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SCIENTIFIC ARTICLE

Validation of the Brazilian version of Behavioral Pain Scale in adult sedated and mechanically ventilated patients



Isabela Freire Azevedo-Santos^a, Iura Gonzalez Nogueira Alves^a,
Manoel Luiz de Cerqueira Neto^b, Daniel Badauê-Passos^{a,c},
Valter Joviniano Santana-Filho^{a,b,c}, Josimari Melo de Santana^{a,b,c,*}

^a Universidade Federal de Sergipe (UFS), Programa de Pós-Graduação em Ciências da Saúde, Aracaju, SE, Brazil

^b Universidade Federal de Sergipe (UFS), Departamento de Fisioterapia, Aracaju, SE, Brazil

^c Universidade Federal de Sergipe (UFS), Programa de Pós-Graduação em Psicologia, Aracaju, SE, Brazil

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KEYWORDS

Validation studies;
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Abstract

Background and objectives: The Behavioral Pain Scale is a pain assessment tool for uncommunicative and sedated Intensive Care Unit patients. The lack of a Brazilian scale for pain assessment in adults mechanically ventilated justifies the relevance of this study that aimed to validate the Brazilian version of Behavioral Pain Scale as well as to correlate its scores with the records of physiological parameters, sedation level and severity of disease.

Methods: Twenty-five Intensive Care Unit adult patients were included in this study. The Brazilian Behavioral Pain Scale version (previously translated and culturally adapted) and the recording of physiological parameters were performed by two investigators simultaneously during rest, during eye cleaning (non-painful stimulus) and during endotracheal suctioning (painful stimulus).

Results: High values of responsiveness coefficient (coefficient = 3.22) were observed. The Cronbach's alpha of total Behavioral Pain Scale score at eye cleaning and endotracheal suctioning was 0.8. The intraclass correlation coefficient of total Behavioral Pain Scale score was ≥ 0.8 at eye cleaning and endotracheal suctioning. There was a significant highest Behavioral Pain Scale score during application of painful procedure when compared with rest period ($p \leq 0.0001$). However, no correlations were observed between pain and hemodynamic parameters, sedation level, and severity of disease.

* Corresponding author.

E-mail: desantana@pq.cnpq.br (J.M. Santana).

PALAVRAS-CHAVE

Estudos de validação;
Mensuração da dor;
Unidades de terapia
intensiva;
Escala de Dor
Comportamental;
EDC brasileira

Conclusions: This pioneer validation study of Brazilian Behavioral Pain Scale exhibits satisfactory index of internal consistency, interrater reliability, responsiveness and validity. Therefore, the Brazilian Behavioral Pain Scale version was considered a valid instrument for being used in adult sedated and mechanically ventilated patients in Brazil.

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Validação da versão Brasileira da Escala Comportamental de Dor (*Behavioral Pain Scale*) em adultos sedados e sob ventilação mecânica

Resumo

Justificativa e objetivos: A Escala Comportamental de Dor (*Behavioral Pain Scale*) é uma ferramenta de avaliação da dor para pacientes não-comunicativos e sedados em unidade de tratamento intensivo (UTI). A falta de uma escala brasileira para a avaliação da dor em adultos sob ventilação mecânica justifica a relevância deste estudo que teve por objetivo validar a versão brasileira da Escala Comportamental de Dor (ECD), bem como correlacionar seus escores com os registros de parâmetros fisiológicos, nível de sedação e gravidade da doença.

Métodos: Vinte e cinco pacientes adultos internados em UTI foram incluídos neste estudo. A versão brasileira da ECD (previamente traduzida e adaptada culturalmente) e os registros dos parâmetros fisiológicos foram realizados simultaneamente por dois avaliadores durante o repouso, durante a limpeza dos olhos (estímulo não doloroso) e durante a aspiração endotraqueal (estímulo doloroso).

Resultados: Valores elevados do coeficiente de responsividade (coeficiente = 3,22) foram observados. O coeficiente alfa de Cronbach do escore total da ECD durante a limpeza dos olhos e aspiração endotraqueal foi de 0,8. O coeficiente de correlação intraclass do escore total da ECD foi $\geq 0,8$ durante a limpeza dos olhos e aspiração endotraqueal. Houve um escore significativamente mais alto na ECD durante a aplicação do estímulo doloroso em comparação com o período de descanso ($p \leq 0,0001$). No entanto, não foram observadas correlações entre dor e parâmetros hemodinâmicos, nível de sedação e gravidade da doença.

Conclusões: Este estudo pioneiro de validação da ECD brasileira apresenta índices satisfatórios de consistência interna, confiabilidade entre avaliadores, responsividade e validade. Portanto, a versão da ECD brasileira foi considerada um instrumento válido para ser usado em pacientes adultos sedados e ventilados mecanicamente no Brasil.

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Introduction

Critically ill patients frequently experience pain and discomfort during Intensive Care Unit (ICU) stay. ICUs are specialized centers where subjects are exposed to different factors which causes acute pain including routine procedures,¹⁻⁵ such as endotracheal suctioning, turning, peripheral and central intravenous puncturing.⁶ Thus, pain assessment and treatment in mechanically ventilated ICU patients have been considered important and studied in last two decades.⁷

The Society of Intensive Care Medicine recommends that pain should be routinely monitored in all adult ICU patients.⁸ Patient's self-reports of pain, physiological parameters and scales based on typical behaviors constitute available methods in the assessment of pain. However, critically ill patients are often unable to effectively communicate due to severe illness, mechanical ventilation, administration of sedatives

and analgesics or a decreased level of consciousness.^{4,9,10} On the other hand, patients may be evaluated by physiological parameters and through the use of scales based on typical behaviors. However, physiological parameters, such as blood pressure, heart rate, peripheral oxygen saturation and respiratory rate appear to be less valid for pain assessment in ICU patients due to underlying disease and treatment with inotropes and vasopressor medicines.¹¹⁻¹³ Therefore, the Society of Intensive Care Medicine advises the use of pain assessment tools that focus mainly on behavioral indicators of pain.⁸

In this context, in order to quantify pain in mechanically ventilated patients, Behavioral Pain Scale (BPS) was firstly validated in English.⁶ The BPS was translated in four languages^{6,14-16} and validated just in two of them.^{6,15} Several studies have shown that BPS is reliable and responsive.^{10,17-25} Despite the importance of pain assessment in ICU non-verbalizing patients, there is a lack of Brazilian studies on

this topic. This occurs because the nonexistence of validated scales in Brazilian Portuguese to measure pain in ICU patients. In Brazil, the BPS was firstly translated to Brazilian Portuguese in a preliminary study recently published by our group.²⁶ It was applied in mechanically ventilated patients showing to be very promising as a tool for measuring pain in Brazilian ICU patients. Thus, the importance of pain measurement in non-verbal patients hospitalized in ICUs and the absence of a validated Brazilian scale for this purpose highlights the relevance of this study. Taking into account the potential of the BPS to measure pain in mechanically ventilated patients,²⁶ this study aimed to analyze the reliability, responsiveness and validity of the translated BPS to Brazilian Portuguese.

Methods

Sample

We performed a cross-sectional study with a repeated measurement design in 25 sedated and mechanically ventilated subjects admitted at a cardiac ICU of a public hospital. Sample size was estimated based on a precision of Cronbach α as 0.90 ± 0.05 for a scale with 3 subscales as BPS. Thus, a minimum of 25 subjects should be assessed in this study.¹⁸ All subjects were legally represented by their conservators, who have signed the term of consent, once they were unconscious or in use of sedative medicines. The Federal University of Sergipe and hospital ethical committees approved the study protocol.

Patients who were sedated and unconscious, in use of mechanical ventilation and in the postoperative period (immediate or delayed) of Coronary Artery Bypass Graft (CABG) or Valve Surgery (VS) were included in our sample. Exclusion criteria considered those with age less than 18 years old and/or with one of these conditions that could change behavioral expressions: quadriplegia, peripheral neuropathy, stiffness due to decortication or

decerebration or in use of neuromuscular blockers during the assessment.

Validation methodological procedures

The Brazilian version of BPS was developed after validation process based on pre-established procedures^{27,28} as shown in Fig. 1.

The first five procedures (from authorization to pretesting) were performed in the preliminary study published by our group.²⁶ Due to the occurrence of doubts and discrepancy among investigators regarding the adequacy of the meanings of each item to clinical practice during pretesting, a second expert committee review was done. After this review and consensus, the "Brazilian BPS application guide" was created with explications and practice adequacy of the sub-items (See Supplemental Digital Content, which is a text document with Brazilian BPS guide).

Training of the ICU staff

For final version test phase, four professionals from the ICU staff (three physical therapists and one nurse) were recruited and trained to participate as investigators in this study. They individually read Brazilian BPS application guide before data collection to standardize the assessment. Explanations for any doubts were done to avoid bias on items interpretation.

Each of these health professionals had specific activities during the evaluation. The physical therapists were responsible for pain assessment (register of BPS scores simultaneously by two of them) and physiological parameters recording (multimodal monitor observation), while the nurse performed the routine procedures (painful and non-painful). For reliability measurement, they could not keep any kind of communication between them during this process.

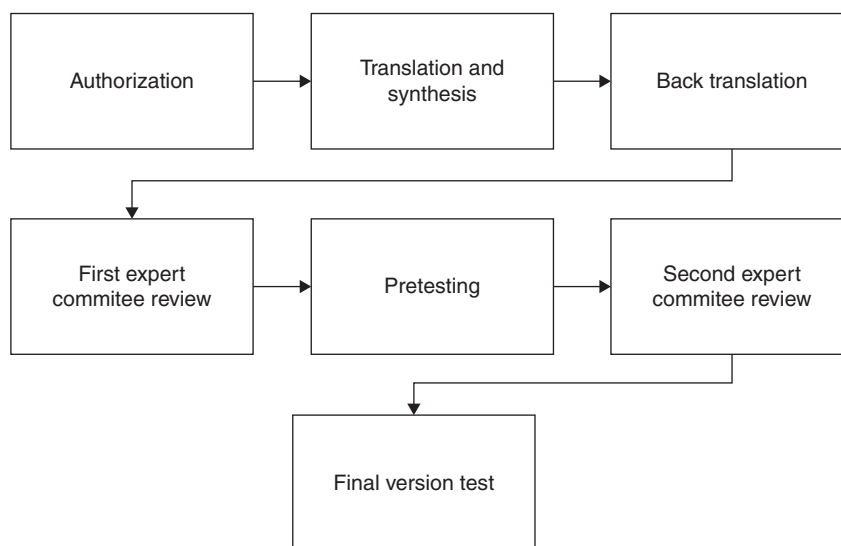


Figure 1 Validation methodological procedures for Brazilian Behavioral Pain Scale.

Data collection

Before pain assessment, baseline data as age, sex, clinical diagnoses, use of sedative and/or analgesics and severity of disease (APACHE II score)²⁹ was recorded based on medical record information. Patient's sedation level was assessed by using both Ramsay and RASS scales.^{30–32} These tools were chosen to establish the inability of subjects to verbalize caused by sedative drugs effects.

Study procedures

Pain assessment with Brazilian BPS occurred in three different moments: at rest (stable subject in bed), during Eye Cleaning (EC) with cotton soaked in saline 0.9% (non-painful procedure)²⁴ and during Endotracheal Suctioning (ETS) with the catheter insertion on the airway (painful procedure)^{24,26,33–35}. In addition to pain scores, hemodynamic parameters were recorded during the three phases of evaluation. Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Blood Pressure (MBP), HR and SpO₂ were measured through non-invasive methods.

Statistical analysis

Data were analyzed with SPSS Statistics version 22.0 (SPSS, Inc., Chicago, IL) and Graph Pad Prism 5 (GraphPad Software, Inc., La Jolla, CA). Baseline data were represented as mean \pm standard error of mean. *t*-Test and Fisher exact test compared the type of surgery and postoperative period data.

Reliability, responsiveness and validity were the psychometric properties analyzed on Brazilian BPS version. Interrater reliability of the BPS was tested by the calculation of Intraclass Correlation Coefficients (ICC) and internal consistency was assessed with Cronbach's coefficient α . These were calculated for Brazilian BPS total scores and for each sub-item during EC and TS. Values between 0.70 and 0.80 were considered as acceptable, and values >0.8 as good.^{36,37}

Responsiveness is the capacity to detect significant changes over time. This coefficient was obtained by dividing the difference between the mean scores of the Brazilian BPS at rest and during painful procedures by the Standard Deviation (SD) of the mean scores at rest. A coefficient value higher than 0.8 was considered satisfactory.³⁸

The ability of a scale to measure what it intends characterizes the instrument validity. It was established in three ways: construct, criterion and content. Pain scores were not normally distributed, and therefore, nonparametric statistical tests were applied. Spearman correlation was calculated to compare Brazilian BPS scores during ETS with physiological parameters, Ramsay, RASS and APACHE II scores (construct validity), while Friedman's test followed by Dunn post hoc test was used to analyze pain score differences over the assessment moments (criterion validity). Semantic, idiomatic, conceptual and practical review of Brazilian BPS items by an expert committee at pre-test phase and final version test consisted on content validity analysis.²⁸

Hemodynamic data were normally distributed, thus to determine changes on physiological parameters over time

Table 1 Demographic data ($n = 25$ subjects).

Variable	Specification
Age (years)	60 \pm 2.1 ^a
Sex	
Male	10
Female	15
Surgery type	
VS	12
CABG	13
Postoperative period	
Immediate	16
Delayed	9
RAMSAI	4.9 \pm 0.21
RASS	-3.8 \pm 0.24
APACHE II	19.12 \pm 0.89 ^a

VS, valve surgery; CABG, coronary artery bypass graft; Immediate, 1 h after surgery; Delayed, 24 h after surgery.

^a Data is represented as mean \pm standard error of mean or absolute frequency, when relevant.

(at rest, during EC and ETS) one way ANOVA for repeated measures was performed. Only subjects with complete evaluation recordings were suitable for analysis. Significance for all statistical tests was set at $p \leq 0.05$.

Results

Twenty-five patients were included in this sample study. Baseline data (age, sex, surgery type, postoperative period, APACHE II score) are presented in [Table 1](#).

There was no significant difference between subjects undergone to VS or CABG in the immediate or delayed postoperative period ($p \geq 1.0$). Similarly, it was not verified influence of surgery type and postoperative period on sedative and severity of disease parameters ($p \geq 0.05$). Thus, the surgery type and postoperative period did not influence the results.

All patients were sedated in continuous infusion (midazolam and fentanyl) at the evaluation moment, one hour (immediate period) or more than forty-eight hours (delayed period, 5 \pm 1.2 days) after surgery procedure. Neuromuscular blockers and analgesic drugs were not administered at the 8 hours previously to the assessment, to not interfere with the data collected.

Reliability

Considering the satisfactory established values for Cronbach α ,³⁶ a high relation between the scales items (internal consistency) occurred in EC and ETS procedures (Cronbach $\alpha = 0.8$, each).

At the same way, high values of ICC were obtained for Brazilian BPS total scores during EC (ICC=0.8) and ETS (ICC=0.9). For sub-items scores, the analysis resulted in higher concordance and reliability between

Table 2 Physiological variables at the three assessment moments with Brazilian Behavioral Pain Scale.

Variable	Rest	Eye cleaning	Endotracheal suctioning	p-Value ^a
SBP (mmHg)	122.4 ± 3.6	119.4 ± 3.8	123.4 ± 4.2	0.5
DBP (mmHg)	71.5 ± 2.8	69.7 ± 3.9	73.1 ± 3.9	0.4
MBP (mmHg)	82.4 ± 3.1	81.3 ± 3.8	82.8 ± 4.0	0.8
HR (bpm)	82.7 ± 4.0	85.8 ± 4.7	84.7 ± 4.2	0.4
SpO ₂	97.4 ± 0.3	96.3 ± 0.8	97.2 ± 0.3	0.2

SBP, systolic blood pressure; DBP, diastolic blood pressure; MBP, mean blood pressure; HR, heart rate; SpO₂, peripheral oxygen saturation. Data were represented as mean ± standard error of mean.

^a $p \geq 0.05$ (one way ANOVA for repeated measures).

the investigators for facial expression items during these moments ($ICC \geq 0.8$).

Responsiveness

The coefficient calculated resulted in a good capacity to detect pain intensity changes over time. The value obtained was 3.22, considered a high effect for a scale.³⁸

Validity

Change in physiological variables is shown in Table 2. There was not a significant increase in all physiological variables when these values were compared at rest, EC and ETS. Construct validity was evaluated by correlations between pain scores and physiological parameters, sedation and severity of disease levels. These correlations were non-significant (Table 3).

For criterion validity, the comparison of pain scores over time was done. Fig. 2 shows that Brazilian BPS final score was significantly higher during painful procedure (TS) than at rest ($p \leq 0.0001$).

Table 3 Correlation between Behavioral Pain Scale scores during painful procedures and physiological parameters, sedation and severity of disease levels.

	Tracheal suctioning	
	BPS score	
	CC	p-Value
SBP	0.35	0.86
DBP	-0.83	0.69
MBP	-0.17	0.93
HR	-0.30	0.89
SpO ₂	0.11	0.61
RAMSAY	-0.34	0.10
RASS	0.32	0.12
APACHE II	-0.03	0.89

CC, Spearman correlation coefficient; SPB, systolic blood pressure; DBP, diastolic blood pressure; MBP, mean blood pressure; HR, heart rate; SpO₂, peripheral oxygen saturation; RASS, Richmond Sedation-Agitation Scale; APACHE, Acute Physiology Health Chronic Evaluation.

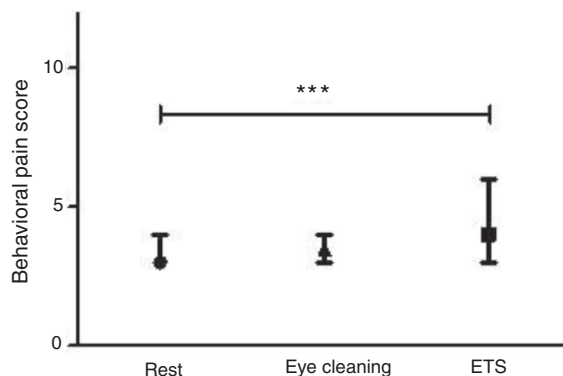


Figure 2 Behavioral Pain Scale score changes over time: at rest, during eye cleaning and during endotracheal suctioning. Values were represented as median, 25th and 75th percentile. * $p \leq 0.0001$ between rest and endotracheal suctioning (Friedman’s test and Dunn post hoc test). ETS, endotracheal suctioning.

Discussion

This pioneer validation study of Brazilian Behavioral Pain Scale exhibits satisfactory index of internal consistency, interrater reliability, responsiveness and validity. Furthermore, non-significant correlations between pain intensity and physiological parameters, sedation and severity of disease levels suggest that this pain assessment tool is a powerful instrument to detect pain in Brazilian ICU patients.

Validity of Brazilian BPS was demonstrated by a significant increase of the scores during painful procedure (ETS). It was evidenced higher pain intensity during ETS compared to rest, which proves the instrument capacity to discriminate pain.¹⁸ These changes over the three assessment times is a parameter that indicates criterion validity and was used on previous studies of this scale in other languages.^{10,14,15,17-25,39}

The ability to detect important changes on pain intensity over time corresponds to responsiveness. This psychometrical property was considered excellent for Brazilian BPS version with high and representative coefficient for this sample. In the same way, Aïssaoui et al.¹⁸ evidenced high responsiveness coefficient and applicability of English BPS. In our study, during EC, Brazilian BPS score was 1 point higher than at rest, but was not significant. This variation on behavioral parameters can be justified by patient’s reaction to the touch done by the investigator, which does not consist in a body response to pain. This result coincides with

the observation of non-significant increases of pain scores measured with BPS during catheter dressing change,⁶ body temperature measurement¹⁵ and eye care^{24,39} when compared to rest. Contrarily, Rijkenberg et al.²² observed a significant increase of total score between rest and the non-painful procedure (oral care) as well as painful procedure (turning) in a critically ill subjects.²²

The correlation of BPS scores with physiological data, sedation and severity of disease were not observed in the present study. Values of heart rate, blood pressure and saturation were not significantly higher during ETS as hypothesized. Oppositively, Payen et al.⁶ and Aïssaoui et al.¹⁸ indicated an increase on blood pressure and heart rate during painful procedure. Farther these authors found an inversely correlation between sedation level and pain scores recorded by the original BPS version. In this context, Young et al.²⁴ affirmed that in addition to sedative and analgesic drugs, tracheostomy and surgery procedure influenced on pain intensity measured by BPS.

It is recommended to record hemodynamic parameters only as a complement for pain assessment or when behavioral indicators are not present on the bedside.¹¹ The failure to prove criterion validity of these variables measured in ICUs sustains this recommendation.¹² Thus, in the current study was not observed a significant correlation between pain score and vital parameters probably due to the lower specificity of these variables.

Reliability results were considered satisfactory during EC and ETS as showed in other BPS validation studies.^{6,15,18,20,24} Higher ICC values (interrater reliability) were observed on the sub-item "Facial Expression". The highest agreement between the investigators in this item may be linked to the familiarity for them to analyze facial changes (specific movements of the eyes, eyebrows, cheeks and lips), a common activity for human subjects who observe facial expressions daily.⁴⁰ Recently published evidence supports the findings of our study when affirms that facial expressions are accentuated during endotracheal suctioning.¹⁹ Eyebrows raised, nose wrinkling and head turned right and up are movements that indicates pain in non-verbally patients.¹⁹ This result encourages the facial expression analysis to quantify pain.

The relevance of this study for clinical practice consists on the applicability of a validated scale to measure pain in Brazilian ICUs. The ease of use, low cost and feasibility in Portuguese can contribute to the establishment of pain assessment and management protocols by ICU professionals from Brazil.

In summary, this study provides evidence that Brazilian BPS presents good interrater reliability, internal consistency, validity and responsiveness. Non-significant correlation between BPS scores and the other variables reinforces the no ability of the vital parameters to measure pain. Therefore, pain assessment and management in Brazilian ICUs is encouraged, by using valid scales, improving critically ill care and consequently promoting physical and social well-being.

Further studies involving different ICU samples are required to prove reproducibility of Brazilian BPS. Moreover, these studies can contribute to reinforce the importance of adequate assessment for a good management of pain by health care professionals responsible for critically ill adults in Brazil.

Summary

Brazilian BPS presents good interrater reliability, internal consistency, validity and responsiveness. It consists in the first validated instrument to assess pain in Brazilian ICUs.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

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References

1. Arroyo-Novoa CM, Figueroa-Ramos MI, Puntillo KA, et al. Pain related to tracheal suctioning in awake acutely and critically ill adults: a descriptive study. *Intensive Crit Care Nurs.* 2008;24:20–7.
2. Gélinas C, Harel F, Fillion L, et al. Sensitivity and specificity of the critical-care pain observation tool for the detection of pain in intubated adults after cardiac surgery. *J Pain Symptom Manage.* 2009;37:58–67.
3. Puntillo KA, Morris AB, Thompson CL, et al. Pain behaviors observed during six common procedures: results from Thunder Project II. *Crit Care Med.* 2004;32:421–7.
4. Puntillo KA, Pasero C, Li D, et al. Evaluation of pain in ICU patients. *Chest.* 2009;135:1069–74.
5. Puntillo KA, Max A, Timsit JF, et al. Determinants of procedural pain intensity in the intensive care unit. The *Europain®* study. *Am J Respir Crit Care Med.* 2014;189:39–47.
6. Payen JF, Bru O, Bosson JL, et al. Assessing pain in critically ill sedated patients by using a behavioural pain scale. *Crit Care Med.* 2001;29:2258–63.
7. Rotondi AJ, Chelluri L, Sirio C, et al. Patients' recollections of stressful experiences while receiving prolonged mechanical ventilation in an intensive care unit. *Crit Care Med.* 2002;30:746–52.
8. Barr J, Fraser GL, Puntillo KA, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Crit Care Med.* 2013;41:263–306.
9. Hamill-Ruth RJ, Marohn ML. Evaluation of pain in the critically ill patient. *Crit Care Clin.* 1999;15:35–54, v–vi.
10. Riker RR, Fugate JE. Participants in the International Multidisciplinary Consensus Conference on Multimodality Monitoring. Clinical monitoring scales in acute brain injury: assessment of coma, pain, agitation and delirium. *Neurocrit Care.* 2014;21 Suppl. 2:27–37.
11. Arbour C, Gélinas C. Are vital signs valid indicators for the assessment of pain in postoperative cardiac surgery ICU adults? *Intensive Crit Care Nurs.* 2010;26:83–90.
12. Chen HJ, Chen YM. Pain assessment: validation of the physiological indicators in the ventilated adult patient. *Pain Manag Nurs.* 2014;16:105–11.
13. Puntillo KA, Miaskowski C, Kehrle K, et al. Relationship between behavioral and physiological indicators of pain, critical care patients' self-reports of pain, and opioid administration. *Crit Care Med.* 1997;25:1159–66.
14. Batalha LMC, Figueiredo AM, Marques M, et al. Adaptação cultural e propriedades psicométricas da versão Portuguesa da escala Behavioral Pain Scale: intubated patient (BPS-IP/PT). *Rev de Enf Ref.* 2013;serIII:7–16.

15. Chen YY, Lai YH, Shun SC, et al. The Chinese behavior pain scale for critically ill patients: translation and psychometric testing. *Int J Nurs Stud*. 2011;48:438–48.
16. Pudas-Tähkä SM, Axelin A, Aantaa R, et al. Translation and cultural adaptation of an objective pain assessment tool for Finnish ICU patients. *Scand J Caring Sci*. 2013;28:885–94.
17. Ahlers SJ, van Gulik L, van der Veen AM, et al. Comparison of different pain scoring systems in critically ill patients in a general ICU. *Crit Care*. 2008;12:R15.
18. Aïssaoui Y, Zeggwagh AA, Zekraoui A, et al. Validation of a behavioral pain scale in critically ill, sedated, and mechanically ventilated patients. *Anesth Analg*. 2005;101:1470–6.
19. Rahu MA, Grap MJ, Cohn JF, et al. Facial expression as an indicator of pain in critically ill intubated adults during endotracheal suctioning. *Am J Crit Care*. 2013;22:412–22.
20. Dehghani H, Tavangar H, Ghandehari A. Validity and reliability of behavioral pain scale in patients with low level of consciousness due to head trauma hospitalized in intensive care unit. *Arch Trauma Res*. 2014;3:e18608.
21. Latorre Marco I, Solís Muñoz M, Falero Ruiz T, et al. Validación de la Escala de Conductas Indicadoras de Dolor para valorar el dolor en pacientes críticos, no comunicativos y sometidos a ventilación mecánica: resultados del proyecto ESCID. *Enferm Intensiva*. 2011;22:3–12.
22. Rijkenberg S, Stilma W, Endeman H, et al. Pain measurement in mechanically ventilated critically ill patients: behavioral pain scale versus critical-care pain observation tool. *J Crit Care*. 2015;30:167–72.
23. Al Sutari MM, Abdalrahim MS, Hamdan-Mansour AM, et al. Pain among mechanically ventilated patients in critical care units. *J Res Med Sci*. 2014;19:726–32.
24. Young J, Siffleet J, Nikoletti S, et al. Use of a Behavioural Pain Scale to assess pain in ventilated, unconscious and/or sedated patients. *Intensive Crit Care Nurs*. 2006;22:32–9.
25. Yu A, Teitelbaum J, Scott J, et al. Evaluating pain, sedation, and delirium in the neurologically critically ill—Feasibility and reliability of standardized tools: a multi-institutional study. *Crit Care Med*. 2013;41:2002–7.
26. Azevedo-Santos IF, Alves IGN, Badauê-Passos D, et al. Psychometric analysis of Behavioral Pain Scale Brazilian version in sedated and mechanically ventilated adult patients: a preliminary study. *Pain Pract*. 2015 [Epub ahead of print].
27. Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25:3186–91.
28. Pasquali L. Instrumentação psicológica: fundamentos e práticas. Porto Alegre: Artmed; 2010.
29. Knaus WA, Draper EA, Wagner DP, et al. APACHE II: a severity of disease classification system. *Crit Care Med*. 1985;13:818–29.
30. Nassar Junior AP, Neto RCP, Figueiredo WBD, et al. Validade, confiabilidade e aplicabilidade das versões em português de escalas de sedação e agitação em pacientes críticos. *São Paulo Med J*. 2008;126:215–9.
31. Ramsay MA, Savege TM, Simpson BR, et al. Controlled sedation with alphaxolone-alphadolone. *Br Med J*. 1974;2:656–9.
32. Sessler CN, Gosnell MS, Grap MJ, et al. The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care unit patients. *Am J Respir Crit Care Med*. 2002;166:1338–44.
33. Puntillo KA. Dimensions of procedural pain and its analgesic management in critically ill surgical patients. *Am J Crit Care*. 1994;3:116–22.
34. Puntillo KA, White C, Morris AB, et al. Patients perceptions and responses to procedural pain: results from Thunder Project II. *Am J Crit Care*. 2001;10:238–51.
35. Vaghadia H, al-Ahdal OA, Nevin K. EMLA patch for venous cannulation in adult surgical outpatients. *Can J Anaesth*. 1997;44:798–802.
36. George D, Mallery P. *SPSS for Windows step by step: a simple guide and reference*. 4th edition 11.0 update Boston: Allyn & Bacon; 2003.
37. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;86:420–8.
38. Wright JG, Young NL. A comparison of different indices of responsiveness. *J Clin Epidemiol*. 1997;50:239–46.
39. Ahlers SJ, van der Veen AM, van Dijk M, et al. The use of the Behavioral Pain Scale to assess pain in conscious sedated patients. *Anesth Analg*. 2010;110:127–33.
40. Arif-Rahu M, Grap MJ. Facial expression and pain in the critically ill non-communicative patient: state of science review. *Intensive Crit Care Nurs*. 2010;26:343–52.