

Supplement to: Bernard et al. “Assessing pain in critically ill brain-injured patients: a psychometric comparison of three pain scales and videopupillometry”

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e-Table 1. Proposition of Psychometric Scoring for Pain Assessment Tools in Brain Injured Patients, According to the Method Developed in the 2018 Pain, Agitation/sedation, Delirium, Immobility and Sleep disruption (PADIS) guidelines [2]

Q #	Question	Scoring Legend	Score		
			BPS	NCS-I	NCS-R-I
	Scale Development: Item Selection and Content Validation				
1.1	Was the process of item selection described?	2: Scale was developed for a specific population, using a theoretical or conceptual framework, or a qualitative approach was used (e.g. consultation with clinicians or patients) 1: Scale was developed based on the literature review only 0: No information is provided about item selection	1	2*	2*
1.2	Was content evaluated by experts? (content validation)	2: Content was evaluated by experts in the field, a Delphi technique may have been used, and Content Validity Index (CVI) were calculated for each item included in the scale 1: Content was evaluated by experts, but no CVI is reported 0: No information is provided about content validation	0	1*	1*
1.3	Are limitations of some items presented or discussed?	1: No limitations or if any limitations, they are presented and item modifications have been made or precautions have been stated 0: No information is provided	1	1	1
Subtotal - Scale development (0-5)			2	4	4
Subtotal weighted score - Scale development (0-2)			0.8	1.6	1.6

* Taking into account other studies reporting the construction of NCS and NCS-R in non mechanically ventilated brain-injured patients

Q #	Question	Scoring Legend	Score		
			BPS	NCS-I	NCS-R-I
Scale Testing - Reliability					
2.1	Was internal consistency of the scale calculated?	2: $0.70 < \alpha < 0.90$ 1: $0.60 < \alpha < 0.70$ or $\alpha > 0.90$ 0: $\alpha < 0.60$ or no information provided	1	1	1
2.2	Was interrater reliability calculated?	2: $\kappa > 0.60$ or $ICC > 0.80$ 1: $0.60 < \kappa < 0.40$ or $0.60 < ICC < 0.80$ 0: $\kappa < 0.40$, $ICC < 0.60$ or no information provided	2	2	2
2.3	Was interrater reliability tested with other raters besides research team?	1: Other raters than research staff members were involved 0: Only research staff members were involved	1	1	1
2.4	Was intrarater reliability tested? Optional-to be examined if $\kappa < 0.60$ or $ICC < 0.80$ for interrater reliability	2: $\kappa > 0.60$ or $ICC > 0.80$ 1: $0.60 < \kappa < 0.40$ or $0.60 < ICC < 0.80$ 0: $\kappa < 0.40$, $ICC < 0.60$ or no information provided	N/A	N/A	N/A
Subtotal - Scale development (0-5 or 0-7 if intrarater reliability testing required)			4/5	4/5	4/5
Subtotal weighted score - Scale development (0-6)			4.8	4.8	4.8

Q #	Question	Scoring Legend	Score		
			BPS	NCS-I	NCS-R-I
Scale Testing: Construct Validity					
3.1	What is the total of participants for the purpose of testing the scale?	2: N>50 1: 20<N<50 0: N<20	2*	1	1
3.2	Criterion validation: Was the scale correlated with the "gold standard" measure renown in the field of interest (e.g. the patient's self-report of pain)?	2: r>0.60 with the "gold standard" measure 1: 0.40<r<0.60 0: r<0.40 or no information provided	2	2	2
3.3	Criterion validation: Was the sensitivity of the scale calculated?	2: Sensitivity > or = 80% 1: 60% < or = Sensitivity<80% 0: Sensitivity<60% or no information provided	2	2	2
3.4	Criterion validation: Was the specificity of the scale calculated?	2: Specificity > or = 80% 1: 60% < or = Specificity < 80% 0: Specificity < 60% or no information provided	2	2	2
3.5	Discriminant validation: Was the scale able to discriminate between different situations, e.g. between pain and no pain (e.g. at rest and during a nociceptive procedure, before and after the administration of an analgesic)?	2: A clinically important difference was found 1: A difference was found but was not considered clinically important 0: No difference was found or no information is provided	2	2	2
Subtotal - Scale development (0-10)			10	9	9
Subtotal weighted score - Scale development (0-8)			8	7.2	7.2

* Taking into account other studies assessing BPS psychometrics in brain-injured intubated patients

Q #	Question	Scoring Legend	Score		
			BPS	NCS-I	NCS-R-I
Scale Feasibility					
4.1	Was the feasibility (i.e. ease of usage with which clinicians can apply the instrument in the clinical setting) of the scale examined?	1: Scale is considered to be feasible to use by more than 80% of the clinicians 0: Scale is considered to be complex to use by more than 20% of the clinicians or no information is provided information is provided	0	1	1
4.2	Are directives of use of the scale clearly described?	1: Yes, directives of use including the scoring method are described 0: No information about directives of use is provided	1	1	1
Subtotal - Scale development (0-2)			1	2	2
Subtotal weighted score - Scale development (0-2)			1	2	2

Q #	Question	Scoring Legend	Score		
			BPS	NCS-I	NCS-R-I
	Scale Relevance or Impact of Implementation in ICU patient outcomes				
5.1	Was the relevance of the scale or impact of its implementation in ICU patient outcomes examined?	1: Scale is considered to be useful and relevant to practice by more than 80% of the clinicians; use of the scale yielded a significant change into practice (e.g. better use of medication, increase in patients' assessments) 0: Scale is not considered to be useful and relevant to practice by more than 20% of the clinicians; use of the scale did not yield to a significant change into practice or no information provided	1	1	1
Subtotal - Scale development (0-1)			1	1	1
Subtotal weighted score - Scale development (0-2)			2	2	2
Total Score (0-23*)			18	20	20
Weighted Score (0-20)			15.7	17.4	17.4
Quality of Evidence			M	M	M

*Total score is 23 instead of 25 because Q2.4 is not required

BPS: Behavioral Pain Scale; NCS-I: Nociception Coma Scale for Intubated patients; NCS-R-I: Revised Nociception Coma Scale for Intubated patients

Quality of evidence: Low (L), Moderate (M), High (H)

Methods

The method of psychometric scoring for behavioral pain scales constructed for assessing pain in critically ill non-communicative adult patients was developed for the Pain, Agitation and Delirium guidelines from the American College of Critical Care Medicine (ACCM) in conjunction with the Society of Critical Care Medicine (SCCM) in 2013 [1,3], and updated in 2018 [2].

Among the 13 behavioral pain scales scored in the 2018 guidelines, the scores ranged from 6 to 21 (weighted scores from 4.5/20 to 16.7/20), with a mean score of 12.1/25 and a weighted score of 9.8/20 [2].

- [1] Barr J, Fraser GL, Puntillo K, Ely EW, Gelinas C, Dasta JF, Davidson JE, Devlin JW, Kress JP, Joffe AM, Coursin DB, Herr DL, Tung A, Robinson BR, Fontaine DK, Ramsay MA, Riker RR, Sessler CN, Pun B, Skrobik Y, Jaeschke R. Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit. *Crit Care Med* 2013;41(1):278-280.
- [2] Devlin JW, Skrobik Y, Gelinas C, Needham DM, Slooter AJC, Pandharipande PP, Watson PL, Weinhouse GL, Nunnally ME, Rochweg B, Balas MC, van den Boogaard M, Bosma KJ, Brummel NE, Chanques G, Denehy L, Drouot X, Fraser GL, Harris JE, Joffe AM, Kho ME, Kress JP, Lanphere JA, McKinley S, Neufeld KJ, Pisani MA, Payen JF, Pun BT, Puntillo KA, Riker RR, Robinson BRH, Shehabi Y, Szumita PM, Winkelman C, Centofanti JE, Price C, Nikayin S, Misak CJ, Flood PD, Kiedrowski K, Alhazzani W. Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU. *Crit Care Med* 2018;46(9):e825-e873.
- [3] Gelinas C, Puntillo KA, Joffe AM, Barr J. A validated approach to evaluating psychometric properties of pain assessment tools for use in nonverbal critically ill adults. *Semin Respir Crit Care Med* 2013;34(2):153-168.