

## Beyond the Meaning of Pain: Optimal Pain Assessment Tools for (Unable to Self-Report) Critically Ill Patients: A Narrative Review

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### Abstract

*Pain and its recognition can be complex issues for critical care nurses and their patients. More than half of critically ill patients have unrecognized/undertreated pain, or under/overestimated pain, which have serious physical and psychological impacts and may delay recovery. Many studies have focused on tools for assessing pain rather than on ways of prioritising pain recognition and management. Since ineffective clinical judgement (pain assessment and recognition) and decision-making (pain management) lead to increased morbidity and mortality among critically ill patients, pain recognition should be a priority in all clinical situations. The present study will justify the importance of pain assessment tools in pain management by reviewing the literature. Many studies identified challenges of pain assessment for (difficult to assess) patients such as patients with intellectual disabilities or tested one or two of the pain assessment tools validities. However, none of these studies considered gathering all tools to identify, describe and compare the appropriate tool(s) validity and reliability for the unable to self-report critically ill patients. So, this study will be the first to cover this literature gap and go beyond the challenges and meaning of pain in critical care.*

**Keywords:** Pain Assessment, Non-Verbal Patients, Critical Care, ICU, CPOT, BPS, NVPS.

### Introduction

Accurate pain assessment is essential in critical care settings, particularly for patients who are unable to communicate their pain due to sedation, neurological impairment, or mechanical ventilation. Pain in these patients often goes under-assessed, leading to inadequate management, which can prolong ICU stays, increase the risk of complications, and negatively impact recovery and quality of life. Despite the availability of various pain assessment tools, the efficacy of these tools in ICU patients who are unable to self-report remains a topic of ongoing research.

Several tools have been designed or adapted to assess pain in non-verbal patients, with the Critical Care Pain Observation Tool (CPOT), Behavioral Pain Scale (BPS), and Non-Verbal Pain Scale (NVPS) being some of the most used in critical care settings. These tools rely on observable signs of pain, such as facial expressions, muscle rigidity, and physiological indicators, to infer pain levels. However, the extent to which these tools are effective across different patient subgroups in ICU settings varies.

This review examines the current literature on CPOT, BPS, and NVPS to assess their reliability and applicability in ICU patients unable to self-report. The review aims to provide critical insights into the

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strengths and limitations of each tool, as well as the factors that affect their performance in diverse ICU environments.

### *Aim and Research Question*

This narrative review aims to evaluate the effectiveness, reliability, and limitations of pain assessment tools in critically ill patients who cannot self-report. The primary research question guiding this review is:

What are the most appropriate tools to recognize and evaluate pain in critically ill patients who are unable to self-report?

## **Methodology**

The framework for this review followed six stages of systematic analysis, designed to ensure comprehensive evaluation and data synthesis.

### *Search Strategy*

The literature search was conducted using Google Scholar and PubMed, yielding an initial set of 22,358 articles. Keywords included “pain,” “pain assessment,” “pain assessment tools,” “adult critical care,” “nonverbal,” and “unable to self-report.” Studies were subsequently filtered based on inclusion criteria, and relevant articles were downloaded through the university database.

### *Initial Screening*

After identifying potential studies using the specified keywords, an initial screening was conducted to select studies that met the inclusion criteria. The inclusion criteria included observational studies and randomized control trials (RCTs) published in English, directly relevant to pain assessment in critical care, and involving human

participants. Only studies from academic journals with extractable data and published between 2012 and 2022 were considered. Out of 22,358 articles, 470 were excluded due to irrelevance to critical care pain assessment tools or lack of focus on non-verbal patients.

### *Retrieval and Second Screening*

During this stage, articles that met the inclusion criteria were retrieved and reviewed in-depth. When abstracts alone did not provide clear relevance, full-text reviews were conducted to determine the articles' suitability. Only articles directly addressing the use or validation of CPOT, BPS, or NVPS for non-verbal ICU patients were retained. Thirty-six full-text articles were excluded at this stage, resulting in a final sample of eleven articles included in this review.

### *Data Analysis*

A systematic approach was used to extract data from each included study. Information such as the authors, year of publication, country of study, pain assessment tool evaluated, study objectives, types of procedures used for pain assessment, study methods, main findings, and comments on each study's relevance and limitations were recorded. The studies' characteristics and main findings are summarized in a table in Appendix 1.

### *Assessment of Study Quality*

The quality of the eleven included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists, specifically for cross-sectional analytical studies and quasi-RCT designs. Although the Critical Appraisal Skills Programme (CASP) tool is commonly used, Hannes et al. (2010) indicate that JBI's

approach is more sensitive to aspects of study validity. The quality assessment considered factors such as risk of bias, publication bias, consistency, evidence precision, dose-response relationships, and confounding factors. Studies were classified as either high quality (Grade I), medium quality (Grade II), or low quality (Grade III). Two studies received a medium-quality rating due to issues with confounding factors (Gomarverdi et al., 2022; Waladani et al., 2020), while the remainder were classified as high quality.

### Data Synthesis

The data synthesis is summarized in Table 1 below, showing each evaluation of the tools' quality and appropriateness for assessing pain in non-verbal ICU patients. The CPOT and BPS were frequently rated as high quality, while NVPS showed more limited applicability.

**Table 1.** Summary Of Data Synthesis and Quality Assessment

Author	Data Synthesis		
	Favorable Tool	Quality	
Klein et al., 2018	CPOT, BPS	High	
Cheng et al., 2018	CPOT, BPS	High	
Georgiou et al., 2020	CPOT, BPS	High	
Heidarzadeh et al., 2018	NVPS	High	
Marques et al., 2022	CPOT	High	
Gomarverdi et al., 2022	CPOT, BPS	Medium	
Wongtangman et al., 2017	CPOT, BPS	High	
Kotfis et al., 2018	BPS	High	

## Results

This review identified several strengths and limitations in the CPOT, BPS, and NVPS for pain assessment in non-verbal ICU patients.

**CPOT and BPS:** Studies like Klein et al. (2018) and Cheng et al. (2018) demonstrate that both CPOT and BPS are adaptable tools with high inter-rater reliability and robust cross-cultural validation. These tools assess pain through observable behaviors such as facial expressions, muscle rigidity, and physiological responses, making them valuable for non-verbal ICU patients. However, Gomarverdi et al. (2022) highlighted limitations in their sensitivity for sedated patients, where physical pain cues are minimal. CPOT and BPS, while effective, may under-assess pain in such cases.

**NVPS:** Heidarzadeh et al. (2018) evaluated NVPS as a reliable tool for mechanically ventilated patients, focusing on procedural pain responses, such as during suctioning. However, NVPS is more limited in its scope compared to CPOT and BPS and may not capture all pain indicators in non-ventilated patients, making it suitable primarily as a complementary tool.

## Discussion

The findings reveal that while CPOT and BPS are broadly applicable and validated tools, they are not without limitations. Both tools depend heavily on observable signs, which may be absent in sedated or neurologically impaired patients. This issue was noted by Gomarverdi et al. (2022), who pointed out that CPOT and BPS may miss subtle indicators of pain, leading to under-assessment in this patient group. In contrast, NVPS, though highly reliable in procedural contexts, is less versatile and primarily benefits ventilated patients, suggesting its use as a supplementary rather than a primary assessment tool.

The effectiveness of these tools is also impacted by the variability in inter-rater reliability across studies. As noted by Georgiou et al. (2020), consistent training and standardized assessment protocols improve the reliability of CPOT and BPS. This suggests that while the tools themselves are technically sound, their practical effectiveness relies heavily on the user's training and adherence to standardized guidelines.

**Methodological Variability:** Across the reviewed studies, differences in sample sizes, procedural focus, and patient characteristics affected the comparability of findings. Smaller studies, such as that by Wongtangman et al. (2017), may lack the statistical power to generalize findings widely, while variations in assessment contexts (e.g., routine care vs. specific procedures) add complexity to cross-study comparisons. These methodological inconsistencies suggest a need for standardized research protocols to strengthen the generalizability of future studies.

## Conclusion

The CPOT and BPS are generally reliable and adaptable pain assessment tools for non-verbal ICU patients, validated across various settings and cultural contexts. However, their reliance on visible behaviors limits their effectiveness in sedated or neurologically impaired patients. NVPS, while useful for ventilated patients, is more specific and less adaptable to the wider ICU population.

Standardized training and clear protocols are essential for optimizing the use of CPOT, BPS, and NVPS in critical care. Future research should address the current limitations of these tools, particularly for patients with reduced physical responsiveness, to enhance pain assessment accuracy and improve patient outcomes in the ICU.

## Conflicts of Interest

The authors declare no conflicts of interest.

The research team and their immediate families have no financial interests related to the research or the research sponsor. This ensures the integrity and objectivity of the study, making it suitable for publication.

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### Appendix 1. Study Characteristics

Author	Year	Country	Tool	Objectives	Procedures	Sample Size	Methodology	Results	Comments
Klein et al.	2018	Canada	CPOT and BPS	Cross-cultural adaptation and validation of the CPOT and BPS into Brazilian Portuguese by comparing behavioral scores during rest, SNSPA, and turning	Turning (positioning)	168	Prospective cohort study with 168 critically ill adults in ICU, two nurses trained in CPOT and BPS, baseline and during SNSPA and turning	Inter-rater reliability supported by high weighted kappa >0.7; discriminative validation supported with higher scores during SNSPA or turning; only Glasgow Coma Scale predicted scores with 44.5% and 55.2% variance, respectively	Brazilian CPOT and BPS versions showed good reliability and validity for critically ill adults unable to self-report. SNSPA used for validation
Cheng et al.	2018	Taiwan	CPOT and BPS	Compare construct validity of the Chinese versions of CPOT and BPS in detecting pain	Non-invasive blood pressure assessment, endotracheal suctioning	316	Observational crossover study of 316 patients, measured by CPOT, BPS, vital signs, and self-report; reliability tested on 20 patients	Self-reported pain predicted by CPOT and BPS scores (OR=1.93 and 1.83, p < 0.01); AUC of 76.4% and 73.1% for CPOT and BPS,	Chinese versions of CPOT and BPS are valid for distinguishing pain presence in ICU patients

								indicating good detection of pain	
Chookalayia et al.	2017	Iran	CPOT	Evaluate CPOT for painful and non-painful procedures	Six occasions (before, during, after nociceptive and non-nociceptive)	65	Prospective study with CPOT on six occasions, categorizing patients by RASS score	Discriminant and criterion validity supported; reliability strong except in agitated patients (RASS +2)	CPOT has strong psychometric properties for assessing pain in ICU, except for agitated patients
Georgiou et al.	2020	Canada	CPOT and BPS	Examine systematic pain assessment effects on pain intensity and outcomes in critically ill patients	Standard care	117	Randomized controlled study with intervention and control groups, CPOT and BPS scores taken twice daily	Intervention group had lower pain incidence ( $p < .001$ ), higher morphine ( $p = 0.045$ ), and propofol use ( $p = 0.027$ ), but no mortality or ICU stay differences	Systematic assessment may decrease pain intensity, influencing pharmacological management
Heidarzadeh et al.	2018	Iran	NVPS	Validate NVPS for mechanically ventilated ICU patients	Before, during, and after painful and non-painful events	60	Methodological study with NVPS, six different times, retest on 37 patients	Cronbach's $\alpha = 0.80$ , high correlation between rates (0.89–0.96), significant difference in pain scores for painful and non-painful procedures ( $p=0.001$ )	NVPS is a reliable and valid tool for pain assessment in ventilated ICU patients
Marques et al.	2022	Portugal	CPOT	Validate CPOT for critically ill adults in Portugal	Turning/positioning, suctioning, 20 min post-procedure	110	Observational cohort study with mechanically ventilated patients, pre- and post-procedure assessments	Excellent inter-rater reliability ( $\alpha = 0.93-1.00$ at rest); CPOT scores higher during NP than at rest ( $p < 0.001$ ); CPOT cut-off $>2$ with 71% sensitivity, 80% specificity	CPOT is valid for both ventilated and non-ventilated patients unable to communicate

Gomarverdi et al.	2022	Iran	CPOT and BPS	Compare CPOT and BPS for pain severity in ICU patients	Resting, invasive (suctioning), non-invasive (position change, mouthwash)	90	Prospective study measuring pain with CPOT and BPS, analyzed by Wilcoxon and Friedman tests for significance	Strong correlation ( $r > 0.80$ , $p < 0.05$ ) between BPS and CPOT across all procedures; significant differences in pain score across situations	CPOT and BPS can monitor pain effectively in ICU patients
Wongtangman et al.	2017	Thailand	CPOT and BPS	Translate and validate CPOT and BPS into Thai for postoperative ICU pain assessment	Multiple procedures	27	Prospective study with concurrent, discriminant, criterion validity, and inter-rater reliability in postoperative ICU setting	Concurrent validity strong ( $r = 0.74-0.78$ , $p < 0.01$ ); high scores in painful situations pre-analgesic (BPS 5, CPOT 3); inter-rater reliability (0.72-0.90)	Thai versions of CPOT and BPS are valid and reliable for ICU pain assessment; further studies recommended
Kotfis et al.	2018	USA	BPS	Validate Polish version of BPS for intubated, sedated post-cardiac surgery ICU patients	At rest, position change, 10 min post-procedure	59	Observational cohort study with sedated and unsedated patients, assessed by BPS and NRS	High inter-rater correlation ( $>0.87$ ); correlation between NRS and BPS strong during nociceptive procedures (Spearman $R > 0.65$ , $p < .001$ )	Polish BPS is a reliable and validated tool for pain assessment in adult intubated patients
Bartels et al.	2019	Germany	CPOT	Evaluate CPOT inter-rater reliability, validity, ROC for diagnostic accuracy in German ICU	Multiple procedures	292	Observational validation study of 292 cardiac surgery patients in German ICUs	German CPOT validation recommended for routine ICU use; simple, reliable, and trainable	CPOT recommended for German ICU guideline implementation; basis for further studies
Waladani et al.	2020	Indonesia	CPOT and NVPS	Assess CPOT and NVPS suitability in ICU ventilated patients	Resting and positioning	50	Descriptive analytic study, pain measured with CPOT and NVPS in different conditions	Pain during positioning: moderate (70%), severe (12%); rest: moderate pain 44%, no pain 50%	CPOT and NVPS are suitable for ICU pain assessment in ventilated patients



