PAIN ASSESSMENT TOOLS FOR THE NONVERBAL CRITICAL CARE ADULT: AN INTEGRATIVE REVIEW OF THE LITERATURE

by

Tami Julianne Creek

A professional paper submitted in partial fulfillment
of the requirement for the degree

of

Master of Nursing

In

Clinical Nurse Leader

MONTANA STATE UNIVERSITY
Bozeman, Montana

November 2019

DEDICATION

I dedicate this project to those who have inspired me in my profession and supported me throughout the journey to obtain my Master's in Nursing. First and foremost, thank you to my family for your understanding, support, and patience over the last five years. Thank you Susan Raph, DNP, RN, NEA-BC for your guidance, patience and support with this project. You believed in my abilities when I doubted myself and provided meaningful feedback to guide this process. Thank you also to my committee members Anne Brown MN, RN, and Julia Fitzpatrick DNP, APRN, FNP-BC. And to the many friends and colleagues have held me up and encouraged me along the way, thank you for your undying support.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

ABSTRACT

Patients in critical care often lack the ability to report the presence of pain due to conditions such as altered levels of consciousness, sedation, and endotracheal tubes. Untreated or poorly managed pain may lead to adverse psychological sequelae, a longer duration of mechanical ventilation, and an increased risk of infection. Several behavioral pain assessment tools are available to clinicians to improve their ability to detect the presence of pain. A large intensive care unit in the Northwest lacks a pain instrument for the assessment of pain in adult, non-verbal patients. An integrative review of the literature was performed from the years 2012-2017 to identify evidence-based pain instruments available for use in this population. Nine instruments were identified representing ten behavioral pain assessment tools. The Joanna Briggs Feasibility, Appropriateness, Meaningfulness, and Effectiveness (FAME) framework was utilized to determine the best instrument for implementation into a general intensive care unit. Based on the FAME criteria, the Critical Care Pain Observation (CPOT) is recommended for implementation for non-verbal patients in a general critical care unit.

CHAPTER ONE

INTRODUCTION AND PROBLEM

Introduction

Pain is experienced by many critically ill patients at rest and during procedures. Critically ill patients are often unable to report pain due to conditions that render them nonverbal such as placement of endotracheal tubes, administration of sedation and/or analgesia, decreased levels of consciousness, or delirium. Despite acknowledgement of the existence of pain experienced by this group of patients and efforts to improve the treatment of pain, as many as 50% of patients report experiencing moderate to severe pain (Barr et al., 2013). As reported by Gelinas, Puntillo, Joffe, and Barr (2013), patients experience pain at rest and during routine procedures such as turning, coughing and deep breathing, endotracheal suctioning, wound care, and drain removal. Adequate treatment of pain in the critically ill patient begins with the clinician's assessment of the presence of pain, however lack of detection is the principle barrier to appropriate treatment (Gelinas et al., 2013).

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (2017). Although pain is considered a subjective experience requiring the patient to self-report, the lack of inability to report pain does not negate its presence (IASP, 2017). The IASP considers self-report to be the gold standard of measure and should be obtained as often as possible. In the critical care

setting patients are often unable to use self-report pain scales due to their illness, mechanical ventilation, and/or altered mental status.

Adverse Outcomes and Cost of Care

Ineffective management of pain negatively impacts patient care, cost of care, and quality of life (Keane, 2013). Additionally, several studies have demonstrated potential adverse patient outcomes, including a higher risk of infection, risk of venous thromboembolism, development of chronic pain syndrome and psychiatric disorders such as post-traumatic stress disorder (PTSD) (Jones, Griffiths, Humphris & Skirrow, 2001; Norman, Stein, Dimsdale & Hoyt, 2008; Page, 2005; Pasero & McCaffery, 2011).

Patients with severe illness often experience extreme physical and mental stress during their critical care stay which may lead to long-term physical and mental sequelae. In a retrospective study of 80 survivors of acute respiratory distress syndrome, Shelling (1998) found that 79% of the patients recalled having one or more adverse experiences during their intensive care stay including nightmares, anxiety (41%) and pain (40%). They also found a higher incidence in chronic pain syndrome (38%), PTSD (27%), and lower health-related quality of life (21%) when compared to controls. Desbians et al.(1997) found a strong correlation between the level of pain experienced by patients during hospitalization and the severity of pain that existed at discharge, two months, and six months following their hospital stay. Conversely, patients who experienced less pain during hospitalization reported less pain at two and six months.

Adequate assessment and treatment of pain is associated with improved outcomes for intensive care patients (ICU). Chanques et al. (2006) found the implementation of systematic evaluation and treatment of pain and agitation in critical care resulted in a shorter duration of mechanical ventilation and fewer nosocomial infections. The authors theorized the poor outcomes of pain and agitation which can lead to tachycardia, increased myocardial oxygen demand, hypercoagulability, immunosuppression, and catabolism, can be improved by mitigating the stress response of patients. In a post-hoc analysis of a large, multi-center study of the use of sedatives and analgesics in 1381 mechanically ventilated patients, Payen et al. (2009) found that only 42% of patients had been assessed for pain on day two of their critical care stay. In comparing outcomes patients with routine pain assessments had a decrease in the number of days of mechanical ventilation (8 vs. 11 days) and a decrease in the ICU length of stay (13 vs. 18 days).

Several behavioral pain assessment tools are designed to accommodate patients unable to report their pain. Most of these tools assess facial expressions, vocalization, and body movements. Facial expressions of pain may include wincing, grimacing, furrowed brow, or closed eyes/withdrawal. Patients may cry, moan or scream in response to pain; however, a limited number of tools exist that allow the clinician to assess compliance with ventilation as these patients are unable to vocalize pain. Scales assessing body movements may observe for restlessness, guarding or splinting, clenched fists, arching of the back and muscle rigidity. Additionally, some pain assessment scales include physiologic indicators of pain such as respirations, heart rate, oxygen saturation, pallor or

diaphoresis, and pupillary changes. Several studies have questioned the reliability of physiologic pain indicators in the critical care setting and recommend using them as a cue, rather than relying on their use to indicate pain.

Problem Statement

The current use of pain assessment tools in one adult ICU in the Northwest United States lacks accommodation for the non-verbal critical care patient population. Inadequate assessment of pain in the non-verbal critical care patient population may lead to poor pain control, the potential for poor healthcare outcomes, and unnecessary healthcare costs. Formal evaluation of the current evidence for the assessment of pain in this population is necessary and the focus of the clinical nurse leader (CNL) scholarly project.

Purpose of the Project

The purpose of this project is to identify evidence-based best practice for pain assessment in non-verbal, critically ill patients through a structured, formal and comprehensive integrative review of the literature.

Clinical Question

What is the known evidence for pain assessment tools in critically ill, non-verbal patients? What is the quality of the identified evidence? Is there a gap in the evidence? What are the implications for CNL practice?

CHAPTER TWO

METHODS

Theoretical Frameworks

Cooper's Integrative Review

This clinical scholarly project utilized Cooper's integrative review framework. Cooper (1998) specifies a five-stage process for conducting a review of the best evidence. The five stages are (a) problem formulation; (b) data collection or the literature search; (d) data evaluation; (d) analysis and interpretation; and (e) presentation of the results. Cooper (1998) suggests using multiple channels to review literature including informal, formal, and secondary channels, erring on the side of being overly inclusive to capture all available research. For the purpose of this graduate nursing scholarly project, only research databases were utilized in conducting research. Criteria for inclusion in this review were English-only, peer-reviewed, quantitative research discussing the psychometric properties of pain assessment tools for the non-verbal, critically ill patient population. Patients less than 18 years of age and those with traumatic brain injury were excluded.

FAME Framework

In 2005, the Joanna Briggs Institute proposed a framework for clinicians in guiding their evaluation of available evidence and integration into practice. Recognizing traditional research methodologies did not include the use of clinician judgment, patient

and professional values, clinical experiences and intuition, the institute developed the Feasibility, Appropriateness, Meaningfulness, and Effectiveness (FAME) framework as part of a new model of evidence-based healthcare (Pearson, Wiechula, Court, & Lockwood, 2005). Feasibility refers to the practicality of an activity or intervention; asking the clinician to consider its physical, cultural or financial practicality within an organization (Pearson et al., 2005). As outlined by Pearson et al. (2005), evidence of appropriateness demonstrates how an activity or intervention fits a particular situation or clinical setting. Meaningfulness in research considers how an activity or intervention is positively experienced by the patient in terms of their values, thoughts, beliefs and interpretations (Pearson et al., 2005). Finally, effectiveness is the degree to which an act or intervention achieves the intended goal (Pearson et al., 2005).

From the perspective of an organization, a feasible pain assessment tool will require little cost to incorporate into the electronic health record and require little cost to implement. Clinicians would ideally find the instrument fast and easy to use and deem it an appropriate tool for the population of patients on that unit. Evidence of meaningfulness is challenging in non-verbal, critically ill patients unable to report their pain, however, another perspective of this measure is to consider whether clinicians deem the assessment tool meaningful to work of assessing pain. An effective pain assessment tool would be a valid and reliable tool, appropriately differentiating between non-nociceptive and nociceptive procedures. Statistical measures of validity and reliability chosen to reflect the effectiveness of pain assessment tools are delineated below.

Evidence Appraisal

Validity

Validity of an instrument refers to its ability to measure what it intends to measure (Polit & Beck, 2017). The authors discuss several different aspects of validity for clinicians to consider including the major components: content, construct and criterion. Content validity is the extent an instrument captures the construct being measured (Polit & Beck, 2017). This is often done in collaboration with experts and examines aspects of relevance, comprehensiveness, and balance (Polit & Beck, 2017). Content validity may also be established by performing a review of the literature and discussion with those familiar with the population and construct of interest. It may be calculated as a content validity index (CVI), and numbers >0.78 are recommended by the authors.

Construct validity is the ability of a scale and its individual components to accurately measure a construct when no "gold standard" exists (Polit & Beck, 2017). There is no measure of construct validity however, examining discriminant validity and establishing that a scale accurately detects the lack of and presence of pain when a painful and non-painful stimulus is applied supports that an instrument measures the construct of pain. When patients are examined at rest, during a non-nociceptive procedure such as eye washing, and then a nociceptive procedure such as turning or endotracheal suctioning, a change in pain scores should reflect the existence of pain only when the painful stimulus is applied, demonstrating discriminant validity.

Criterion validity, in this review, examines how closely an instrument measures the construct of pain when compared to a "gold standard" such as patient report (Polit &

Beck, 2017). This relationship may be expressed in Pearson's correlation coefficient (r) or Spearman's rho where < 0.3 is equal to a weak or nonexistent relationship, 0.3-0.5 as moderate, and >0.5 is considered strong (Heavey, 2019).

Reliability

Internal consistency, a reliability measure, reflects the ability of the instrument to accurately demonstrate a construct, in this case pain (Polit & Beck, 2017). The Cronbach's alpha metric measures the internal consistency of a scale from 0-1 with higher numbers indicating greater reliability. According to Polit & Beck (2017), Cronbach's alphas greater than or equal to 0.80 are most desirable. Kline (2000) considers a Cronbach's alpha of 0.7-0.8 as acceptable, 0.8-0.9 as good, and >0.9 as excellent.

Another important aspect of reliability assessed in studies is interrater reliability (IRR), which measures the response of two or more raters at the same time. Cohen's kappa statistic represented by the Greek lower-case letter k is the measurement of IRR between two raters. Interrater reliability is measured on a scale from -1 to +1 where -1 represents no agreement and +1 represents a perfect agreement between raters (McHugh, 2012). A Kappa result of 0.01-0.20 is described as none to slight agreement, 0.21-0.40 as fair, 0.41-0.60 as moderate, 0.61-0.80 as substantial, and 0.81-1.0 as near perfect. The author cautions nursing researchers that a "substantial" agreement among raters may be used to drive a change in practice but this represents 20-40% disagreement, making the recommendation that Kappa results of >0.80 most desirable (McHugh, 2012). When the results of two or more raters are analyzed they may be expressed as Fleiss-Cohen Kappa.

Similar to the interpretation of Cohen's Kappa, Landis and Koch (1977) suggest that < 0 indicates no agreement, 0.01-0.20 indicates slight agreement, 0.21-0.40 indicates fair agreement, 0.41-0.60 is considered moderate agreement, 0.61-0.80 indicating substantial agreement, and >0.80 is near perfect agreement between raters. When an instrument is administered to the same patient on more than one occasion (test-retest), IRR is expressed as an Intraclass Coefficient (ICC) (Polit & Beck, 2017). Intraclass coefficients of <0.40 indicate poor agreement, 0.40-0.59 is considered fair, 0.60-0.74 indicates good agreement, and values >0.75 is considered excellent agreement between raters (Cicchetti, 1994).

Search Methods

A computerized search of the literature was conducted from January 2012 to December 2017 using PubMed, Cumulative Index to Nursing and Health Literature (CINAHL), Cochrane Library, Proquest, Web of Science, PsycInfo, and Joanna Briggs Institute databases. Multiple combinations of search terms included (pain OR pain assessment OR pain assessment tool) AND (critical care OR intensive care) AND (nonverbal) from the years 2012-2017. Consultation with the Montana State University (MSU) librarians was undertaken to develop and conduct the search process.

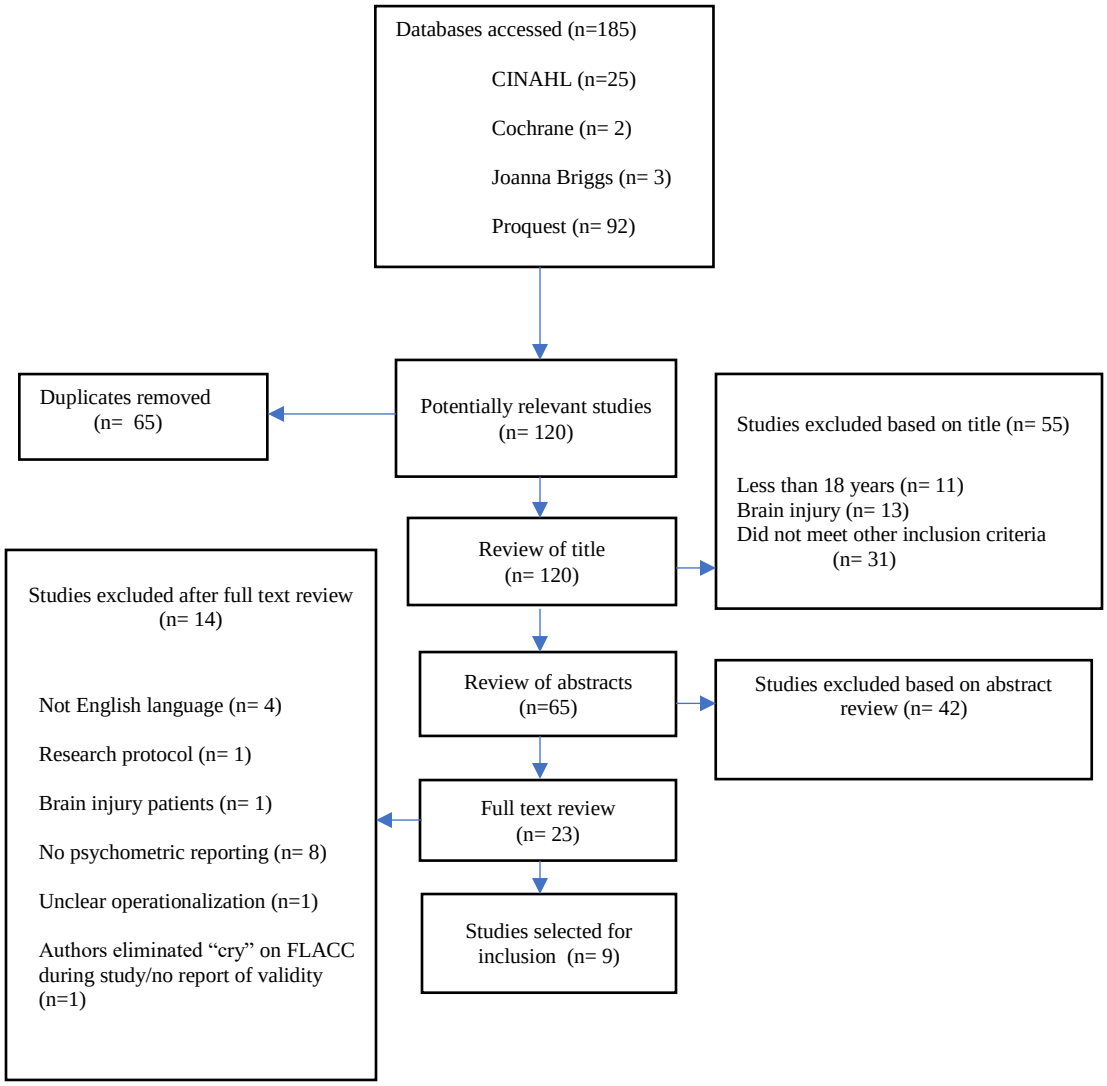
CHAPTER THREE

DATA EVALUATION

Overview

A total of 185 studies were identified in this search. Studies were cross-referenced and duplicate studies discarded leaving 120 potentially relevant studies. Following this, abstracts were reviewed to identify articles that warranted a full text review. Twenty-three full text articles were reviewed for inclusion criteria. Those meeting inclusion criteria were appraised for quality using Joanna Briggs Critical Appraisal tools (Appendix A). After a full text review and appraisal, nine studies remained representing ten pain instruments (Table 1). These included one systematic review [level 1 evidence], seven cohort studies [level 3 evidence], and one expert opinion [level 6 evidence] (Melnyk & Fine-Overholt, 2015).These were entered into an evidence synthesis table outlining the methodology, sample size and characteristics, measurement of variables, data analysis and findings.

Table 1. Decision Tree



Overview of 10 Behavioral Pain Instruments

The systematic review conducted by Vardell, Fry, & Elliot (2016) includes 26 studies published between 2001-2016, representing five behavioral pain assessment tools: 1) Behavioral Pain Scale (BPS), 2) Critical Care Pain Assessment Tool (CPOT), 3) Faces, Legs, Activity, Cry, and Consolability (FLACC), 4) Pain Assessment in Advanced Dementia (PAINAD), and 5) the Original Nonverbal Pain Scale (ONVPS). Sample sizes ranged from 25-239 across the studies. The authors report most of the studies were conducted in a single ICU setting with rare reporting of the type of ICU setting.

The seven cohort studies identified in the search process included four behavioral pain assessment scales: BPS, CPOT, ONVPS, and the Revised Nonverbal Pain Scale (RNVPS) (Al Darwish et al., 2016, Boitor et al., 2016, Chanques et al., 2015, Chookalayi et al., 2017, Linde et al., 2013, Rijkenberg et al., 2015, and Ross et al., 2016). These represent a wide variation of ICU settings with sample sizes ranging from 22-125 subjects.

The expert opinion article (Gelinas et al., 2013) identified 32 studies from 1997-2002 which yielded nine behavioral pain assessment tools: BPS, Behavioral Pain Scale-Non Intubated (BPS-NI), CPOT, FLACC, Nonverbal Pain Assessment Tool (NPAT), ONVPS, RNVPS, Pain Assessment and Intervention Notation (PAIN), and Pain Behavioral Assessment Tool (PBAT). The authors developed a validated approach to evaluate eight behavioral pain scales capturing the process, psychometric properties, and tool feasibility using a 0-20 scoring system (Gelinas et al., 2013). The scale assessed various aspects of validity, reliability, and feasibility based on clinician input and

assigned a weighted score to each instrument. The reported range of scores (5.9 to 17.5) reflected the strength of the psychometric properties and tool feasibility. The quality of the evidence ranged from very low to medium (Gelinas et al., 2013). Of note, Gelinas and Puntillo were involved with scale development of the CPOT, PAIN, and PBAT and were excluded from analysis of the instruments.

Instrument Summaries

The literature search identified the use of ten different pain assessment currently in practice. Each are detailed and summarized below.

Behavioral Pain Scale

The Behavioral Pain Scale (BPS) assesses three behavioral domains of pain including facial expression, upper limb movement, and compliance with the ventilator, each scored from 1-4 for a total score of 3-12. A pain score of >6 is indicative of pain (Ahlers, van der Veen, van Dijk, Tibboel, & Knibbe, 2010). The BPS was identified in five studies with convenience sample sizes ranging from 30-247 patients. The studies were conducted in medical, surgical, cardiac and military hospital intensive care settings.

Behavioral Pain Scale Non-intubated

The Behavioral Pain Scale Non-Intubated (BPS-NI) was adapted from the BPS for non-ventilated patients, replacing the domain of compliance with the ventilator with "vocalization", also scored on a scale of 1-4. The total score of the scale remains unchanged (Chanques et al., 2009). The BPS-NI was identified in the expert opinion article only and tested in a sample of 30 cardiac ICU patients.

Critical-Care Pain Observation Tool

The Critical-Care Pain Observation Tool (CPOT) is a Likert-scale measure outlining four domains of pain including facial expression, body movements, compliance with the ventilator or vocalization, and muscle tension (Gelinas, Fillion, Puntillo, Viens, and Fortier, 2006). Seven studies addressed the CPOT with all studies using a convenience sample ranging from 22-125 patients. Studies were conducted on cardiac, medical and surgical intensive care units.

Faces, Legs, Arms, Consolability and Cry

The FLACC scale was originally developed for use of measuring pain in children unable to report pain due to lack of verbal or cognitive skills (Merkel, Voepel-Lewis, Shayevitz, & Malviya, 1997). The scale is scored on a Likert-scale from 0-10, assessing the domains of facial expression, legs (relaxed, restless/tense, or kicking/drawn up), activity, cry, and consolability, assigning a score of 0-2 for each subscale. The FLACC was evaluated in the systematic review and expert opinion articles representing five studies though details of the specific critically ill, adult population were not reported.

Nonverbal Pain Assessment Tool

The Nonverbal Pain Assessment Tool (NPAT) is a behavioral assessment tool scored on a Likert-scale from 0-10, assessing the domains of emotion, movement, verbal cues, facial expression and position/guarding, assigning a score of 0-2 for each subscale (Klein, Dumpe, Katz, & Bena, 2010). The NPAT was identified in the expert opinion article only representing one study.

Original Nonverbal Pain Scale

The Original Nonverbal Pain Scale (ONVPS) was developed in response to nurse concerns that the FLACC did not represent adult pain behaviors (Odhner, M., Wegman, D., Freeland, N., Steinmetz, A., & Ingersoll, G., 2003). The scale assesses five domains of pain including face, activity, guarding, physiology I (changes in vital signs such as heart rate, blood pressure, and respiratory rate), and physiology II (skin, pupillary response and perspiration). The ONVPS was identified in two descriptive studies using convenience samples with 30 and 60 patients and conducted in medical, surgical and trauma intensive care units.

Pain Assessment and Intervention Notation

The Pain Assessment and Intervention Notation (PAIN) is an algorithm in which the nurse observes the patient for behavioral and physiologic indicators of pain. In a three-step process, the nurse assigns the patient a pain score on a Likert-scale from 0-10 after each observation (Puntillo, Stannard, Miaskowski, Kehrle, & Gleeson, 2002). The behavioral indicators for pain in this scale are movements, vocalization, facial indicators, and posturing/guarding. Physiologic indicators include changes in heart rate, respiratory rate, blood pressure from baseline, as well as the presence of perspiration or pallor. Clinicians check yes or no to indicate the presence of behavioral and physiologic indicators of pain, although no numbers are assigned. After each of the observations, clinicians indicate their perception of the patient's pain on a scale from 0-10. The final step is to evaluate both the behavioral and physiologic indicators of pain and score the

patient again from 0-10 (Puntillo et al., 2002). The PAIN was examined in the expert opinion article only representing two studies.

Pain Assessment in Advanced Dementia

The Pain Assessment in Advanced Dementia (PAINAD) is a behavioral pain assessment tool originally developed for use in patients with dementia who are unable to communicate pain due to cognitive impairment (Warden, Hurley, and Volicer, 2003). The tool assesses five domains of pain including breathing, vocalization, facial expression, body language, and consolability (Paulson-Conger, Leske, Maidl, Hanson, & Dziadulewicz, 2011). Each domain is scored from 0-2 with a total score from 0-10. The PAINAD was identified in the systematic review across four ICU settings including cardiac, medical, surgical and neurologic representing 100 patients.

Pain Behavioral Assessment Tool

The Pain Behavioral Assessment Tool (PBAT) is a checklist of 38 behavioral indicators assessing three domains of pain: facial expression, verbal response, and body movements (Gelinas et al., 2013). The clinician observes the patient for one-minute and reports the presence or absence of behaviors. The PBAT was examined in the expert opinion article only representing three studies and included medical, surgical and cardiac ICU settings.

Revised Nonverbal Pain Scale

The Revised Nonverbal Pain Scale (RNVPS) assesses five domains of pain including facial expression, activity, guarding, physiology I (changes in vital signs such

as heart rate and blood pressure), and respiratory (changes in respiration, spo2, and compliance with the ventilator). The instrument was represented by two cohort studies and expert opinion article representing cardiac, medical, surgical and trauma ICU settings.

Summary

Several behavioral pain assessment tools were identified meeting inclusion criteria for this integrative review. All of the pain scales identified assess the patient for facial expressions of pain and activity or body movements (posturing, guarding, restlessness). A limited number of pain scales allows the practitioner to assess for compliance with the ventilator. Additionally, some scales include aspects of vocalization (cry) and physiologic assessment of respiratory rate, blood pressure, pupil dilation and diaphoresis which may not be reliable indicators of pain in the adult intensive care setting.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION

Introduction

Ten behavioral pain assessment tools were identified in the search process. The psychometric properties of each instrument are described in the following discussion. The CPOT and BPS are represented the most frequently in this integrative review by cohort studies, a systematic review, and expert opinion article. The studies did not universally examine all aspects of feasibility, appropriateness, and meaningfulness, and effectiveness guiding this integrative review. Each pain instrument is identified and analyzed from the literature.

Behavioral Pain Scale

Discriminant validity was explored in two cohort studies by Chanques et al. (2014) and Rijkenberg et al. (2015). Chanques et al. (2014) reported a significant change in BPS score from baseline to nociceptive procedure (turning and suctioning) with $P< 0.001$. Rijkenberg et al. (2015) demonstrated a mean increase in pain score during nociceptive procedure (turning) of two points ($P=0.000$). The systematic review performed by Vardell et al. (2016) identified four studies which assessed discriminant validity, one of which was the study by Rijkenberg et al. (2015). Two of the four studies identified included a total of eighty patients. The BPS was able to discriminate between non-nociceptive and nociceptive procedures in each study. Vardell et al. (2016) also

evaluated construct validity in five studies ranging from 30-124 subjects, finding a statistically significant change in score between rest and painful procedures in four studies. Further, the systematic review identified two studies which examined the level of sedation and the patient response to non-nociceptive and nociceptive procedures finding similar, and statistically significant results. Discriminant validity was supported in the expert opinion article where a clinically important difference was found between non-nociceptive and nociceptive procedures.

Criterion validity was discussed in Vardell et al. (2016) which identified one study comparing BPS and a patient's self-report of pain, the gold standard, finding a moderate correlation (rho=0.71, P=<0.001) in a study of 55 patients. Similarly, Gelinas et al. (2013) found a rho of > 0.60 when the BPS was compared against patient report.

Reliability was discussed in terms of internal consistency and interrater reliability (IRR). Moderate to high internal consistency with a Cronbach's alpha of 0.70 and 0.95 were identified in three cohort studies (Al Darwish et al., 2016, Chanques et al., 2014, and Rijkenberg et al., 2015). Vardell et al. (2016) identified seven studies ranging from 30-175 subjects addressing internal consistency, reporting a wide variation in Cronbach's alpha from 0.501-0.94. A Cronbach's alpha of >0.70 is achieved removing two of the studies, one of which examined deeply sedated or sedated patients. Gelinas et al. (2013) also found a Cronbach's alpha > 0.70 in their examination of studies addressing this aspect of validity.

Interrater reliability was discussed in three of the cohort studies using intraclass correlation and kappa coefficients, also showing moderate to high correlations (Al

Darwish et al., 2016, Rijkenberg et al., 2015, and Ross et al., 2016). Vardell et al. (2016) reported interrater reliability in terms of ICC and kappa coefficients. Intraclass coefficients ranged from 0.74 to 0.95 indicating good to excellent agreement between raters, with the largest study of 100 patients reporting ICC of 0.807. Four of the studies demonstrated substantial to near perfect IRR with kappa coefficients ranging from 0.67-0.83. Gelinas et al. (2013) identified the BPS in 8 of their studies representing 567 patients in a variety of ICU settings and reported ICC and kappa coefficients > 0.80 or 0.60 respectively. The weighted score assigned to the BPS was 13.3, citing medium evidence quality.

Ease of learning, scale accuracy and usefulness of the BPS scale was explored in the study by Chanques et al. (2014). Twenty-one of the nurses participating in the study rated ease of learning an eight out of ten, and both accuracy and usefulness as a seven out of ten. This study compared the BPS, CPOT and ONVPS in their study of thirty patients citing similar results among the three behavioral pain scales. Gelinas et al. (2013) reported that more than eighty percent of clinicians on the expert panel deemed the scale feasible, useful and clinically relevant to practice.

Behavioral Pain Scale Non-Intubated

This scale was identified in the expert opinion only, citing only one article which refers to validity and reliability (Gelinas et al., 2013). The study of the BPS-NI was conducted on 30 subjects in a single ICU setting. In their psychometric assessment of the BPS-NI, Gelinas et al. (2013) found that internal consistency was > 0.70 in their review

of 1 study, and IRR supported with kappa > 0.60 or ICC > 0.80. The authors assigned a weighted score of 10.2 citing low evidence quality (Gelinas et al., 2013). The authors further report that more than twenty percent of clinicians on the expert panel consider the scale not useful or relevant to practice.

Critical Care Pain Assessment Tool

The psychometric properties of the CPOT were discussed in the systematic review, seven cohort studies, and expert opinion article. Various aspects of validity were discussed in five of the cohort studies (Boitor et al., 2016; Chanques et al., 2014; Linde et al., 2013; Rijkenberg et al., 2015; Ross et al., 2016). Construct validity was supported with an increase in CPOT score of 3.04 during a nociceptive procedure (turning) compared to a 0.25 increase in CPOT score during the non-nociceptive procedure of a central-line dressing change (Linde et al., 2013). Discriminant validity was reported in the five studies ranging from 22 -125 subjects, each demonstrating statistically significant changes in CPOT scores between rest and nociceptive procedures (Boitor et al., 2016; Chanques et al., 2014; Linde et al., 2013; Rijkenberg et al., 2016; and Ross et al., 2016). The systematic review by Vardell et al. (2016) identified eight studies which addressed discriminant validity, finding a statistically significant increase in CPOT scores from baseline to nociceptive procedures. Gelinas et al. (2013) also found a clinically significant change in pain scores between non-nociceptive and nociceptive procedures. Criterion validity between the patient's self-report using the Faces Pain Thermometer was performed by Boitor et al. (2016) using Pearson correlations, finding a moderate

correlation with pain intensity and CPOT score (r=0.419, P<0.01). Gelinas et al. (2013), in their review of 13 studies, found only a moderate correlation between the CPOT score and the patient's report of pain. Additionally, Boitor et al. (2016) examined fluctuations in vital signs during mediastinal tube removal (MTR) finding no significant correlation between vital signs and a patient's self-report (P>0.05). Concurrent validity was discussed in Vardell et al. (2016) which identified one study comparing the CPOT and a patient's self-report of pain, finding moderate to high correlations (r=0.71, P=<0.05) in a study of 55 patients.

Reliability was discussed in terms of internal consistency and IRR. Acceptable to excellent internal consistency with a Cronbach's alpha 0.70 – 0.95 was reported during painful procedure (Al Darwish et al. 2016; Rijkenberg et al. 2015). Conversely, Vardell et al. (2016) examined six studies that reported internal consistency. Five of the six studies, ranging in sample size of 25-48 subjects reported Cronbach's alphas of 0.71-0.89, indicating acceptable to good internal consistency however, one study reported a wide variation of Cronbach's alpha scores of 0.31-0.81. Internal consistency of the CPOT was supported by Gelinas et al. (2013) as they found a Cronbach's of > 0.70 in their review of eleven studies. Interrater reliability is reported using ICC in four studies and two studies reporting Fleiss-Cohen weighted kappa. Of these, five of six studies demonstrate moderate to excellent correlation (Al Darwish et al. 2016; Boitor et al. 2016; Chanques et al., 2014; Linde et al. 2013; Rijkenberg et al. 2015; Ross et al. 2016). However, the largest study by Boitor et al. (2016) of 125 patients showed a wide variation of ICCs ranging from 0.304-0.863. The systematic review by Vardell et al.

(2016) identified nine studies addressing IRR using ICCs and kappa coefficients, demonstrating moderate to excellent interrater reliability. Gelinas et al. (2013) identified the CPOT in 11 studies, representing 524 patients in a variety of ICU settings and reported ICC and kappa coefficients > 0.80 or 0.60 respectively.. Based on their psychometric testing of the instrument the CPOT was assigned a weighted score 17.7 reflecting medium quality evidence.

Ease of learning, scale accuracy and usefulness of the CPOT scale was explored in the study by Chanques et al. (2014). Twenty-one of the nurses participating in the study rated ease of learning, accuracy and usefulness as an eight out of ten. This study compared the BPS, CPOT and ONVPS in their study of thirty patients citing similar results among the three behavioral pain scales. The systematic review by Vardell et al. (2016) identified one study which reported feasibility and utility although the number of participants is not reported by the authors. Feasibility is reported as a range from 79-100%, and utility as 55-72%. Vardell et al. (2016) also reported one study in which 10 of 66 participants compared the feasibility and applicability of the CPOT to the NVPS. Participants found the scales equally feasible with more respondents favoring the CPOT (18% v. 7%). Gelinas et al. (2013) reports that more than eighty percent of clinicians on the expert panel deem the scale feasible, useful and clinically relevant to practice.

Faces, Legs, Arms, Cry and Consolability

The FLACC was identified in the systematic review and expert opinion articles (Gelinas et al., 2013; Vardell et al., 2016). Vardell et al. (2016) identified one study of 29

subjects addressing construct validity finding statistically significant decreases in pain scores following administration of analgesia. The FLACC, identified in three studies by Gelinas et al. (2013), was deemed to demonstrate discriminant validity by the authors according to their psychometric assessment scale.

High internal consistency and interrater reliability was discussed in one study with a Cronbach's alpha of 0.84-0.88 and kappa = 0.98 (Vardell et al., 2016). Vardell (2016) also notes in the systematic review that the "cry" domain demonstrated poor internal consistency but an overall Cronbach's alpha 0.934 when this domain is removed. Gelinas et al. (2013) evaluated 3 studies which addressed the FLACC assigning a weighted score of 9.6, citing very-low evidence quality. Gelinas et al. (2013) found that internal consistency was > 0.70 in their review of 3 studies, and IRR supported with kappa > 0.60 or ICC > 0.80.

Vardell et al. (2016) reported on one study in his systematic review which addressed applicability finding that in 200 patient assessments, cry is marked as 'not applicable' 62 times. Further, Gelinas et al. (2013) report that more than twenty percent of clinicians on the expert panel consider the scale not useful or relevant to practice.

Nonverbal Pain Assessment Tool

This scale was identified in the expert opinion only, citing one article which refers to validity and reliability (Gelinas et al., 2013). The authors awarded no points for discriminant validity as the study did not include information regarding procedures performed (nociceptive v. non-nociceptive procedures, administration of analgesia).

Internal consistency was supported with Cronbach's alphas > 0.70, though only a moderate agreement demonstrated with IRR <0.60 or ICC < 0.80. Feasibility was either not assessed in the studies identified by Gelinas et al. (2013) or was considered not useful or relevant by more than 20% of clinicians. A total weighted score of 7.2 was assigned citing low evidence quality.

Original Nonverbal Pain Scale

The psychometric properties of the Nonverbal Pain Scale (ONVPS) were addressed in the systematic review, two cohort studies, and the expert opinion article. Discriminant validity of the scale was supported in the two cohort studies of 30 and 60 subjects (Chanques et al., 2014; Chookalayi et al., 2017). Vardell et al. (2016) identified two additional studies supporting this aspect of validity. Gelinas et al. (2013) identified the ONVPS in one study of 123 subjects, awarding full points for discriminant validity. Vardell et al. (2016) also discussed concurrent validity between the ONVPS and a patient's self-report of pain. This was examined in one study showing weak, yet statistically significant correlations (rho=0.313, P .001). Criterion validity was addressed utilizing a patient's ability to nod head (Chookelayi, Heidarzadeh, Hasapour, & Sadeghpour, 2017). The authors saw an expected increase in pain when patients indicated pain however, the physiology II category increased only 9% of the time when patients indicated the presence of pain. Further, the physiology I domain also showed a small increase of 19.8% when patients reported pain suggesting that vital signs are not reliable in the detection of pain in this population. The lack of responsiveness of the physiology

domains this scale further supports the use of vital signs as a cue to the presence of pain in this population rather than relying on them to indicate pain. Reliability testing was reported in seven of the studies identified by Vardell et al. (2016). The author reports an overall Cronbach's alpha of 0.75 between these studies. One study was reported to have high interrater agreement (90.8%) while two other studies demonstrated substantial agreement with a kappa of 0.71-0.80 (Vardell et al., 2016). Chanques et al. (2014) also observed low IRR physiology domain II (skin, pupillary response and pallor) in this study with a kappa of 0.02 suggesting poor responsiveness of this domain. In their study of 60 subjects, Chookalayi et al. (2017) report an acceptable Cronbach's alpha of 0.76 and excellent correlation between the two raters (ICC = 0.87-0.97). Gelinas et al. (2013) reported a Cronbach's alpha of 0.70-0.90 in the studies reviewed and good to substantial interrater reliability. A weighted score of 11.2 was given by Gelinas et al. (2013) citing very low evidence quality.

Ease of learning, scale accuracy and usefulness of the ONVPS scale was explored in the study by Chanques et al. (2014). Twenty-one of the nurses participating in the study rated ease of learning an eight out of ten and both accuracy and usefulness as a seven out of ten. This study compared the BPS, CPOT and ONVPS on thirty patients citing similar results among the three behavioral pain scales. Gelinas et al. (2013) reports that more than eighty percent of expert panel clinicians deem the scale feasible, useful and clinically relevant to practice. The ONVPS was studied on 164 ICU patients in the study conducted by Gelinas et al. (2013). The authors assigned a weighted score of 11.2, citing very low evidence quality.

Pain Assessment and Intervention Notation

The study by Gelinas et al. (2013) identified use of the PAIN scale in one study. The authors awarded no points for discriminant validity. Further, there was no evaluation of construct validity, internal consistency or interrater reliability. However, 80% clinicians consider the tool to be useful and relevant to clinical practice. The authors assigned a weighted score of 5.9 was given, citing very-low evidence quality.

Pain Assessment in Advanced Dementia

The systematic review by Vardell et al. (2016) identified one study in which the PAINAD was tested. In the study of 100 subjects across four ICU settings, Vardell et al. (2016) demonstrated substantial interrater reliability (ICC = 0.80). No studies were identified which addressed validity or internal consistency of the scale.

Patient Behavioral Assessment Tool

Gelinas et al. (2013) identified one study which tested the use of the PBAT. Discriminant validity was supported in a group of mechanically ventilated adult cardiac surgery patients as the tool distinguished between nociceptive (endotracheal suctioning, turning, etc.) and non-nociceptive procedures (gentle touch). Internal consistency and interrater reliability were not examined. The authors assigned a weighted score of 7.5, indicating low evidence quality.

Revised Nonverbal Pain Scale

The RVNPS was identified in two cohort studies and the expert opinion article. Validity was not addressed in the study by Al Darwish et al. (2016). An increase in pain scores of 2 from baseline during a nociceptive procedure (turning) supports discriminant validity (Chookalayi et al., 2017). The authors also assessed criterion validity utilizing a patient's ability to nod head finding the physiology I domain (changes in vital signs such as heart rate and blood pressure) only increased 19.8% of the time when patients reported pain suggesting that vital signs are not reliable in the detection of pain in this population. Respiratory changes (physiology II) were present 40.0% of the time when patients were able to self-report. The RNVPS was studied on 264 ICU patients in the review conducted by Gelinas et al. (2013). Discriminant validation was supported with significant increases in pain scores with nociceptive procedures when compared to non-nociceptive procedures. Internal consistency testing in two cohort studies demonstrated a Cronbach's alpha > 0.80 (Al Darwish et al., 2016, Chookalayi et al., 2017). Gelinas et al. (2013) also reported Cronbach's alpha > 0.70 in their expert opinion article. Interrater reliability was examined in two cohort studies, each reporting excellent agreement between raters with an ICC >0.80. Interrater agreement was >90% in one of the studies identified by Gelinas et al. (2013), with an ICC in the second study of 0.60-0.76. They assigned a weighted score of 7.8, citing very low evidence quality.

CHAPTER FIVE

DISCUSSION

Overview

The purpose of this integrative review was to identify behavioral pain assessment tools that are generalizable across various critical care settings to aid the practitioner in assessing pain in the nonverbal, critically ill patient. After a thorough review of the literature and critical appraisal of seven cohort studies, one systematic review, and one expert opinion article published between January 2012 and December 2017, ten behavioral pain assessment tools were identified for evaluation. The FAME framework, developed by Joanna Briggs Institute, is utilized to evaluate the feasibility, appropriateness, meaningfulness and effectiveness of the pain instruments identified in this integrative review.

Evaluation

Feasibility

Feasibility has two components that should be considered by an organization or unit; the first is the practicality of implementing a pain assessment tool such as financial barriers, the second is the perspective of the clinicians utilizing the tool. Very few studies identified in this integrative review assessed the feasibility of behavioral pain instruments, and none addressed the potential financial implications of integrating a new assessment tool in terms of information technology time or training of nurses.

For the purpose of this discussion feasibility and ease of use are included in this evaluation. In a small sample size of nurse respondents (n=20), Chanques et al. (2014) found that nurses rated the BPS, CPOT and the ONVPS as an 8 on a Likert-scale of 0-10. Vardell et al. (2016) referenced two studies addressing this aspect. Ten of sixty-six nurses who responded stated the CPOT and ONVPS were feasible 49% and 47% respectively. The second study identified by Vardell et al. (2016) found that 79-100% of respondents found the CPOT favorable however it is unclear how many survey responses were utilized in this analysis. Gelinas et al. (2013) also addressed feasibility using their psychometric assessment tool, evaluating eight behavioral pain assessment tools. The authors rated the BPS and the CPOT feasible by at least 80% of clinicians. For the remaining instruments identified in the aforementioned study, the scale was considered "not useful" by more than 20% of clinicians, the scale did not yield a significant change to practice, or there was a lack of information provided in the studies reviewed.

Appropriateness

An appropriate pain assessment tool would be generalizable across settings including medical, surgical, cardiac, trauma and neurologic ICUs. Neurologic patients were excluded in the search criteria as these patients are known to have different expressions of pain and no pain instrument to date has been universally accepted however, some of the studies included a small neurologic population and were included as other ICU settings were also examined.

In their most recently published clinical practice guidelines, the SCCM (2013) which reviewed the literature from December 1999 to December 2010, recommends the

use of vital signs in the assessment of pain in the critically ill adult patient be used as a cue, rather than as an indication of pain. In a study of 125 subjects in the cardiac ICU, Boitor et al. (2016) found no correlation between vital signs and a nociceptive procedure (MTR). Chookalayi et al. (2017), in the evaluation of the ONVPS and RNVPS in sixty patients able to nod their head in response to pain, found that the physiology domains of the ONVPS and RNVPS rarely increased when patients indicated pain. These findings support the growing body of evidence that the inclusion of vital signs in pain assessment in the adult, critical care population may not be valid.

The FLACC, originally developed to assess pain in the pediatric population, has not been validated for use in adults. Vardell et al. (2016) identified one study of 59 subjects with 200 pain assessments finding that the subscales of cry and consolability were marked as "NA" 62 and 16 times respectively. Children often cry or wail in response to pain, but this expression of pain is not representative of the adult population. Further, the tool makes no accommodation for the intubated patient unable to cry.

Pain assessment instruments with single ICU settings include the BPS-NI, NPAT and the PBAT and are not generalizable. The FLACC was limited to medical and surgical ICU setting, whereas the ONVPS and RNVPS represented medical, surgical, trauma and neurologic ICUs. The BPS and the CPOT have been studied in a variety of ICU settings including medical, surgical, cardiac and trauma units, lending to their generalizability.

Meaningfulness

Pearson et al. (2005) describes meaningfulness as how the activity or intervention is positively experienced by the patient in terms of their values, thoughts, beliefs, and interpretations. This integrative review did not identify qualitative studies assessing the patient's response to the implementation of a pain assessment tool, however meaningfulness from the clinician perspective is considered in terms of usefulness and influence to nursing practice by clinicians. In a small sample size of nurse respondents (n=20), Chanques et al. (2014) found that nurses rated the BPS, CPOT and the ONVPS as a 7, 8, and 7 respectively on a Likert-scale of 0-10 regarding usefulness. In one study of 33 respondents identified by Vardell et al. (2016), 54% indicated the CPOT positively influenced their practice in assessing pain. Gelinas et al. (2013) found in their assessment of psychometric properties of eight behavioral pain assessment scales, only the BPS, CPOT and ONVPS were considered useful and relevant and/or yielded a significant change into practice (better use of pain medication, increase in patient pain assessments).

Effectiveness

Pearson et al. (2005) describe effectiveness as the degree to which an act or intervention achieves the intended goal. Aspects of validity and reliability were examined in the ten studies identified in this integrative review.

Several of the behavioral pain assessment tools identified lack supportive validity and reliability testing to recommend their implementation into the ICU setting. Although the NPAT contains behavioral expressions of pain identified in other pain assessment tools (movement, verbal cues, facial expressions and guarding), it lacked evaluation of

reliability and validity testing to support its use in the critical care population. The PAINAD, developed for adults with cognitive impairment, was identified in the systematic review and demonstrated high interrater reliability however additional studies are needed to assess the construct validity, discriminant validity, and internal consistency in the adult critical care setting (Vardell et al., 2016). Similarly, the PAIN assessment tool, referenced in the study by Gelinas et al. (2013), lacked evaluation of discriminant validity, construct validity, IRR, and internal consistency. The PBAT was identified by Gelinas et al. (2013) in one study of intubated, cardiac patients who were able to self-report pain. In their assessment of psychometric properties, the PBAT was given full points for discriminant validity however, reliability is questionable as the authors reported a Cronbach's alpha <0.60 and/or ICC and kappa coefficients were either less than 0.60 and 0.40 respectively or not reported. As the BPS-NI represented one study on thirty subjects unable to report pain, further testing is needed to confirm the validity and reliability of this instrument although discriminant validity, internal consistency and IRR were favorable (Gelinas et al., 2013). Further discussion of effectiveness will include the BPS, CPOT, FLACC, ONVPS and RNVPS.

Content validity was not evaluated in the seven cohort studies and the systematic review however, Gelinas et al. (2013) examined this aspect in their psychometric assessment tool of pain instruments. They awarded full points to the CPOT as either the content was evaluated by experts in the field or a CVI of 0.75 was established. The ONVPS and RNVPS were given half-points in their assessment as content was reviewed

by experts but a CVI was not reported, whereas the articles which identified the FLACC provided no information about content

validation (Gelinas et al., 2013).

Criterion validity was examined by Chookalayi et al. (2017) and found the physiology I (changes in vital signs) and physiology II (skin, pupillary response and perspiration) to be unreliable indicators of pain when patients were able to indicate the presence of pain by nodding their head. Only moderate correlations were found between a patient's ability to self-report pain and the BPS and CPOT scales.

Reliability was examined in terms of internal consistency and interrater reliability. Internal consistency was supported in the BPS, CPOT, FLACC, and RNVPS with Cronbach's alphas > 0.70. The study by Gelinas et al. (2013) found a lower Cronbach's alpha, reporting a range of 0.60-0.70 in their assessment of studies which discussed the ONVPS. Interrater reliability was supported in the BPS, CPOT, FLACC, and ONVPS instruments using ICC and kappa coefficients. The ONVPS was reported by Chanques et al. (2014) as excellent however, the subscale of showed poor agreement between raters with a kappa of 0.02. The IRR of the RNVPS was supported by the study by Al Darwish et al. (2016) with an excellent ICC however Gelinas et al. (2013) reported kappa coefficients and ICC of this scale as <0.60 or <0.80 respectively.

Recommendations

The FAME framework provides a foundation for recommendation in the use of a pain assessment tool for the clinical agency with the non-verbal population. The

feasibility of behavioral pain instruments was limited in this integrative review. Of the ten instruments identified, only the BPS, CPOT and ONVPS had assessments of feasibility. In their assessment of the psychometric properties of eight behavioral pain assessment tools, Gelinas et al. (2013) rated the BPS and the CPOT as feasible by more than 80% of clinicians with the remaining instruments lacking evidence of feasibility. Vardell et al. (2016) identified two studies which assessed feasibility of the ONVPS and CPOT, showing some evidence of feasibility though the response rate was low. Finally, in a small sample of nurse respondents (n=20), Chanques et al. (2015) identified the BPS, CPOT and ONVPS as feasible using a Likert-scale of 0-10, with each instrument scoring and eight. None of the studies addressed the financial impact or the cost to implement and train clinicians.

The BPS, CPOT, ONVPS and RNVPS demonstrated appropriateness or generalizability as they were studied in a variety of critical care settings. Only the BPS, CPOT and RNVPS make accommodations for the intubated patient, lending to their utility. A version of the BPS (BPS-NI) is available for the non-intubated patient but lacked evidence of effectiveness and generalizability in this review to recommend its use at this time. The use of vital signs to indicate pain in this population remains questionable with the SCCM making the recommendation clinicians use them as a cue rather than relying on a change to indicate pain. Two cohort studies identified in this integrative review support this recommendation (Boitor et al., 2016, Chookalayi et al., 2017) as the physiology aspects of scales studies did not change in response to nociceptive procedures.

Though Pearson et al. (2005) describes meaningfulness as how the activity or intervention is positively experienced by the patient in terms of values, thoughts, beliefs, and interpretations, this aspect was explored from the clinician perspective in relation to usefulness or influence to practice. Of eight pain instruments identified by Gelinas et al. (2013), only the BPS, CPOT and ONVPS were considered useful or relevant to practice by an expert panel. These pain instruments were also identified as useful to practice in a cohort study and in one study represented in a systematic review (Chanques et al., 2015, Vardell et al., 2016).

Effectiveness was evaluated in terms of several aspects of validity and reliability, with the BPS, CPOT, FLACC and ONVPS demonstrating the strongest psychometric properties among studies identified. The BPS-NI, NPAT, PAIN, PAINAD, and PBAT lack validity and reliability testing in the critical care population in studies reviewed.

The goal of this master's prepared CNL candidate was to identify evidence-based recommendations for pain assessment in the non-verbal, critical care adult patient. In considering feasibility, appropriateness, meaningfulness to clinicians, and effectiveness, the CPOT was identified as having the strongest overall evidence to support implementation in a large ICU in the Northwest United States.

Strengths and Limitations

This integrative review was undertaken using evidence-based tools to assess the strength of the studies identified using the Joanna Briggs appraisal checklists. Only studies demonstrating high quality evidence were included. The FAME framework was

utilized to consider additional aspects of evidence aside from scientific psychometric properties. There are several limitations to this review. First, the literature search process and quality assessment of potential studies were conducted by the graduate student alone. The time frame of the literature review was five years, from 2012-2017. Additional studies may have been omitted that would have led to richer data. Relevant studies may have been overlooked regarding feasibility, usefulness, appropriateness, generalizability and meaningfulness with the narrow search parameters and this student's focus on psychometric properties of instruments. Further, many of the studies included in this review had small sample sizes. Lastly, qualitative data was not included which could have informed the meaningfulness aspect of pain assessment tools by clinicians.

Implications for CNL Practice

Despite an increased focus on the presence of pain in the critical care population and efforts to improve pain assessment, as many as 50% of patients report experiencing moderate to severe pain (Barr et al., 2013). Untreated or undertreated pain may add to the burden of healthcare costs related to infection, a longer duration of mechanical ventilation and ICU stays, and the adverse psychological sequelae from a patients' hospitalization. The master's prepared CNL has a unique skillset to aid an organization in evaluating and improving patient outcomes with knowledge of appraising literature and implementing change (AACN, 2013). With this understanding, the CNL may "facilitate the lateral integration of evidence-based care across the setting and among care providers to promote quality, safe, and coordinated care" (AACN, 2013, p. 20). The CNL leading

the implementation of the new pain assessment tool may be involved in working with information technology staff to make changes to the electronic health record, data collection and building a database to track outcomes, and the training and monitoring of staff during this process. Additionally, new research is emerging regarding behavioral pain assessment tools in brain-injured patients. As this CNL student plans to implement the CPOT into an organization caring for this population of patients, ongoing appraisal of new evidence should be undertaken to identify evidence-based practice recommendations for assessing pain in patients with neurologic injuries.

Implications for Research

This integrative review excluded studies that included brain injury patients as they are known to have different expressions of pain, and no pain assessment tool has been shown reliable and valid in this population. Further research is necessary to identify expressions of pain in these patients and develop and valid and reliable tool as these patients may not be treated appropriately for pain. Additional research of pain assessment tools should also include feasibility, appropriateness and meaningfulness as these important aspects are often overlooked in studies.

Summary

The purpose of this scholarly project was to identify an evidence-based pain assessment tool for use in the non-verbal, critically ill adult patient through a comprehensive review of the literature. Following a structured process and critical

appraisal of studies, ten pain assessment tools were identified. Using the Joanna Briggs FAME framework, a recommendation was made to implement the CPOT into practice in a large ICU in the Northwest United States.

APPENDICES

APPENDIX A

JOANNA BRIGGS APPRAISAL CHECKLISTS

JBI Critical Appraisal Checklist for Cohort Studies

Reviewer_____Date_____

Author _____Year_____Record Number_____

		Yes	No	Unclear	Not applicable
1.	Were the two groups similar and recruited from the same population?	□	□	□	□
2.	Were the exposures measured similarly to assign people to both exposed and unexposed groups?	□	□	□	□
3.	Was the exposure measured in a valid and reliable way?	□	□	□	□
4.	Were confounding factors identified?	□	□	□	□
5.	Were strategies to deal with confounding factors stated?	□	□	□	□
6.	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	□	□	□	□
7.	Were the outcomes measured in a valid and reliable way?	□	□	□	□
8.	Was the follow up time reported and sufficient to be long enough for outcomes to occur?	□	□	□	□
9.	Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	□	□	□	□
10.	Were strategies to address incomplete follow up utilized?	□	□	□	□
11.	Was appropriate statistical analysis used?	□	□	□	□

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (Including reason for exclusion)

_____

_____

JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses

Reviewer_____ Date_____

Author _____ Year_____ Record Number _____

		Yes	No	Unclear	Not applicable
1.	Is the review question clearly and explicitly stated?	□	□	□	□
2.	Were the inclusion criteria appropriate for the review question?	□	□	□	□
3.	Was the search strategy appropriate?	□	□	□	□
4.	Were the sources and resources used to search for studies adequate?	□	□	□	□
5.	Were the criteria for appraising studies appropriate?	□	□	□	□
6.	Was critical appraisal conducted by two or more reviewers independently?	□	□	□	□
7.	Were there methods to minimize errors in data extraction?	□	□	□	□
8.	Were the methods used to combine studies appropriate?	□	□	□	□
9.	Was the likelihood of publication bias assessed?	□	□	□	□
10.	Were recommendations for policy and/or practice supported by the reported data?	□	□	□	□
11.	Were the specific directives for new research appropriate?	□	□	□	□

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (Including reason for exclusion)

_____

_____

JBI Critical Appraisal Checklist for Text and Opinion Papers

Reviewer_____ Date_____

Author _____ Year_____ Record Number _____

	Yes	No	Unclear	Not applicable
1. Is the source of the opinion clearly identified?	□	□	□	□
2. Does the source of opinion have standing in the field of expertise?	□	□	□	□
3. Are the interests of the relevant population the central focus of the opinion?	□	□	□	□
4. Is the stated position the result of an analytical process, and is there logic in the opinion expressed?	□	□	□	□
5. Is there reference to the extant literature?	□	□	□	□
6. Is any incongruence with the literature/sources logically defended?	□	□	□	□

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (Including reason for exclusion)

_____

_____

_____

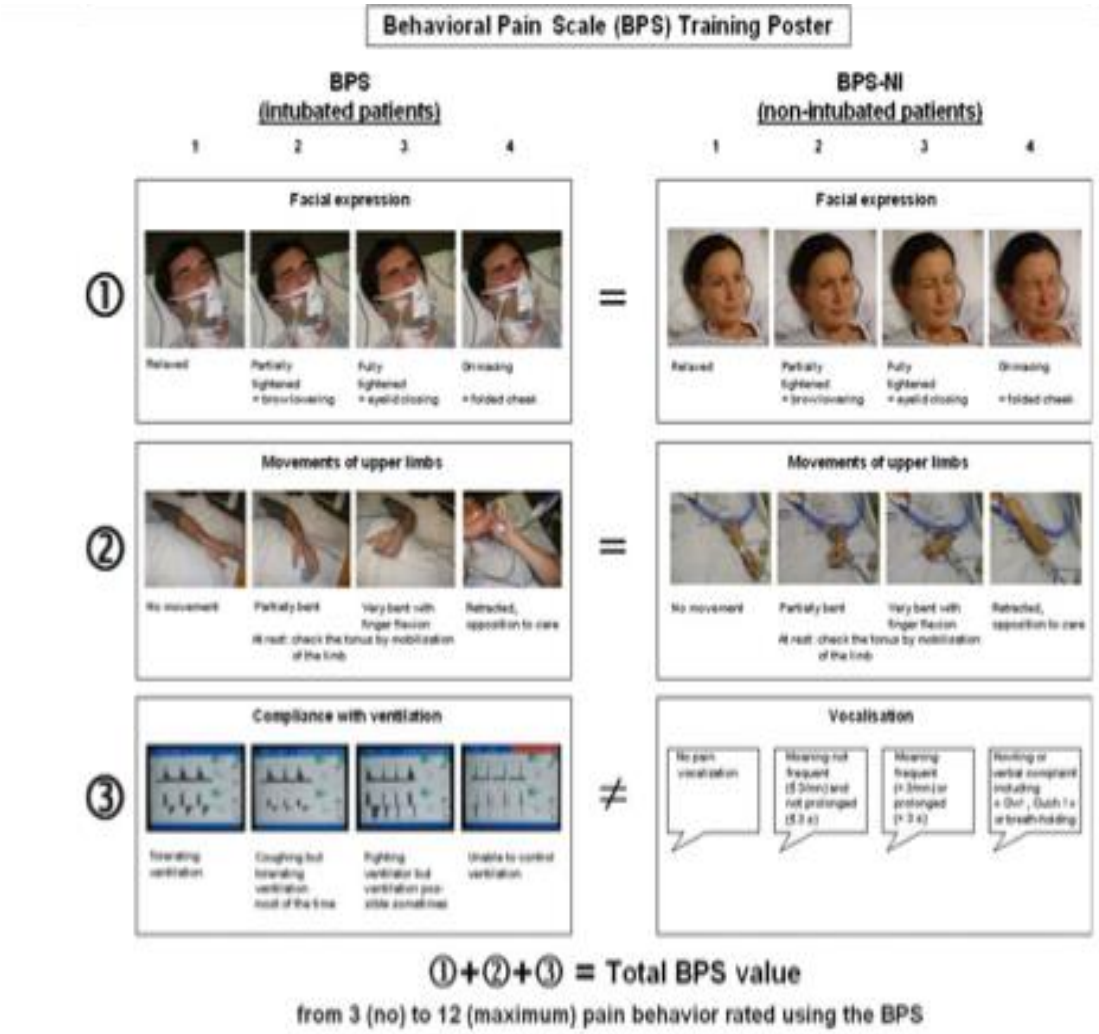
APPENDIX B

BEHAVIORAL PAIN INSTRUMENTS

Table 1. The Behavioral Pain Scale[13]

Item	Description	Score
Facial expression	Relaxed	1
	Partially tightened	2
	Fully tightened	3
	Grimacing	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with ventilation	Tolerating movement	1
	Coughing but tolerating ventilation for most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4

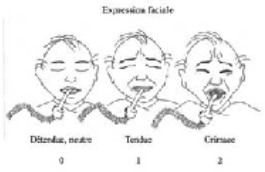
(Ahlers et al., 2010)



(Chanques et al., 2009)

The Critical-Care Pain Observation Tool (CPOT)

(Gélinas et al., 2006)

Indicator	Score		Description
Facial expression  Caroline Arbour, RN, B.Sc., PhD(student) School of Nursing, McGill University	Relaxed, neutral	0	No muscle tension observed
	Tense	1	Presence of frowning, brow lowering, orbit tightening and levator contraction or any other change (e.g. opening eyes or tearing during nociceptive procedures)
	Grimacing	2	All previous facial movements plus eyelid tightly closed (the patient may present with mouth open or biting the endotracheal tube)
Body movements	Absence of movements or normal position	0	Does not move at all (doesn't necessarily mean absence of pain) or normal position (movements not aimed toward the pain site or not made for the purpose of protection)
	Protection	1	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements
	Restlessness/Agitation	2	Pulling tube, attempting to sit up, moving limbs/thrashing, not following commands, striking at staff, trying to climb out of bed
Compliance with the ventilator (intubated patients)	Tolerating ventilator or movement	0	Alarms not activated, easy ventilation
	Coughing but tolerating	1	Coughing, alarms may be activated but stop spontaneously
	Fighting ventilator	2	Asynchrony: blocking ventilation, alarms frequently activated
OR			
Vocalization (extubated patients)	Talking in normal tone or no sound	0	Talking in normal tone or no sound
	Sighing, moaning	1	Sighing, moaning
	Crying out, sobbing	2	Crying out, sobbing
Muscle tension Evaluation by passive flexion and extension of upper limbs when patient is at rest or evaluation when patient is being turned	Relaxed	0	No resistance to passive movements
	Tense, rigid	1	Resistance to passive movements
	Very tense or rigid	2	Strong resistance to passive movements or incapacity to complete them
TOTAL	**___ / 8**		

Faces, Legs, Activity, Cry and Consolability (FLACC)

Category	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to; distractable	Difficult to console

Each of the five categories is scored from 0 – 2, resulting in total range of 0 – 10, FLACC = Face, Leg, Activity, Cry, Consolability

(Redmann et al., 2017)

Original and Revised NVPS

Table 1: Adult nonverbal pain scale

Categories	0	1	2
Revised-NVPS*			
Face	No particular expression or smile	Occasional grimace, tearing, frowning, wrinkled forehead	Frequent grimace, tearing, frowning, wrinkled forehead
Activity (movement)	Lying quietly, normal position	Seeking attention through movement or slow, cautious movement	Restless, excessive activity and/or withdrawal reflexes
Guarding	Lying quietly, no positioning of hands over areas of body	Splinting areas of the body, tense	Rigid, stiff
Physiologic I (vital signs)	Stable vital signs (no change in past 4 h)	Change over past 4 h in any of the followings SBP >20 mmHg HR >20/min	Change over past 4 h in any of the followings SBP >30 mmHg HR >25/min
Respiratory	Baseline RR/SpO_2 Compliant with ventilator	RR >10 above baseline, or 5% SpO_2 or mild asynchrony with ventilator	RR >20 above baseline, or 10% SpO_2 or severe asynchrony with ventilator
Original-NVPS**			
Face	No particular expression or smile	Occasional grimace, tearing, frowning, wrinkled forehead	Frequent grimace, tearing, frowning, wrinkled forehead
Activity (movement)	Lying quietly, normal position	Seeking attention through movement or slow, cautious movement	Restless, excessive activity and/or withdrawal reflexes
Guarding	Lying quietly, no positioning of hands over areas of body	Splinting areas of the body, tense	Rigid, stiff
Physiologic I (vital signs)	Stable vital signs (no change in past 4 h)	Change over past 4 h in any of the followings SBP >20 mmHg HR >20/min RR >10/min	Change over past 4 h in any of the followings SBP >30 mmHg HR >25/min RR >20/min
Physiologic II	Warm, dry skin	Dilated pupils, perspiring, flushing	Diaphoretic, pallor

*Adopted from Wegman DA. (2005).[17] **Adopted from Odhner *et al*. (2003).[14] NVPS: Nonverbal pain scale; RR: Respiratory rate; HR: Heart rate; SBP: Systolic blood pressure

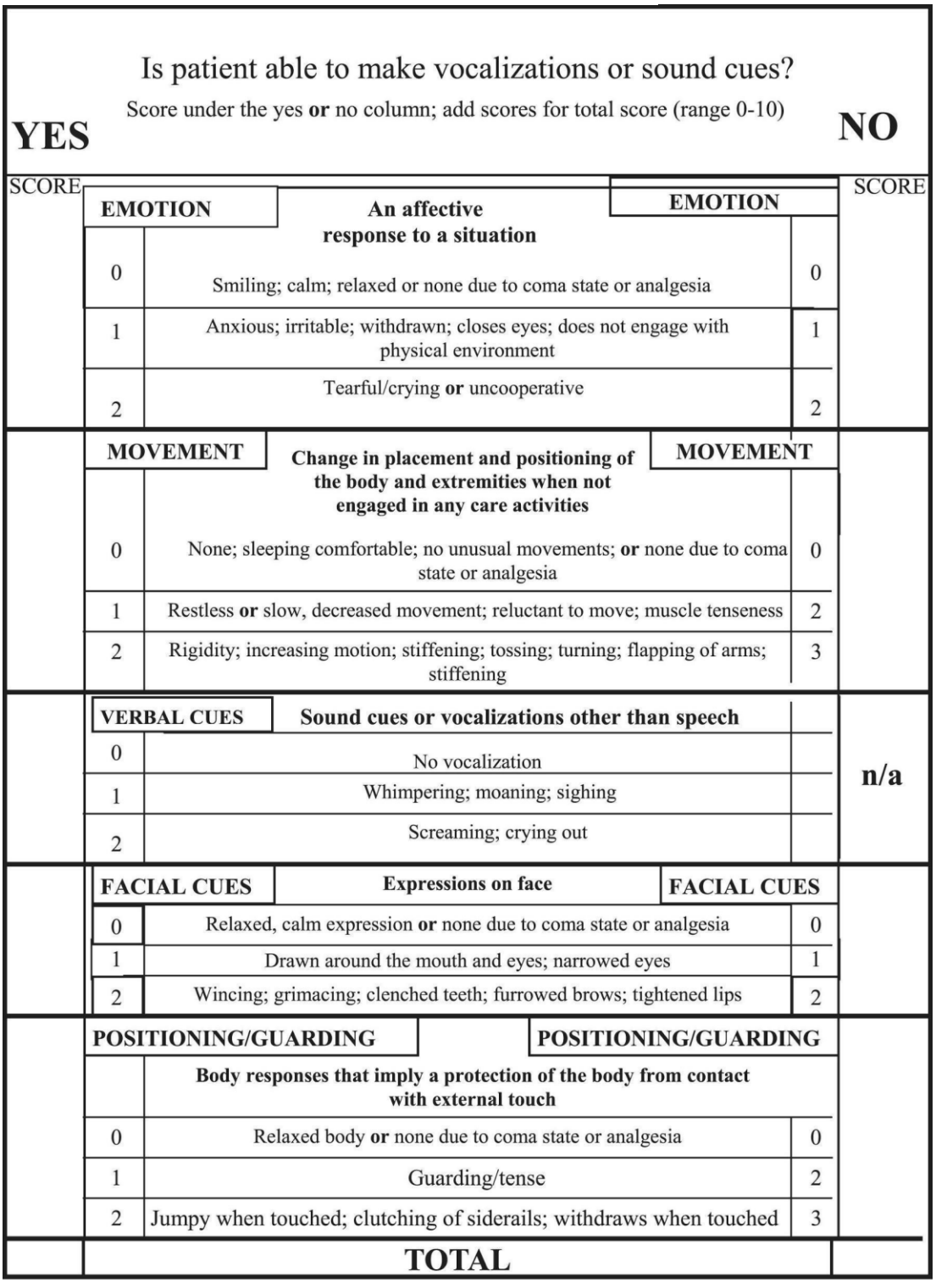
Pain Assessment in Advanced Dementia Scale (PAINAD)

Instructions: Observe the patient for five minutes before scoring his or her behaviors. Score the behaviors according to the following chart. Definitions of each item are provided on the following page. The patient can be observed under different conditions (e.g., at rest, during a pleasant activity, during caregiving, after the administration of pain medication).

Behavior	**0**	**1**	**2**	**Score**
Breathing Independent of vocalization	• Normal	● Occasional labored breathing ● Short period of hyperventilation	● Noisy labored breathing ● Long period of hyperventilation ● Cheyne-Stokes respirations	
Negative vocalization	• None	● Occasional moan or groan ● Low-level speech with a negative or disapproving quality	● Repeated troubled calling out ● Loud moaning or groaning ● Crying	
Facial expression	• Smiling or inexpressive	• Sad • Frightened • Frown	• Facial grimacing	
Body language	• Relaxed	• Tense • Distressed pacing • Fidgeting	● Rigid ● Fists clenched ● Knees pulled up ● Pulling or pushing away ● Striking out	
Consolability	• No need to console	• Distracted or reassured by voice or touch	• Unable to console, distract, or reassure	
TOTAL SCORE				

(Warden et al., 2003)

Nonverbal Pain Assessment Tool (NPAT)



Is patient able to make vocalizations or sound cues?

Score under the yes **or** no column; add scores for total score (range 0-10)

SCORE	YES		NO	SCORE
	EMOTION	**An affective response to a situation**	**EMOTION**	
	0	Smiling; calm; relaxed or none due to coma state or analgesia	0	
	1	Anxious; irritable; withdrawn; closes eyes; does not engage with physical environment	1	
	2	Tearful/crying **or** uncooperative	2	
	MOVEMENT	**Change in placement and positioning of the body and extremities when not engaged in any care activities**	**MOVEMENT**	
	0	None; sleeping comfortable; no unusual movements; **or** none due to coma state or analgesia	0	
	1	Restless **or** slow, decreased movement; reluctant to move; muscle tenseness	2	
	2	Rigidity; increasing motion; stiffening; tossing; turning; flapping of arms; stiffening	3	
	VERBAL CUES	**Sound cues or vocalizations other than speech**		**n/a**
	0	No vocalization		
	1	Whimpering; moaning; sighing		
	2	Screaming; crying out		
	FACIAL CUES	**Expressions on face**	**FACIAL CUES**	
	0	Relaxed, calm expression **or** none due to coma state or analgesia	0	
	1	Drawn around the mouth and eyes; narrowed eyes	1	
	2	Wincing; grimacing; clenched teeth; furrowed brows; tightened lips	2	
	POSITIONING/GUARDING		**POSITIONING/GUARDING**	
		Body responses that imply a protection of the body from contact with external touch		
	0	Relaxed body **or** none due to coma state or analgesia	0	
	1	Guarding/tense	2	
	2	Jumpy when touched; clutching of siderails; withdraws when touched	3	
	TOTAL			

Choose only one behavior per category

(Klein et al., 2010)

Pain Assessment and Intervention Notation

P.A.I.N. TOOL **Step 1: ASSESS PAIN**

A. ARE POTENTIAL PAIN-RELATED BEHAVIORS PRESENT?

YES	NO	MOVEMENTS
		No movement
		Slow, decreased, hesitant, cautious
		Restlessness
		Seeking attention through movements
		Vocalization
YES	**NO**	**FACIAL CUES**
		Grimacing, frowning, wincing
		Drawn around mouth and eyes
		Teary/crying
		Wrinkled forehead
YES	**NO**	**POSTURING/GUARDING**
		Rigid
		Splinting
		Tense, stiff

Based upon the behaviors you've noted above, what number would you assign to the pain behavior indicator scale?

0 1 2 3 4 5 6 7 8 9 10
Patient has no pain — Patient has worst pain imaginable

B. ARE POTENTIAL PHYSIOLOGICAL PAIN INDICATORS PRESENT?

YES	NO	PHYSIOLOGICAL INDICATORS
		Increased HR
		Decreased HR
		Increased blood pressure
		Decreased blood pressure
		Increased respiratory rate
		Decreased respiratory rate
		Perspiration
		Pallor

Based upon the physiological indicators you've noted above, what number would you assign to the pain physiological indicator scale?

0 1 2 3 4 5 6 7 8 9 10
Patient has no pain — Patient has worst pain imaginable

NURSE'S OVERALL ASSESSMENT OF PAIN INTENSITY

BASED ON YOUR OBSERVATIONS ABOVE, WHAT NUMBER DO YOU BELIEVE BEST INDICATES YOUR ASSESSMENT OF HOW INTENSE THE PATIENT'S PAIN IS? *(Circle a number)*

0 1 2 3 4 5 6 7 8 9 10
Patient has no pain — Patient has worst pain imaginable

PATIENT'S SELF-REPORT OF PAIN INTENSITY

NURSE ASKS PATIENT, "On a scale of 0 – 10, where 0 = No Pain, and 10 = Worst Pain Imaginable, tell me or show me how much pain you're having right now."

0 1 2 3 4 5 6 7 8 9 10
No pain — Worst pain imaginable

(Puntillo et al., 2002)

REFERENCES CITED

American Association of Colleges of Nursing. (2013). Competencies and curricular expectations for clinical nurse leader education and practice. Retrieved from https://www.aacnnursing.org

Ahlers, S. J., van der Veen, A. M., van Dijk, M., Tibboel, D., Knibbe, C. (2010). The use of the behavioral pain scale to assess pain in conscious sedated patients. *Anesthesia & Analgesia,* 110, 127-133. doi: 10.1213/ANE.0b013e3181c3119e

Al Darwish, Z., Hamdi, R., & Fallatah, S. (2016). Evaluation of pain assessment tools in patients receiving mechanical ventilation. *Advanced Critical Care Nursing*, 27, 162-172. doi.org/10.4037/aacnaac2016287

Barr, J., Fraser, G. L., Puntillo, K., Ely, E. W., Gelinas, C., Dasta, J. F., ... Jaeschke, R. (2013). Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Critical Care Medicine*, *41*, 263-306. doi:10.1097/CCM.0b013e3182783b72

Boitor, M., Fiola, J. L., & Gelinas, C. (2016). Validation of the critical-care pain observation tool and vital signs in relation to the sensory and affective components of postoperative cardiac surgery intensive care unit adults. *Journal of Cardiovascular Nursing*, 31, 425-432. doi:10.1097/JCN.0000000000000250

Chanques, G., Jabir, S., Barbotte, E., Violet, S., Sebbane, M., Perrigault, P., ... Eledjam, J. (2006). Impact of systematic evaluation of pain and agitation in an intensive care unit. *Critical Care Medicine*, *34,* 1691-1698. doi: 10.1097/01.CCM.0000218416.62457.56

Chanques, G., Payen, J., Mercier, G., Lattre, S., Viel, E., Jung, B., …Jaber, S. (2009) Assessing pain in non-intubated critically ill patients unable to self report: An adaptation of the behavioral pain scale. *Intensive Care Medicine, 35,* 2060-2067. doi: 10.1007/s00134-009-1590-5

Chanques, G., Pohlman, A., Kress, J. P., Morinari, N., Jong, A., Jaber, S., & Hall, J. B. (2014). Psychometric comparison of three behavioral scales for the assessment of pain in critically ill patients unable to self-report. *Critical Care, 18,* R160. doi: 10.1186/cc14000

Chookalayi, H., Heidarzadeh, M., Hasanpour, M., Jabrailzadeh, S., & Sadeghpour, F. (2017). A study on the psychometric properties of revised-nonverbal pain scale and original-nonverbal pain scale in Iranian nonverbal-ventilated patients. *Indian Journal of Critical Care Medicine*, *21*, 429-435. doi: 10.4103/ijccm.IJCCM_114_17

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*, 284-290. doi:10.1037/1040-3590.6.4.284

Cooper, H. (1998). *Synthesizing research: A guide for literature reviews* (3rd ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Desbiens, N. A., Wu, A. W., Alzola, C., Mueller-Rizner, N., Wenger, N. S., Connors, A. F., ... Phillips, R. S. (1997). Pain during hospitalization is associated with continued pain six months later in survivors of serious illness. *The American Journal of Medicine*, *102*, 269-276.

Gelinas, C., Fillion, L., Puntillo, K. A., Viens, C., & Fortier, M. (2006). Validation of the critical care pain observation tool in adults. *American Journal of Critical Care,* 15, 420-427.

Gelinas, C., Puntillo, K. A., Joffe, A. M., & Barr, J. (2013). A validated approach to evaluating psychometric properties of pain assessment tools for use in nonverbal critically ill adults. *Seminars in Respiratory and Critical Care Medicine*, *34*, 153-167. doi:10.1055/s-0033-1342970

Heavey, E. (2019). *Statistics for Nursing: A practical approach* (3rd ed.). Burlington, MA: Jones & Bartlett

International Association for the Study of Pain website. (2017). Retrieved from https://www.iasp-pain.org

Jones, C., Griffiths, R. D., Humphris, G., & Skirrow, P. M. (2001). Memory, delusions, and the development of acute posttraumatic stress disorder-related symptoms after intensive care. *Critical Care Medicine*, *29*, 573-580. doi: 10.1097//XEB.0000000000000155

Keane, K. M. (2013). Validity and reliability of the critical care pain observation tool: A replication study. *Pain Management Nursing*, *14*, e216-e225. doi: 10.1016/j.pmn.2012.01.002

Klein, D. G., Dumpe, M., Katz, E., & Bena, J. (2010). Pain assessment in the intensive care unit: Development and psychometric testing of the nonverbal pain assessment tool. *Heart & Lung*, *39*, 521-528. doi: 10.1016/j.hrtlng.2010.05.053

Kline, P. (2000). *The handbook of psychological testing* (2nd ed.). London: Routledge.

Landis, J. R. & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*, 159-174. doi: 10.2307/2529310

Linde, S. M., Badger, J. M., Machan, J. T., Beaudry, J., Brucker, A., Martin, K., …Navedo, R. D. (2013) Reevaluation of the critical-care pain observation tool in intubated adults after cardiac surgery. *American Journal of Critical Care, 22*, 491-497. doi:10.4037/ajcc2013700

McHugh, M.L. (2012) Interrater reliability: the kappa statistic. *Biochemia medica, 22*, 276-282.

Melnyk, B. M., & Fine-Overholt, E. (2015). *Evidence-based practice in nursing and healthcare: A guide to best practice* (3rd. ed.). Philadelphia, PA: Wolters Kluwer.

Merkel, S. I., Voepel-Lewis, T., Shayevitz, J. R., & Malviya, S. (1997) The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing*, *23*(3), 293+.

Norman, S. B., Stein, M. B., Dimsdale, J. E., & Hoyt, D. B. (2008). Pain in the aftermath of trauma is a risk factor for post-traumatic stress disorder. *Psychological Medicine, 38,* 533-542. doi: 10.1017/S0033291707001389

Odhner, M., Wegman, D., Freeland, N., Steinmetz, A. (2003). Assessing pain control in nonverbal critically ill adults. *Dimensions of Critical Care Nursing*, *22*, 260-267. doi: 10.1097/00003465-200311000-00010

Page, G. G. (2005). Immunologic effects of opioids in the presence or absence of pain. *Journal of Pain and Symptom Management,* 29, 25-32. doi: 10.1016/j.jpainsymman.2005.01.006

Pasero, C., & McCaffery, M. (2011). *Pain assessment and pharmacologic management*. St. Louis: Elsevier/Mosby.

Paulson-Conger, M., Leske, J., Maidl, C., Hanson, A., & Dziadulewicz, L. (2011). Comparison of two pain assessment tools in nonverbal critical care patients. *Pain Management Nursing, 12,* 218-224. doi: 10.1016/j.pmn.2010.05.008

Payen, J., Bosson, J., Chanques, G., Mantz, J., & Labarere, J. (2009). Pain assessment is associated with decreased duration of mechanical ventilation in the intensive care unit. *Anesthesiology, 111,* 1308-1316. doi: 10.1097/ALN.0b013e3181c0d4f0

Pearson, A., Wiechula, R., Court, A., & Lockwood, C. (2005). The JBI model of evidence-based healthcare. *International Journal of Evidence-Based Healthcare, 3,* 207-215.

Polit, D. F. & Beck, C. T. (2017). Nursing research: Generating and assessing evidence for nursing practice. Philadelphia, PA: Wolters Kluwer.

Puntillo, K. A., Stannard, D., Miaskowski, C., Kehrle, K., & Gleeson S. (2002). Use of pain assessment and intervention notation (P.A.I.N.) tool in critical care nursing practice: Nurses' evaluations. *Heart & Lung, 31,* 303-314. doi: 10.1067/mlh.2002.125652

Redmann, A., Wang, W., Furstein, J., Myer, C., & Alarcon, A. (2017) The use of the FLACC pain scale in pediatric patients undergoing adenotonsillectomy. *International Journal of Pediatric Otorhinolaryngology, 92,* 115-118. doi: 10.1016/j.ijporl.2016.11.016

Rijkenberg, S., Stilma, W., Endeman, H., Bosman, R. J., & Oudemans-van Straaten, H. M. (2015). Pain measurement in mechanically ventilated critically ill patients: Behavioral pain scale versus critical-care pain observation tool. *Journal of Critical Care, 30,* 167-172. doi:10.1016/j.jcrc.2014.09.007

Ross, M., Boitor, M., & Gelinas, C. (2016). Validation of the critical-care pain observation tool with seriously ill patients. *Journal of Hospice & Palliative Nursing, 18,* 413-420. doi:10.1097/NJH.0000000000000266

Schelling, G., Stoll, C., Haller, M., Briegl, J., Manert, W., Hummel, T., ... Peter, K. (1998). Health-related quality of life and posttraumatic stress disorder in survivors of the acute respiratory distress syndrome. *Critical Care Medicine, 26,* 651-659. doi: 10.1097/00003246-199804000-00011

Vardell, W., Fry, M., & Elliott, D. (2016). A systematic review of observational pain assessment instruments for use with nonverbal intubated critically ill adult patients in the emergency department: An assessment of their suitability and psychometric properties. *Journal of Critical Care Nursing*, 26, 7-32. doi:10.1111/jocn.13594

Warden, V., Hurley, A. C., & Volicer, L. (2003) Development and psychometric evaluation of the pain assessment in advanced dementia (PAINAD) scale. *Journal of the American Medical Doctors Association, 4,* 9-15. doi: 10.1097/01.JAM.0000043422.31640.F7