with critical illness.

IV. DNP Project Methodology

Project Plan

This project consisted of three phases that align with the project objectives. Phase one identified the challenges associated with use of the Braden Scale in the critical care setting. Phase two used information gathered during phase one to identify and optimize the Norton Scale
for use in the critical care setting. Phase three, evaluated the oNS among CCNs at the project site.

**Phase One**

Phase one included a review of the literature to identify deficiencies in the use of the Braden Scale in the critical care setting. Three deficiencies were identified. Use of the Braden Scale in the critical care setting presents reliability, interrater reliability, and usability challenges.

**Reliability.** The Braden Scale may not sufficiently reflect characteristics of critical care patients. Specifically, perfusion and oxygenation, are prevalent among patients with critical illness and known pressure injury predictors (National Pressure Ulcer Advisory Panel et al., 2014). Perfusion and oxygenation are not assessed within the Braden Scale.

Several studies have identified statistically-significant pressure injury predictors for patients with critical illness. In a systematic review of primary research, including high quality studies; age, mobility/activity, perfusion, and vasopressor use were identified as independently predictive risk factors of pressure injury development among critical care patients (Alderden, Rondinelli, Pepper, Cummins, & Whitney, 2017). A 24-month retrospective study of 468 adult, medical and coronary care intensive care patients identified age, ICU length of stay, diastolic blood pressure, albumin level, total Braden score, use of mechanical ventilation, and fecal incontinence as significant predictors (p<0.05) of hospital-acquired pressure injuries in the critical care setting (Deng et al., 2015). A descriptive study of 51 critical care patients reports that a length of stay over 10 days (p=0.001), low Glasgow scale score (p<0.001), use of invasive mechanical ventilation (p<0.001), sedation use (p=0.004), use of vasoactive drugs (p=0.002) and invasive pressure monitoring (p=0.006) as statistically significant pressure injury predictors.
among patients with critical illness (Oliveira de Carvalho et al., 2015). Many of these high-risk pressure injury predictors are not assessed within the Braden Scale.

The Braden scale shows insufficient predictive validity and poor accuracy in discriminating among intensive care patients at risk of developing pressure injuries. A cohort study of Braden in twelve critical care units in Brazil demonstrated that performance decreased for the most severely ill patients (Ranzani, Simpson, Japiassú, & Noritomi, 2016). A retrospective, descriptive study of 7790 critical care patients demonstrated sensitivity of 0.954, specificity of 0.207, positive predictive value of 0.114, and negative predictive value of 0.977. The area under the curve was 0.672 (95% CI, 0.663-0.683) (Sookyung et al., 2013).

Three critical care categories of pressure injury risks emerged, oxygenation, perfusion, and comorbidity. Oxygenation-specific risk factors with statistically-significant influence on pressure injury risk included, SV02 or SV02 <60% for five minutes (p=.002), PF < 200 (p=.001), SPO2 < 90% (p=.001), mean hemoglobin of 7.7 g/dL or less (p=.001), and use of inhaled dilators (p=.001) (Bly, Schallom, Sona, & Klinkenberg, 2016). Perfusion-specific risk factors with statistically-significant influence on pressure injury risk included, mean arterial blood pressure <60 (p=.001), diastolic blood pressure <50 (p=.02), and systolic blood pressure <90 (p=.01); use of one vasopressor (p=.001), body temperature <36 degrees Celsius (p=.001), and >38 degrees Celsius (p=.001), and continuous veno-venous hemodialysis (p=.001) (Bly et al., 2016). Comorbidity-specific risk factors with statistically-significant influence on pressure injury risk included, albumin of 2.4 g/dL (p=.001), blood glucose >180mg/dL (p=.001), and pulmonary history per patient (p=.03) (Bly et al., 2016).

The Braden scale has high sensitivity but low specificity for determining the risk for pressure injury in critical care patients. Critical illness generally results in some level of
immobility, diminished sensory perception, moisture management challenges, and nutritional compromise. All of these factors are measured within the Braden Scale and commonly result in a total score of 9 to 12 (Sookyung et al., 2013) which is significantly lower than the critical score of 18. This over-prediction of the pressure injury risks of critical care patients may result in unnecessary employment of preventive strategies and waste of human and financial resources. Consequently, the specificity of the Braden Scale, when used in the critical care setting needs to be markedly improved or an alternative tool employed.

**Interrater reliability.** The interrater reliability of the Braden Scale in the critical care setting is inadequate. The lack of agreement among nurses assessing the pressure injury risk of patients in the critical care setting not only jeopardizes accurate identification of at-risk patients but it inhibits proper planning of preventive measures. An interrater reliability study by Kottner & Dassen (2010) assessing the Braden scale among 70 nurses in two critical care units in Germany reported up to 50% measurement error and a low ability of obtained scores to differentiate among critical care patients; as indicated by sum scores of ICC (1,1) = 0.72 (95% CI 0.52–0.87) and 0.84 (95% CI 0.72–0.92). Based on these findings, use of the Braden scale for measuring pressure injury risk in the critical care setting is not recommended (Kottner & Dassen, 2010). A descriptive exploratory study assessing the agreement among 22 nurses in four critical care units of Brazil demonstrated general agreement among nurses in three of the six Braden subscales; sensory perception, mobility, friction/shear and only in two of the four units. Poor agreement was observed across all critical care units for moisture, activity, and nutrition (Fonseca Simão, Larcher Caliri, & dos Santos, 2013).

**Utility.** According to Cho & Noh (2010), Braden has very low utility and low-to-moderate positive predictive performance. A retrospective analysis of 21,115 hospital-days of
715 inpatients in critical care unit in South Korea demonstrated a Braden Scale usage rate of 11.26%. Analysis of the Braden’s utility, based on a receiver operating characteristic analysis with the cutoff set at 13, gave sensitivity (75.9%), specificity (47.3%), positive predictive values (18.1%) and negative predictive values 98.2%. This demonstrates weak correlations between the scores and nursing interventions, except for the category of position changes (Cho & Noh, 2010).

**Usability.** The construction of the Braden scale presents usability challenges for nurses charged with identifying pressure injury risk among patients with critical illness. Braden presents problems in the interpretation of descriptions of the subscale categories (Fonseca Simão et al., 2013). Categorization of patients into the appropriate risk level is dependent on accurate assessment of each subscale based on specific qualifying criteria. Two factors inhibit this process for nurses assessing patients in the critical care setting. The subscale headings lend themselves to subjective application as they do not directly reflect what is being measured. Therefore, nurses who negate the details of each subscale may inappropriately determine the patient’s level of risk. Because the subscales are often used to individualize preventive strategies, this oversight may leave at-risk patients vulnerable.

Secondarily, the complexity of the subscale criteria can be time-consuming for the CCNs, who is often tasked with a multitude of higher priority responsibilities. Two of the Braden subscales, moisture and nutrition, require the nurse to have prior knowledge of patient patterns that may not be evident during the first patient evaluation. Locating this information may require more time from the nurse. This is often not possible when the critical needs of the patient take priority, as they often do in the critical care setting. Conversely, the absence of essential information creates a barrier to identification of the appropriate level of risk.

**Phase Two**
The objective of phase two was to optimize the Norton Scale for pressure injury risk assessment in the critical care setting. Optimization was dependent on two factors and offered the following benefits. Relevant critical care-specific pressure injury risk factors were incorporated into the Norton Scale to improve the nurses’ ability to more accurately predict pressure injury risk among patients with critical illness. Subjective measures were clarified for increased objectivity to improve usability and increase interrater reliability.

**Tool identification.** Twenty-six risk assessment tools or variations of these tools have historical use in the critical care setting. Thirteen risk assessment scales were excluded due to the absence of quantitative validity data in the published literature. Cut-Score, validity, sensitivity, specificity, positive predictive value, negative predictive value, and interrater reliability data were extracted for the remaining thirteen tools. Risk assessment tools were sorted and means were determined for all data points based on available evidence. These findings were used as the basis for identification and optimization of a pressure injury risk assessment tool for critical care use. Based on all data points, the Norton Scale was determined to be the most valid tool. However, despite demonstrating some validity in the critical care setting; it omitted known critical care specific pressure injury predictors. To address this gap and improve the usability of the tool, the Norton Scale was optimized for clarity and relevance to the critical care setting.

**Optimization.** Norton Scale optimization was multi-faceted. Permission was received for use and modification of the tool. Modifications added clarity by replacing subjective measurements with evidence-based objective parameters. For physical condition, good, fair, poor, very bad were replaced with no deficits, fair, and poor. Statistically-significant critical-care specific risk factors were provided as guidance for selection of fair and poor. For mental condition, alert, apathetic, confused, and stuporous was simplified to two categories, alert and
appropriate versus altered mentation or sensory perception. For activity, ambulant, walks with help, chair bound, and bedfast were replaced by independent ambulation, walks with help, chair bound, and bed bound. Mobility was clarified to include the bed and chair and full, slightly impaired, very limited, and immobile was replaced by completely independent, requires one-person assistance, and total turn. For incontinence, none, occasional, usually urinary, and urinary and fecal was replaced by continent, incontinent urine or stool, dual incontinence. The included version was selected from five potential versions based on peer consensus at the project site.

**Phase Three**

Phase three involved evaluation of the oNS using a video simulated patient scenario. Pressure injury risk assessment is the foundation of pressure injury prevention intervention. Simulation facilitated a “real world” situation without compromising the actual needs of patients in the critical care units for intervention. Additional benefits of the digital delivery of a simulated patient scenario included the ability to use of a standardized patient to alleviate unnecessary variation and access to a convenience sample of 30-100 CCNs without significant disruption to the normal workflow of high acuity critical care units at the project site.

**Implementation.** Institutional Review Board (IRB) approval has been granted from both the University of Alabama Birmingham (UAB) and the University of Alabama Huntsville (UAH). The current UAB IRB number is 300000150 (Appendix B). UAH granted an IRB approval based on submission of the UAB protocol and approval letter (Appendix C).

A letter of invitation was sent to CCNs and CWCNs at the project site. The letter of invitation solicited participation by describing the project in detail, including the consent process. Participation was voluntary and implied consent. A questionnaire containing all necessary
components of the project was embedded within the letter of invitation. The questionnaire included the simulated patient video and allowed for electronic evaluation of the patient’s pressure injury risk using both the Braden and Norton Scales. Sociodemographic, ease of use, and preference data was collected as a component of the questionnaire.

A convenience sample of CCNs at the project site viewed the video simulated patient scenario then assessed the patient’s risk of pressure injury using the Braden Scale (Risk Assessment B). Incorporation of the Braden Scale as a component of the project evaluation offered two benefits. It prospectively assessed the CCNs’ proficiency in predicting pressure injury risk using the facility’s incumbent tool. It also served as a benchmark for the simulated patient’s level of risk using the known tool. This benchmark level of risk was used to assess the ability of the oNS to identify the same level of risk. Following assessment of the patient using the Braden Scale, the patient scenario was played again and the patient’s level of pressure injury risk was assessed using the optimized Norton Scale (Risk Assessment N). The full names of the risk assessment tools were blinded with the goal of minimizing bias based on familiarity. The participant then completed an ease of use questionnaire and a preference questionnaire which focused on identification of a preferred tool and reasons supporting that choice.

The convenience sample also include certified wound care nurses (CWCN) at the project site. Segmentation of the CWCN assessments from those completed by the CCNs occurred through distribution of the same letter of invitation and included program components to a separate wound care nurse distribution list. Consenting CWCNs followed the same processes for evaluation of the tools as the CCNs. The goal of this component of the project was to utilize the expertise of the CWCN, who are trained in pressure injury risk assessment. The CWCN assessments served as the benchmark for the CCN assessments.
Access to the program components was available for thirty days from the date of inception. Data were collected electronically. Confidentiality was maintained as no participant information was recorded beyond that solicited within the questionnaire and all information is being presented in aggregate form.

**Evaluation.** Data was analyzed using Qualtrics® (Qualtrics® Analytics, Seattle, WA) and IBM SPSS statistical package version 24 (SPSS Inc, Chicago, IL). Pressure injury risk assessment by the CCNs was completed using both the Braden and Norton Scales. The patient’s level of risk, as identified by the incumbent Braden Scale, served as the benchmark. The patient’s level of risk using the oNS was then compared to the Braden benchmark. The goal of this process was to prospectively evaluate pressure injury risk assessment using the Braden Scale, which is the facility’s incumbent tool and compare those outcomes to the same data points when nurses assessed pressure injury risk using the oNS.

Risk scores of the CCNs were also compared to the benchmarks established by the CWCN using the same two scales. The CWCN assessments served as the benchmark, through which oNS risk assessments by the CCNs were measured. Socio-demographic, subscale and total score data for both scales, as well as ease of use data and preference outcomes were also collected.

**V. Project Outcomes**

**Sociodemographic**

The total sample included 111 CCNs and 3 CWCNs. Conversely, not all participants completed all components of the assessment. Notations of the actual sample size are disclosed in each section, where appropriate. Sociodemographic data collected were gender and age, as well
as nursing, critical care, and wound care nurse experience. The proficiency of pressure injury risk assessment among the participants was also assessed.

**Gender.** Most participants were female. Eighty-six percent (N=98) of the participants were female. Fourteen percent (N=16) were male. All CWCN participants were female.

**Age.** Most participants were between the ages of 50-69 years (65.9%, N=73). The remaining participants were between the ages of 30-49 (36.6%, N=37) and 18-29 years (3.5%, N=4). No participants were 70 years old or older. Correlation between age and prediction of risk was not undertaken since all 114 participants determined the patients appropriate level of risk.

**Nursing education.** Most participants were Bachelors-prepared nurses (86.8%, N=98). Educational preparation for the participants also included Associates (8.8%, N=10) and Masters (3.5%, N=4). Two Doctoral-prepared nurses also participated. Correlation between educational preparation and prediction of risk was not undertaken since all 114 participants determined the patients appropriate level of risk.

**Experience.** General nursing and specialty experience were also measured. Most of the participants have been nurses for 1-10 years (63%, N=72), followed by less than 1 (20%, N=23), 11-20 years (11%, N=12), and more than twenty-one years (6%, N=7). Most of the CCNs have been in the critical care specialty for 1-10 years (64%, N=72), followed by less than 1 (26%, N=28), 11-20 years (6%, N=7), and more than twenty-one years (4%, N=4). Most of the wound care nurses have been in the wound care specialty for 1-10 years (67%, N=2), followed by 11-20 years (33%, N=1). Correlation between experience and prediction of risk was not undertaken since all 114 participants determined the patients appropriate level of risk.
Proficiency. Participants (N=114) were asked to make a subjective assessment of their proficiency in risk assessment. The four available proficiency levels were not proficient, low proficiency, proficient, or advanced proficiency. Most of the participants felt that they were proficient in pressure injury risk assessment (69%, N=79). The remaining participants were not proficient (22%, N=25), had low proficiency (7%, N=8), or advanced proficiency (2%, N=2). All three CWCNs assessed their level of proficiency in pressure injury risk assessment as advanced. Correlation between perceived proficiency and actual prediction of risk was not undertaken since all 114 participants determined the patients appropriate level of risk.

Risk Assessment B (Braden Scale)

There were 114 participants who completed the assessment of the patient using the Braden Scale. This sample was comprised of 111 CCN participants and 3 CWCN participants. Braden Scale assessment of the simulated patient by the CCN participants was compared to assessments by the CWCN participants. The CWCN assessments serve as the benchmark.

For simplicity, mean scores are presented as whole numbers. Subscale scores were consistent for activity (1 - bedfast), mobility (2 – very limited), and friction/shear (1 - problem). There were one-point variations for sensory perception, moisture, nutrition, and the total score. For sensory perception, the CCNs scored the patient a 2 (very limited), compared to 1 (completely limited) by the CWCN participants. For moisture, the CCN scored the patient a 3 (occasionally moist) compared to a 2 (very moist) by the CWCN. For nutrition, the scores were a 2 (probably inadequate) by the CCN participants compared to 1 (very poor) by the CWCN. For the total scores, the patient was scored a 10 and 9, respectively. Both CCNs and CWCN participants deemed the patient to be high risk. However, the CWCN participants deemed the patient to be severe high risk, as evidenced by total score of 9.
For the Braden Scale, there were differences in the level of risk identified for three of the six subscales (50%), as well as the total score. The CCNs rated the patient higher, in the areas of sensory perception, moisture, and nutrition. These higher scores represent lower risk. Since the subscale scores are often used to individualize the plan of care; deeming the patient at lower risk could result in the omission of needed preventative interventions. Regarding the total score, a severely high-risk patient would generally receive additional high-level interventions, such as a specialty support surface, wound care nurse consult, or preventative dressings. Therefore, this disparity in the total score could leave the patient vulnerable.

The CWCN’s ability to identify the highest level of risk is the result of advanced training. This training is provided as a component of all wound care educational programs. It focuses on pressure injury risks as the foundation of risk assessment, as well and associated evidence-based risk-focused strategies. This knowledge creates a heightened sensitivity to pressure injury risks and accuracy in identifying the at-risk patient regardless of the risk assessment instrument used.

CCNs do not receive this training as a component of their nursing or critical care education. It is also rarely provided during new hire orientation. Conversely, education of the CCNs regarding pressure injury risks and risk assessment would improve their proficiency at identifying at risk patients and employing appropriate preventative interventions.

**Risk Assessment N (Optimized Norton Scale)**

There were 114 participants who completed the assessment of the patient using the Braden Scale. This sample was comprised of 111 CCNs and 3 CWCNs. Assessment of the simulated patient using the oNS by CCN participants was compared to that of the CWCN participants. The CWCN assessments serve as the benchmark.
For simplicity mean scores were rounded to whole numbers. Subscale scores were consistent for mental condition (1 – altered mentation or sensory perception), activity (1-bedbound), mobility (1 – total turn). Both groups deemed the patient to be very high risk as evidence by a total cut-score of less than 10. One-point variations were noted for the remaining two subscales, physical condition and incontinence.

For physical condition, the CCNs rated the patient a 1 (poor), compared to a 2 (fair) by the CWCN participants. The CCNs often have advanced training in measures of critical illness. This advanced training makes them better equipped to recognize these characteristics of the simulated patient or actual patient with critical illness. This highlights the relevance of oNS to care of the critically ill patient and how inclusion of measures of critical illness may aid the CCN in improving pressure injury risk identification.

For incontinence, the CCN participants scored the patient a 2 (incontinent of urine or stool), compared to a 1 (dual incontinence) from the CWCN participants. This, again, speaks to the benefit of advanced training. CWCNs are also trained in moisture management, including the risk of excess moisture to the skin and how single or dual incontinence affects the skin differently. Therefore, CWCNs are better equipped to identify dual incontinence and its contribution to the patient’s pressure injury risk. Conversely, providing this same level of training to the CCNs would improve their ability to accurately identify the patient’s true level of moisture-related risk and to employ appropriate preventative strategies.

**Reliability.** The simulated patient’s benchmark level of risk, as established by CWCN participants using the Braden Scale, was very high risk. Within the oNS, very high risk is represented by a total score of less than ten. All 114 participants were able to appropriately predict the patient’s level of risk using the oNS. The mean oNS total score was 5.89 (range 4.0,
minimum 5, maximum 9], standard deviation 0.72, variance 0.52). Cronbach’s alpha demonstrated a high degree of reliability for the oNS. Computations were completed using SPSS statistical package version 24 (SPSS Inc, Chicago, IL) for 114 valid participants. oNS demonstrated excellent reliability based on a Cronbach’s alpha of .944.

**Interrater reliability.** Intraclass correlation coefficient (ICC) demonstrated a high degree of interrater reliability among 114 participants for the five oNS subscales. Estimates and their 95% confident intervals were calculated using SPSS statistical package version 24 (SPSS Inc, Chicago, IL) based on consistency and a one-way random effects model. The average measure ICC was .933 with a 95% confidence interval from .911 to .950 (F (113,456) = 14.841, p<.001).

**Predictive validity.** Pearson correlation coefficient was computed to assess the relationship between the five oNS subscales and the total score using SPSS statistical package version 24 (SPSS Inc, Chicago, IL). The oNS demonstrated excellent predictive validity based on a correlation coefficient > 0.6. Among 114 participants, there is a positive correlation between the mental condition (r=.978, p<.001), activity (r=.950, p<.001), mobility (r=.881, p<.001), incontinence (r=.885, p<.001) and the total score (r=1). Physical condition was not reported because it was constant.

**Usability**

Usability of the oNS was assessed among CCNs (N=63) and CWCN (N=3) participants. Participants were presented with six statements that assessed whether the oNS was relevant to the critical care setting, improved the effectiveness of assessment, was easy to use, required the fewest steps possible, was intuitive, and whether the criteria were clearly defined. Participants responded based on a five-point Likert scale, 1 (strongly agree) to 5 (strongly disagree).
Relevance. A total of 83.3 percent of the participants strongly agree (24.4%, N=16) and agree (59.1%, N=39) that the oNS is relevant to patients in the critical care setting. Ten participants (15.2%) were neutral and one (1.5%) disagreed that the oNS was relevant to the critical care setting. No participants strongly disagreed with the presumption that the oNS is relevant in the critical care setting.

Improved effectiveness. A total of 71.2 percent of the participants strongly agree (18.2%, N=12) and agree (53%, N=35) that the oNS improved the effectiveness of risk assessment for patients in the critical care setting. Fourteen participants (21.2%) were neutral and 5 (7.6%) disagreed that the oNS was relevant to the critical care setting. No participants strongly disagreed with the presumption that the oNS improved the effectiveness of risk assessment for patients in the critical care setting.

Ease of use. A total of 84.9 percent of the participants strongly agree (27.2%, N=18) and agree (57.6%, N=38) agree that the oNS was easy to use. Nine participants (13.5%) were neutral and one participant (1.5%) disagreed that the oNS was easy to use. No participants strongly disagreed with the presumption that the oNS was easy to use.

Fewest steps. A total of 74.3 percent of the participants strongly agree (24.2%, N=16) and agree (50.1%, N=33) agree that the oNS required the fewest steps possible for accurate pressure injury risk assessment in the critical care setting. Fifteen participants (22.7%) were neutral and two participants (3%) disagreed that the oNS required the fewest steps possible for accurate pressure injury risk assessment in the critical care setting. No participants strongly disagreed with the presumption that the oNS was required the fewest steps possible for accurate pressure injury risk assessment in the critical care setting.
Intuitive. A total of 72.8 percent of the participants strongly agree (30.4%, N=20) and agree (42.4%, N=28) agree that use of the oNS was intuitive. Fifteen participants (22.7%) were neutral and three participants (4.5%) disagreed that that use of the oNS was intuitive. No participants strongly disagreed with the presumption that that use of the oNS was intuitive.

Clearly defined criteria. A total of 78.8 percent of the participants strongly agree (24.4%, N=16) and agree (54.6%, N=36) agree that use of the oNS criteria were clearly defined. Eleven participants (16.7%) were neutral and three participants (4.5%) disagreed that the oNS criteria were clearly defined. No participants strongly disagreed with the presumption that that the oNS criteria were clearly defined.

Preference
To assess whether one tool was preferred over the other, eleven descriptors were presented. Participants were asked to select the scale that the descriptor most accurately represents. Participants also had the option of selecting both scales, where appropriate. Descriptors used included familiar, easy, quick to use, organized, evidence-based, relevant, specific, precise, descriptive, effective, and critical care specific. The highest percentages for each descriptor were used to determine preference. Sixty-four participants (CCN=61 and CWCN=3) completed this portion of the project.

The Braden Scale and oNS were deemed comparable. Participants deemed both the oNS and the Braden Scale as organized (51.5%, N=33), evidence-based (57.8%, N=37), relevant (59.3%, N=38), specific (42.2%, N=27), precise (37.5%, N=24), descriptive (40.6%, N=26), and critical care specific (59.4%, N=38). Participants assessed the Braden scale to be more familiar (70.3%, N=45) than the oNS. This is an appropriate assessment since the Braden Scale is the facility’s incumbent tool. Conversely, the oNS was deemed easier (45.2%, N=29) and quicker
(48.4%, N=31) to use than the Braden Scale. The oNS was also assessed to be more critical care specific (43.8%, N=28) than the Braden Scale.

**Implications for Practice**

The critical care environment is one of the highest risk units for pressure injury. Critical care units also have the highest incidence of hospital-acquired pressure injuries in acute care (National Pressure Ulcer Advisory Panel et al., 2014). Hospital-acquired pressure injuries are considered never events by CMS and a nurse-sensitive indicator of quality. In addition, CMS halted payments for stage 3 and stage 4 HAPIs in 2008 and has since associated additional reimbursement penalties with pressure injuries. Effective risk assessment is a primary component of pressure injury prevention. Conversely, patients with critical illness often present with unique risks such as oxygenation and perfusion that may be overlooked by other risk assessment tools. For this reason, a critical care focused risk assessment tool is needed.

The implications for practice associated with this project are related to improved prevention of pressure injuries among patients in the critical care setting and mitigation of associated adverse outcomes for the patient, nurse, and healthcare organization. Implementation of the oNS into practice offers CCNs a quick and easy to use, critical-care specific risk assessment tool. The oNS, a critical care focused risk assessment tool, increased the efficiency of pressure injury risk assessment by helping the nurse to better identify pressure injury predictors associated with critical illness. This focused risk assessment serves as the foundation for timely initiation risk-focused pressure injury prevention strategies. Individualized, patient centered care that addresses the critically ill patient’s unique vulnerabilities will facilitate a decrease in pressure injury development. More effective risk assessment will also decrease the
prevalence of human and financial impacts such as pain, suffering, debility, unnecessary resource utilization, and loss revenue.

Cost

No hard costs existed for the development and implementation of this project. Hard costs were minimized by a digital delivery medium for dissemination of the program components, use of Qualtrics® software for data collection and analytics, and utilization of personal video production services, all of which were free. Another cost management measure includes minimizing the time investment required for participation of CCNs at the study site. A time study revealed that the timeframe required for each nurse to complete the evaluation was commonly 6-7 minutes, but up to 15 minutes for a novice evaluator. Soft costs associated with nursing time for 114 registered nurses was $779.76. This cost analysis is based on a mean hourly wage $27.36 for Alabama registered nurses (Bureau of Labor Statistics, 2017) and fifteen minutes per nurse.

Descriptions of Materials Developed

**Simulated patient scenario video.** Permission was granted from Indiana University (IU) Health for use and modification of the foundational video entitled, “Intensive Care Unit (ICU): What to Expect” (Appendix A). Patient stills were used from the original IU Health video. A patient scenario video was developed, which details a critical care patient experience including relevant signs of critical illness and pressure injury risks. Care was taken to ensure inclusion of relevant indicators of critical illness and pressure injury risks. The completed video is 1.2 minutes long.

The video, which was shown as a component of the Qualtrics® questionnaire, presents the case of Martin Smith, a fictitious patient. Martin Smith, a 41-year old male, was admitted for
an elective left total hip arthroplasty. He has a history of liver transplant, avascular necrosis, degenerative arthritis, pulmonary obstructive disorder with CPAP use at night, diabetes mellitus with neuropathic changes, and obesity (height 180cm and weight 156.3kg). Due to his liver transplant history, he was admitted to the critical care unit following surgery. He was alert, oriented, and able to get out of bed with 1-person assistance on the first post-operative day. Later in nurse’s shift, the patient becomes confused, incontinent of stool, and short of breath. The nurse immediately elevates the head of bed to 90 degrees, places the patient on oxygen via non-rebreather, and initiates a rapid response. However, Mr. Smith continues to deteriorate. He becomes bradycardic (heart rate 52-58), hypotensive (systolic blood pressure 85-90 and diastolic blood pressure 52-62) and loses consciousness. A code blue is called. He was successfully resuscitated but remained intubated and sedated. He remained on intravenous pain medication and vaso-active drips for blood pressure management throughout the night.

**Letter of invitation.** The letter of invitation (Appendix D) explained the project, provisions for voluntary participation, and conditions of consent. It specified that participation in the project conferred consent. A link to the Qualtrics® questionnaire and its components was also included in the letter of invitation. The letter of invitation was sent via email to critical care registered nurses and the CWCN team at the study site by the facility mentor. This process was repeated after fourteen days due to a low response rate of 19 participants.

**Qualtrics questionnaire.** A Qualtrics® questionnaire was created that included all necessary project components. Necessary components included a sociodemographic questionnaire, patient scenario video, risk assessment N, risk assessment B, ease of use questionnaire, and a preference questionnaire.
Sociodemographic questionnaire. The sociodemographic questionnaire was used to identify factors that may affect the proficiency of nurses charged with pressure injury risk assessment in the critical care setting. Age, gender, education, proficiency, and experience data were collected. Experience will be further quantified based on years as a nurse and years in the critical care setting.

Risk assessment N. Risk assessment N represented the optimized Norton Pressure Sore Risk Assessment Scale. Risk assessment N serves as the experimental tool. Consents to use and modify the tool were obtained (Appendix E and F).

Risk assessment B. Risk assessment B represented the unaltered incumbent tool, Braden Scale for Predicting Pressure Ulcer Risk (Table 1). Risk assessment B served as the control. Consent to use the tool was obtained (Appendix G).

Ease of use questionnaire. The ease of use questionnaire assessed the participants’ perception of each risk assessment tool. It was comprised of six questions including two for usefulness, two for ease of use, and two for ease of learning. A five-point Likert scale was used, one (strongly agree) to five (strongly disagree).

Preference questionnaire. The preference questionnaire was used to identify the preferred tool among the participants. It asked the participants to select a preferred tool between risk assessment B and risk assessment N. The participant also selected, from eleven descriptors, those supporting their reported preference.

DNP PROJECT PRODUCT

Professional Journal Selection

A primary endpoint of this project is publication in a peer-reviewed journal. The Journal/Author Name Estimator was used to identify an appropriate journal. Keywords used
were "pressure ulcer risk assessment and intensive care". Thirty-one journals options were provided. The American Journal of Critical Care (AJCC) was selected because of its alignment with the proposed project and high impact factor of 1.88 (Journal/Author Name Estimator, 2017).

The American Journal of Critical Care is the principal source for evidence-based critical care practice. This bi-monthly, peer-reviewed journal accepts original manuscripts describing critical care advances, investigations, and observations. Clinical studies, preliminary communications, basic research studies, reports on new apparatuses and techniques, case reports, clinical science reviews, guest editorials, and letters to the editors will all be considered for publication. Manuscripts demonstrating research and collaborative practice are encouraged.

The American Journal of Critical Care’s mission is to provide its readers with clinically-relevant content in every issue. AJCC also serves as a vehicle for the American Association of Critical-Care Nurses to achieve its mission of improving the care of critically ill patients and their families (American Journal of Critical Care, 2017). Publication of the outcomes of this scholarly project in AJCC would contribute new knowledge to the body of work focusing on pressure injury.

Conference Presentation

An additional option for dissemination of the outcomes of this project would be a national conference. Two conferences that commonly present these types of topics would be the Wound, Ostomy, Continence Nurses (WOCN) Society conference as well as the National Teaching Institute (NTI) & Critical Care Exposition. Both national conferences are credentialed through the American Nurses Credentialing Center and occur annually. However, the WOCN Society hosts regional conferences annually, as well.
The poster and/or podium presentation would be more influential at NTI. WOCN Society conference attendees are commonly nurses practicing in some capacity in the wound care specialty. They may or may not work in the critical care setting. However, NTI conference attendees are commonly nurses working in some capacity in the critical care environment. One differentiator between the two conferences is that CCNs are often charged with pressure injury prevention. Therefore, the outcomes of this project would be valuable to this audience from both the critical care and pressure injury prevention perspectives.

NTI is hosted by the American Association of Critical Care Nurses. NTI seeks topics related to all nursing roles and patient populations, clinical systems such as cardiovascular, hemodynamics, and pharmacology; and professional practice such as electronic health records, healthy work environment, patient safety (NTI, 2017). Completion of this project by the end of spring 2018 would allow submission for the 2019 conference which will be held in Orlando, FL on May 19-23, 2019.

In the interim, consideration will be given to both a poster and/or podium presentation at the 2019 WOCN Society conference which will be held in Nashville, TN on June 23-26, 2019. Proposals for sessions should address the needs of nurses and allied health professionals who care for patients in the areas of wound, ostomy and continence as well as possible professional practice information related to this field (WOCN Society, 2017). Novel clinical or education interventions, innovative models of care, emerging health conditions, evolving leadership and policy issues, original research findings and resourceful outcome measures are examples of preferred topics.
## LIST OF CHARTS

<table>
<thead>
<tr>
<th>Chart</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gender</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Age</td>
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</tr>
<tr>
<td>3</td>
<td>Nursing Education</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>Specialty Experience</td>
<td>43</td>
</tr>
<tr>
<td>5</td>
<td>Proficiency</td>
<td>44</td>
</tr>
<tr>
<td>6</td>
<td>Mean Braden Scores</td>
<td>45</td>
</tr>
<tr>
<td>7</td>
<td>Mean oNS Scores</td>
<td>46</td>
</tr>
<tr>
<td>8</td>
<td>oNS Reliability</td>
<td>47</td>
</tr>
<tr>
<td>9</td>
<td>oNS Interrater Reliability</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>oNS Relevance</td>
<td>49</td>
</tr>
<tr>
<td>11</td>
<td>oNS Effectiveness</td>
<td>50</td>
</tr>
<tr>
<td>12</td>
<td>oNS Ease of Use</td>
<td>51</td>
</tr>
<tr>
<td>13</td>
<td>oNS Minimal Steps</td>
<td>52</td>
</tr>
<tr>
<td>14</td>
<td>oNS Intuitive</td>
<td>53</td>
</tr>
<tr>
<td>15</td>
<td>oNS Clearly Defined Criteria</td>
<td>54</td>
</tr>
<tr>
<td>16</td>
<td>oNS Preference</td>
<td>55</td>
</tr>
</tbody>
</table>
Gender
Age

AGE (YEARS)

- 18-29: 64.90%
- 30-49: 36.60%
- 50-69: 3.50%
- 70 or greater: 0%

41
NURSING EDUCATION

- Associate: 8.80%
- Bachelors: 0.9%
- Masters: 3.50%
- Doctoral: 86.80%

Nursing Education
Specialty Experience

![SPECIALTY EXPERIENCE Chart]

- Nursing Experience
- Critical Care Experience
- Wound Care Experience

Experience Categories:
- Less than 1
- 1-10
- 11-20
- 21 or greater
Proficiency

RISK ASSESSMENT PROFICIENCY

- Not: 2%
- Low: 7%
- Proficient: 22%
- Advanced: 69%
Mean Braden Scores

![Bar chart showing comparison of mean Braden scores for CWCN (N=3) and CCN (N=111) across different subscales: Sensory Perception, Moisture, Activity, Mobility, Nutrition, Friction/Shear, and Total. The chart highlights differences in scores for each subscale and the overall total score.](image-url)
Mean Norton Scores

MEAN ONS (SUBSCALE AND TOTAL) 
CWCN VS CCN

<table>
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<tr>
<th>Physical Condition</th>
<th>Mental Condition</th>
<th>Activity</th>
<th>Mobility</th>
<th>Incontinence</th>
<th>Total</th>
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<tr>
<td>WOCN (N=3)</td>
<td>CCN (N=111)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
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</table>
### oNS Reliability

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>N of Items</th>
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<tr>
<td>0.944</td>
<td>0.962</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Intraclass Correlation</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
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<tr>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Single Measures</td>
<td>0.735</td>
<td>0.672</td>
</tr>
<tr>
<td>Average Measures</td>
<td>0.933</td>
<td>0.911</td>
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</table>
oNS Relevance

ONS RELEVANCE

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

- 59.1%
- 15.2%
- 24.2%
- 1.5%
- 0%
ONS Effectiveness

ONS IMPROVED EFFECTIVENESS

- Strongly Agree: 18.2%
- Agree: 21.2%
- Neutral: 7.6%
- Disagree: 53.0%
- Strongly Disagree: 0%
ONS Ease of Use

ONS EASE OF USE

- Strongly Agree: 27.3%
- Agree: 13.6%
- Neutral: 1.5%
- Disagree: 0%
- Strongly Disagree: 57.6%
Minimal Steps

ONS FEWEST STEPS POSSIBLE

- Strongly Agree: 3.0%
- Agree: 24.2%
- Neutral: 22.7%
- Disagree: 50.1%
- Strongly Disagree: 0%

Running head: CRITICAL CARE RISK ASSESSMENT
### Intuitive

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONS Intuitive</td>
<td>30.4%</td>
<td>22.7%</td>
<td>42.4%</td>
<td>0%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

![Circle chart showing percentages for different responses to ONS Intuitive.](chart.png)
Clearly Defined Criteria

CLEARLY DEFINED CRITERIA

Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree

4.5% | 16.7% | 24.2% | 54.6%
LIST OF FIGURES

Figure 1: Braden Scale for Predicting Pressure Sore Risk…………………….57

Figure 2: The Norton Pressure Sore Risk Assessment Scale Scoring System…58

Figure 3: The Systems Model………………………………………………..59

Figure 4: Optimized Norton Scale (Risk Assessment N or oNS)……………..60
**FIGURE 1**

**BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK**

<table>
<thead>
<tr>
<th>Patient's Name</th>
<th>Evaluator's Name</th>
<th>Date of Assessment</th>
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</table>

<table>
<thead>
<tr>
<th><strong>SENSORY PERCEPTION</strong></th>
<th><strong>MOISTURE</strong></th>
<th><strong>ACTIVITY</strong></th>
<th><strong>MOBILITY</strong></th>
<th><strong>NUTRITION</strong></th>
<th><strong>FRICION &amp; SHEAR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ability to respond meaningfully to pressure-related discomfort</td>
<td>degree to which skin is exposed to moisture</td>
<td>degree of physical activity</td>
<td>ability to change and control body position</td>
<td>usual food intake pattern</td>
<td></td>
</tr>
<tr>
<td>1. Completely Limited: Unresponsive (does not mean, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation OR limited ability to feel pain over most of body.</td>
<td>1. Constantly Moist: Skin is kept moist almost constantly by perspiration, urine, etc. Dryness is detected every time patient is moved or turned.</td>
<td>1. Bedfast: Confined to bed.</td>
<td>1. Completely Immobile: Does not make even slight changes in body or extremity position without assistance.</td>
<td>1. Very Poor: Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IVs for more than 5 days.</td>
<td>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. Soreness, contractures or agitation leads to almost constant friction.</td>
</tr>
<tr>
<td>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 1/3 of body.</td>
<td>2. Very Moist: Skin is often, but not always moist. Linen must be changed at least once a day.</td>
<td>2. Chairfast: Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.</td>
<td>2. Very Limited: Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.</td>
<td>2. Probably Inadequate: Rarely eats a complete meal and generally eats only about 1/3 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.</td>
<td>2. Potential Problem: Moves freely 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.</td>
</tr>
</tbody>
</table>

| 3. Slightly Limited: Responds to verbal commands, but cannot always communicate discomfort or the need to be turned OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities. | 3. Occasionally Moist: Skin is occasionally moist, requiring an extra linen change approximately once a day. | 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. | 3. Slightly Limited: Makes frequent though slight changes in body or extremity position independently. | 3. Adequate: Eats over half of most meals. Eats a total of 4 or more 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. | 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. |

| 4. No Impairment: Responds to verbal commands. Has no sensory deficit which would limit ability to feel or sense pain or discomfort. | 4. Rarely Moist: Skin is usually dry, liness only requires changing at routine intervals. | 4. Walks Frequently: Walks outside room at least twice a day and inside room at least once every two hours during waking hours. | 4. No Limitation: Makes major and frequent changes in position without assistance. | | 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. |
The Norton Pressure Sore Risk-Assessment Scale Scoring System

The Norton Scoring system, shown below, and created in England in 1962, has been the first pressure sore risk evaluation scale to be created, back in 1962, and for this it is now criticized in the wake of the results of modern research. Its ease of use, however, makes it still widely used today.

To evaluate the Norton Rating for a certain patient look at the tables below and add up the values beside each parameter which apply to the patient. The total sum is the Norton Rating (NR) for that patient and may vary from 20 (minimum risk) to 5 (maximum risk).

(Indicatively, a Norton Rating below 9 means Very High Risk, 10 to 13 means High Risk, 14 to 17 medium risk and above 18 means low risk)

<table>
<thead>
<tr>
<th>Physical Condition</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Very Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mental Condition</th>
<th>Alert</th>
<th>Apathetic</th>
<th>Confused</th>
<th>Stuporous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Ambulant</th>
<th>Walks with help</th>
<th>Chairbound</th>
<th>Bedfast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Full</th>
<th>Slightly Impaired</th>
<th>Very Limited</th>
<th>Immobile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incontinence</th>
<th>None</th>
<th>Occasional</th>
<th>Usually Urinary</th>
<th>Urinary and Fecal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Generally, the risk factor is coded this way:

<table>
<thead>
<tr>
<th>Norton Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 18</td>
<td>Low Risk</td>
</tr>
<tr>
<td>Between 18 and 14</td>
<td>Medium risk</td>
</tr>
<tr>
<td>Between 14 and 10</td>
<td>High Risk</td>
</tr>
<tr>
<td>Lesser than 10</td>
<td>Very High Risk</td>
</tr>
</tbody>
</table>
FIGURE 3

(Neuman & Fawcett, 2011)
## FIGURE 4

### OPTIMIZED NORTON SCALE (RISK ASSESSMENT N OR oNS)

<table>
<thead>
<tr>
<th>PHYSICAL CONDITION</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No deficits</td>
<td>4</td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
</tr>
<tr>
<td>Current or previous pressure injury</td>
<td></td>
</tr>
<tr>
<td>Edema</td>
<td></td>
</tr>
<tr>
<td>Malnutrition</td>
<td></td>
</tr>
<tr>
<td>BMI &lt;19 or &gt; 40</td>
<td></td>
</tr>
<tr>
<td>Albumin level ≤ 2.4 g/dL</td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td></td>
</tr>
<tr>
<td>Blood glucose level &gt; 180 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular or pulmonary disease</td>
<td></td>
</tr>
<tr>
<td>ICU LOS ≥ 12 days</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1</td>
</tr>
<tr>
<td>Hemodynamic instability</td>
<td></td>
</tr>
<tr>
<td>Mean arterial BP &lt; 60</td>
<td></td>
</tr>
<tr>
<td>Diastolic BP &lt; 50 or Systolic BP &lt; 90</td>
<td></td>
</tr>
<tr>
<td>Use of &gt; 1 vasopressor</td>
<td></td>
</tr>
<tr>
<td>Body temperature, °C &lt;36 or &gt;38</td>
<td></td>
</tr>
<tr>
<td>Continuous veno-venous hemodialysis</td>
<td></td>
</tr>
<tr>
<td>Svo2 or Scvo2 &lt; 60% for 5 min</td>
<td></td>
</tr>
<tr>
<td>Spo2 &lt; 90%</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin level ≤ 7.7 g/dL</td>
<td></td>
</tr>
<tr>
<td>P/F &lt; 200</td>
<td></td>
</tr>
</tbody>
</table>

### MENTAL CONDITION

| Alert and appropriate                           | 4     |
| Altered mentation or sensory perception         | 1     |

### ACTIVITY

| Independent ambulation                          | 4     |
| Walks with help                                  | 3     |
| Chair bound                                      | 2     |
| Bed bound                                        | 1     |

### MOBILITY (BED OR CHAIR)

| Completely independent                          | 4     |
| Requires 1 person assistance                    | 2     |
| Total turn                                       | 1     |

### INCONTINENCE

| Continent                                        | 4     |
| Incontinent urine or stool                       | 2     |
| Dual incontinence                                | 1     |
APPENDIX A

Gardner, Megan E <mgardner3@iuhealth.org>
To: Rhonda Sullivan <rss0024@uah.edu>

Wed, Jul 26, 2017 at 9:04 AM

Hi Rhonda,

As long as the video is properly cited, you would be ok to use whatever portion of the video that you would need. We appreciate you asking for permission and best of luck on the project!

Megan

From: Rhonda Sullivan [mailto:rss0024@uah.edu]
Sent: Tuesday, July 25, 2017 8:22 PM
To: Gardner, Megan E
Subject: Re: Knowledge Center Videos

**** EXTERNAL Message From rsa0024@uah.edu. DO NOT open attachments or click links from unknown senders or unexpected emails. ****

Hi Megan,

Thank you for your prompt response. Would it be possible to use only the patient portions of the video and not the information slides? If so, how should I proceed for permission?

My goal is to create an hypothetical ICU patient scenario through which critical care nurses at my project site will assess pressure injury risk using two risk assessment tools. The patient scenario portions of the video would be kept intact but the text slides would be replaced with details of the simulated patient scenario. Of course, any portions of the video that I use will be properly cited.

Kind regards,

Rhonda Sullivan

University of Alabama at Huntsville
Doctor of Nursing Practice Student

9/1/17, 6:44 PM
APPENDIX B

APPROVAL LETTER

TO: Graham, Shannon McMillan

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000190 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)

DATE: 31-Aug-2017

RE: IRB-300000150
Pressure Injury Risk Assessment in the Critical Care Setting

The IRB reviewed and approved the Initial Application submitted on 24-Aug-2017 for the above referenced project. The review was conducted in accordance with UAB’s Assurance of Compliance approved by the Department of Health and Human Services.

Type of Review: Exempt (Category 2)
Determination: Exempt
Approval Date: 31-Aug-2017
Approval Period: No Continuing Review

The following apply to this project related to informed consent and/or assent:

- Waiver of Consent Documentation

Documents Included in Review:

- agreement.170824
- datacollection.170823
- cof.170721
- datacollection.170823
- datacollection.170823
- datacollection.170823
- othermisc.170824
- datacollection.170823
- othermisc.170823
- letterofinvitation/infosheet.clean.170823
September 27th, 2017

Rhonda Sullivan  
College of Nursing  
University of Alabama in Huntsville

Dear Ms. Sullivan,

The UAH Institutional Review Board of Human Subjects Committee has reviewed your proposal, Pressure Injury Risk Assessment in the Critical Care Setting, and found it meets the necessary criteria for approval. Your proposal seems to be in compliance with this institution’s Federal Wide Assurance (FWA) 00019998 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

Please note that this approval is good for one year from the date on this letter. If data collection continues past this period, you are responsible for processing a renewal application a minimum of 60 days prior to the expiration date.

No changes are to be made to the approved protocol without prior review and approval from the UAH IRB. All changes (e.g., a change in procedure, number of subjects, personnel, study locations, new recruitment materials, study instruments, etc.) must be prospectively reviewed and approved by the IRB before they are implemented. You should report any unanticipated problems involving risks to the participants or others to the IRB Chair.

If you have any questions regarding the IRB’s decision, please contact me.

Sincerely,

[Signature]

Bruce Stallsmith  
IRB Chair  
Professor, Biological Sciences
Dear UAB Critical Care Nurses:

You are being asked to participate in a Doctoral of Nursing Practice (DNP) Scholarly Project entitled “Pressure Injury Risk Assessment in Critical Care” (IRB-300000150). The purpose of this project is to evaluate the efficiency of pressure injury risk assessment; using both your current tool, Braden Scale for Predicting Pressure Ulcer Risk, as compared to the optimized Norton Pressure Sore Risk Assessment Scale. You are being invited to participate because you are a nurse in one of the critical care units at UAB. Your participation will help gather information about the efficiency of risk assessment among patients in the critical care setting.

What to Expect: You will view a short video simulating a critical care patient encounter. The video will provide information regarding the patient’s associated pressure injury risks. Following the video, you complete a pressure injury risk assessment using your incumbent risk assessment tool followed by the experimental risk assessment tool. This will be followed by an ease of use and preference questionnaire. Completing all components of the questionnaire will take approximately 15 minutes.

Confidentiality: Your answers will be used for research purposes and the outcomes presented within the context of a scholarly project. The risks involved in this project are considered no more than the risks of everyday living. Your name will not be recorded with your answers, so that your confidentiality is be protected. Information obtained during this project will only be shared in aggregate form.

Consent: Participation in this project is voluntary and is not part of your UAB duties. If you wish to not participate, it will not affect your relationship with UAB. You can skip any questions that make you uncomfortable. You will not be offered or receive any special consideration if you take part in this research. You will not be compensated for your participation. Participation in the questionnaire conveys consent.

Questions: Please contact Rhonda Sullivan at (904) 510-7438 or rss0024@uah.edu or Dr. Shannon Graham at (205) 934-9919 or sgraham@uabmc.edu. If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the UAB Office of the IRB for Human Use (OIRB) at the University of Alabama at Birmingham (UAB) at (205) 934-3789 or toll free at 1-855-860-3789. Regular hours for the OIRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday. You may also call this number in the event the research staff cannot be reached or you wish to talk to someone else.

Please click on the project title link to access the questionnaire.

Pressure Injury Risk Assessment in the Critical Care Setting

Thank you,

Rhonda Sullivan, RN (Student Investigator)
DNP Student (University of Alabama Huntsville)
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Thank you for your RightsLink / Elsevier transaction

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License Date: Sep 23, 2016
License Number: 3954820322560
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Total: 0.00 USD

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Dear Ms Sullivan,

Thank you for your email.

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I can confirm that we are happy for you to modify the figure as you require.

If you have any further questions please don’t hesitate to contact me.

Kind regards
Laura

Laura Pritchard
Permissions Supervisor - Global Rights Department | ELSEVIER |
The Boulevard | Langford Lane | Kidlington | Oxford OX5 1GB |
Tel: +44 1865 845817 Fax: +44 1865 853353
l.pritchard@elsevier.com
Date: September 29, 2017

To: Rhonda Sullivan, Doctoral Student – University of Alabama-Huntsville

From: Barbara Braden, PhD, RN, FAAN, Nancy Bergstrom, PhD, RN, FAAN

RE: Permission to use the Braden Scale*

As holders of the official copyright for the Braden Scale and the interventions, we hereby grant permission for the use of the scale in your DNP scholarly project.

*It is understood that the tool must be printed as it appears on the Braden Scale website (www.bradenscale.com) in relation to title, wording and scoring of each subscale, and the acknowledgement, “Copyright, Barbara Braden and Nancy Bergstrom, 1988. Reprinted with permission. All rights reserved.”

Barbara Braden    Nancy Bergstrom
APPENDIX H

Permission is not needed to use the Neuman Systems Model for any purpose.

For educational purposes (student papers, theses, dissertations; teaching and curriculum):


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Overview of the Neuman Systems Model -- PowerPoint Slides


Copyright permission granted for educational purposes by Dr. Betty Neuman (2005).

http://www.neumansystemsmode.org/NSMdocs/NSM%20overview%20as%20PDF.pdf
APPENDIX I

PRESSURE INJURY RISK ASSESSMENT IN THE CRITICAL CARE SETTING (B-ON)

Sociodemographic Questionnaire

Please answer the following questions.

1. Gender
   - Female
   - Male

2. Age (Years)
   - 18 - 29
   - 30 - 49
   - 50-69
   - 70 or greater

3. Nursing Education (Highest Degree Achieved)
   - Associate
   - Bachelor's
   - Masters
   - Doctoral

4. Nursing Experience (Years)
   - Less than 1
   - 1 - 10
   - 11-20
   - 21 or greater

5. Critical Care Experience (Years)
   - Less than 1
   - 1-10
6. How proficient are you with assessing pressure injury risk?

- Not Proficient
- Low Proficiency
- Proficient
- Advanced Proficiency

Please view the patient scenario video. Following the video, you will be asked to assess the patient's pressure injury risk using RISK ASSESSMENT B.

V. Video here

**Risk Assessment Scale B**

Please assess the patient's risk using RISK ASSESSMENT B.

<table>
<thead>
<tr>
<th>Sensory Perception</th>
<th>Moisten</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Completely Limited</td>
<td>Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, or Limited ability to feel pain over most of body surface.</td>
<td>0</td>
</tr>
<tr>
<td>2. Very Limited</td>
<td>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.</td>
<td>0</td>
</tr>
<tr>
<td>3. Slightly Limited</td>
<td>Responds to verbal commands but cannot always communicate discomfort or need to be or Has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.</td>
<td>0</td>
</tr>
<tr>
<td>4. No Impairment</td>
<td>Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.</td>
<td>0</td>
</tr>
</tbody>
</table>

**MOISTURE (Degree to which skin is exposed to moisture)**
### CRITICAL CARE RISK ASSESSMENT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.</td>
<td>Skin is often but not always moist. Linen must be changed at least once a shift.</td>
<td>Skin is occasionally moist, requiring an extra linen change approximately once a day.</td>
<td>Skin is usually dry; linen requires changing only at routine intervals.</td>
</tr>
</tbody>
</table>

### ACTIVITY (Degree of physical activity)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Confined to bed.</td>
<td>Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.</td>
<td>Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.</td>
<td>Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.</td>
</tr>
</tbody>
</table>

### MOBILITY: Ability to change and control body position

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not make even slight changes in body or extremity position without assistance.</td>
<td>Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.</td>
<td>Makes frequent though slight changes in body extremity position independently.</td>
<td>Makes major and frequent changes in position without assistance.</td>
</tr>
</tbody>
</table>

### NUTRITION: Usual food intake pattern

|--------------|------------------------|------------|-------------|
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 NPO1 and/or maintained on clear liquids or IV2 for more than 5 days.

| 0 |

FRICTION AND SHEAR

<table>
<thead>
<tr>
<th>1. Problem</th>
<th>2. Potential Problem</th>
<th>3. No Apparent Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequent slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.</td>
<td>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.</td>
<td>Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.</td>
</tr>
</tbody>
</table>

Total | 0 |

Please view the patient scenario video. Following the video, you will be asked to assess the patient's pressure injury risk using RISK ASSESSMENT N.

VI. Video here

Risk Assessment Scale N

Please assess the patient's risk using RISK ASSESSMENT N.
**PHYSICAL CONDITION**

<table>
<thead>
<tr>
<th>4. No Deficits</th>
<th>2. Fair</th>
<th>1. Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Current/previous pressure injury</td>
<td>- Hemodynamic instability</td>
<td></td>
</tr>
<tr>
<td>- Edema</td>
<td>- Mean arterial BP &lt; 60</td>
<td></td>
</tr>
<tr>
<td>- Malnutrition</td>
<td>- Diastolic BP &lt; 50 or Systolic BP &lt; 90</td>
<td></td>
</tr>
<tr>
<td>- BMI &lt;19 or &gt; 40</td>
<td>- Use of &gt; 1 vasopressor</td>
<td></td>
</tr>
<tr>
<td>- Albumin level &lt; 2.4 g/dL</td>
<td>- Body temperature, °C &lt;36 or &gt;38</td>
<td></td>
</tr>
<tr>
<td>- Smoker</td>
<td>- Continuous veno-venous hemodialysis</td>
<td></td>
</tr>
<tr>
<td>- Blood glucose level &gt;180</td>
<td>- Svo2 or Scvo2 &lt; 60% for 5 min</td>
<td></td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
<td>- Spo2 &lt; 90%</td>
<td></td>
</tr>
<tr>
<td>- Pulmonary disease</td>
<td>- Hemoglobin level &lt; 7.7 g/dL</td>
<td></td>
</tr>
<tr>
<td>- ICU LOS ≥ 12 days</td>
<td>- P/F &lt; 200</td>
<td></td>
</tr>
</tbody>
</table>

**MENTAL CONDITION**

<table>
<thead>
<tr>
<th>4. Alert and appropriate</th>
<th>1. Altered mentation or sensory perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**ACTIVITY**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MOBILITY (Bed and/or Chair)**

<table>
<thead>
<tr>
<th>4. Completely independent</th>
<th>2. Requires 1 person assistance</th>
<th>1. Total Turn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INCONTINENCE**

<table>
<thead>
<tr>
<th>4. Continent</th>
<th>2. Incontinent of urine or stool</th>
<th>1. Dual incontinence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ease of Use Questionnaire

Please answer the following questions about RISK ASSESSMENT N.

1. Risk Assessment N is relevant to patients in the critical care setting.
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

2. Risk Assessment N improves my effectiveness in protecting patients.
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

3. Risk Assessment N is easy to use.
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

4. Risk Assessment N requires the fewest steps possible.
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

5. Risk Assessment N is intuitive.
   - Strongly Agree
   - Somewhat agree
   - Neutral
   - Disagree
   - Strongly Disagree

6. The subscale scoring criteria for Risk Assessment N were clearly defined.
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

Preference Questionnaire

Please select the risk assessment scale that you think of when you read each descriptor.

<table>
<thead>
<tr>
<th>Risk Assessment N</th>
<th>Risk Assessment B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td></td>
</tr>
<tr>
<td>Feature</td>
<td>Risk Assessment N</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Quick to use</td>
<td>☐</td>
</tr>
<tr>
<td>Organized</td>
<td>☐</td>
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<td>Evidence-based</td>
<td>☐</td>
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<tr>
<td>Relevant</td>
<td>☐</td>
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<tr>
<td>Specific</td>
<td>☐</td>
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<tr>
<td>Precise</td>
<td>☐</td>
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<tr>
<td>Descriptive</td>
<td>☐</td>
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<tr>
<td>Effective</td>
<td>☐</td>
</tr>
<tr>
<td>Critical-Care Specific</td>
<td>☐</td>
</tr>
</tbody>
</table>
REFERENCES


Running head: CRITICAL CARE RISK ASSESSMENT


