ORIGINAL ARTICLE

Brazilian Versions of the Physical Function ICU Test-scored and de Morton Mobility Index: translation, cross-cultural adaptation, and clinimetric properties

Vinicius Zacarias Maldaner da Silva[1,2], Amanda Sanches Lima[1], Hilana Nadiele[1], Ruy Pires-Neto[3], Linda Denehy[4], Selina M. Parry[4]

1. Programa de Pós-Grauação em Ciencias da Saúde, Escola Superior de Ciências da Saúde, Brasília (DF) Brasil.
2. Instituto Hospital de Base do Distrito Federal, Brasília (DF) Brasil.
3. Departamento de Fisioterapia, Universidade de São Paulo, São Paulo (SP) Brasil.
4. Department of Physiotherapy, School of Health Sciences, The University of Melbourne, Melbourne (Vic) Australia.

Submitted: 21 December 2018.
Accepted: 12 July 2019.

Study carried out in the Instituto Hospital de Base do Distrito Federal and Escola Superior de Ciências da Saúde, Brasília (DF) Brasil.

ABSTRACT

Objective: The present study aimed to translate and cross-culturally adapt the Physical Function in ICU Test-scored (PFIT-s) and the De Morton Mobility Index (DEMMI) to Brazilian Portuguese. **Methods:** This study consisted of the translation, synthesis, and back-translation of the original versions of the PFIT-s and DEMMI, including revision by the Translation Group and pretesting of the translated version, assessed by an Expert Committee. The Brazilian versions of these instruments were applied to 60 cooperative patients with at least 48 h of mechanical ventilation at ICU discharge. The interrater reliability of both scales was tested using the Intraclass Correlation Coefficient (ICC). **Results:** The authors of both original scales have approved the cross-culturally validated versions. Translation and back-translation attained consensus, and no item was changed. Both scales showed good interrater reliability (ICC>0.80) and internal consistency (α>0.80). **Conclusion:** The versions of the PFIT-s and DEMMI adapted to Brazilian Portuguese proved to be easy to understand and apply clinically in the ICU environment.

Keywords: Physical therapy; Questionnaires; Translation; Intensive care unit.

INTRODUCTION

Impairments in physical functioning and muscle weakness are evident in the intensive care unit (ICU) setting, and can persist long after hospital discharge, impacting on activities of daily living and participation in societal and work roles.[1,2]

Physical functioning assessment is critical to understanding the trajectories of recovery and treatment efficacy in response to interventions such as rehabilitation.[3] In recent years, a number of assessment tools have been developed specifically for the ICU setting or adapted from other patient populations, e.g., geriatric and neurological patients, to assist with the physical functioning evaluation in critically ill patients.[4] When selecting the most appropriate measure to evaluate efficacy and change over time, clinicians and researchers should consider whether the clinimetric properties of the measure of interest have been established.[5]

Among these measures, clinicians may utilize the Physical Function in ICU Test-scored (PFIT-s) and De Morton Mobility Index (DEMMI). The PFIT-s is a four-component outcome measure: Assistance (sit-to-stand level of assistance: 0, 1, or 2 people needed), Cadence (maximal marching on the spot duration and number of steps), Shoulder (flexion strength), and Knee (extension strength), with the last two items based on the greatest of left and right using the Oxford grading system.[6] The PFIT-s is a robust measurement tool with demonstrated reliability, validity and responsiveness, and a minimal clinically important difference (MCID) >1.5 points using a 0-10 interval scale range.[4,6,7] The DEMMI is a one-dimensional measure of mobility originally developed for the geriatric population.[8,9] It has recently been assessed in a study within the ICU setting, showing excellent reliability and low floor and ceiling effects during and after ICU discharge[10].

Most tools utilized by health professionals to evaluate functional outcomes in ICU (including PFIT-s and DEMMI) were originally developed in English. In order to be used in Brazil, they must be translated, cross-culturally adapted, and tested for their measurement properties within the local setting. In addition, this procedure facilitates comparison of the results from the same outcome measure in different countries and cultures.[11] Some tools, such as the Functional Status Score for the ICU, ICU Mobility Scale, and Perme Intensive Care Unit Mobility Score have already been translated into Brazilian Portuguese.[12,13] To date, neither the PFIT-s nor the DEMMI has been appropriately translated and validated for use in Brazil taking into account the language and cultural differences. Thus, the aims of this study were 1) to translate and cross-culturally adapt the DEMMI and PFIT-s instruments to Brazilian Portuguese and 2) to evaluate their clinimetric properties (content validity, reliability, floor and ceiling effects). The Strengthening the Reporting of Observational

Studies in Epidemiology (STROBE)[14] and COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines[15,16] were followed in the conduct and reporting of this study.

METHODS

This process was authorized by one of the authors of the original version, Professor Linda Denehy, the University of Melbourne, Melbourne, Australia. This study approved by the Ethics Committee of the Health Sciences Teaching and Research Foundation (FEPECS- Brasilia-Brazil) under process no. 1.338.188.

Translation and cross-cultural adaptation

The translation and cross-cultural adaptation of the aforementioned instruments was conducted according to the guidelines proposed by Beaton et al.[11] which included the following steps: translation, synthesis of the translation, back-translation, review by the expert committee, and pretesting of the pre-final version. This expert committee included an author of the original tool, three physical therapists with over three years of experience specifically in intensive care unit (ICU), and four Portuguese-English accredited translators.

The questionnaire and instructions were translated into Portuguese by two bilingual (Portuguese and English) translators whose native language was Brazilian Portuguese. Translator 1 had experience in occupational health and knowledge of the concepts of the instrument, whereas Translator 2 had no experience in health care and was not familiar with the assessment tools. Both were accredited translators for Portuguese. Once the independent translated versions (T1 and T2) were completed, the teams met with the expert committee (which included the project and translation coordinators) to compare the versions and reach a consensus on any discrepancy, which resulted in a common translated pilot version (T12). Next, the single version was back-translated into the original language by two other independent bilingual translators, native speakers of English and fluent in Brazilian Portuguese, who had no knowledge on the instrument (the so-called naive translators). This step resulted in two back-translations.

The expert committee evaluated all translations and back-translations thoroughly. Rather than focusing on indices of agreement, the translation board attempted to make the best use of the language expertise of its members. The next step consisted of the back-translation

of the T12, which was performed by two independent translators fluent in both languages. The back-translated versions (BT1 and BT2) were also compared and a consensus back-translated version (BT12) was attained. The BT12 was submitted to the evaluation of one of the authors of the scales. After this process, the expert committee produced a pre-final version of the DEMMI and PFIT-s instruments for use in Brazil. The professional background of the participants is described in Table 1.

Pretesting was performed to verify whether this version was equivalent to the original scale and whether the target group could understand it properly. The objective of this stage was to identify interpretative problems regarding the experiential, conceptual, semantic and idiomatic equivalence of the items with the aim of enhancing the inventory as well as reviewing and modifying problematic issues.

For the pretesting, a sample of thirty (30) physical therapists (PTs) from public and private hospitals in Brazil were selected and invited by e-mail to participate in the study. To this end, the following selection criteria were used: having degree in physical therapy and at least one year of clinical work experience in ICU.

The PTs were asked to read the scale, fully explain their answers, and report any issues. None of the PTs reported difficulty in understanding or interpreting the questions.

Application of the translated scales in a Brazilian setting

Study design and setting

This is a single-center prospective study conducted in the surgical and trauma ICUs of the *Hospital de Base do Distrito Federal*. All participants provided written informed consent.

Participants

Inclusion criteria were as follows: 1) adults, aged ≥18 years; 2) mechanically ventilated for more than 48 h; 3) able to ambulate independently for at least 10 m prior to ICU admission (with or without a gait aid); 4) expected to remain in ICU for longer than four days. Additionally, due to the volitional (patient effort dependence) nature of the physical measures, the participants were required to be cooperative with assessments to be included in the study. The ability to comprehend and follow commands was determined using the De Jonghe comprehension criteria (open and

Table 1. Characteristics of the Expert Committee members.

Professional	Occupation	Academic Degree	Professional Experience
Translator 1	Language Professional	M.Sc.	11 years
Translator 2	Physical Therapist	Ph.D.	6 years
Back-translator 1	Physical Therapist	M.Sc.	15 years
Back-translator 2	Language Professional	Ph.D.	21 years
Project Coordinator	Physical Therapist	M.Sc.	15 years
Translation Coordinator	Bachelor of Arts	Ph.D.	24 years

close your eyes; look at me; open your mouth and put out your tongue; nod your head; raise your eyebrows when I have counted up to five).[17] Participants should score at least 3 out of 5 on two consecutive occasions within a six-hour period.[17] Participants were excluded from the study if they presented pre-existing cognitive impairment prior to hospitalization or were admitted with a new neurological condition, such as stroke or spinal cord injury.

Outcome measures

The final Brazilian Portuguese version (available in the online Supplementary Material) was tested by two qualified physical therapists who had received a minimum of 8 hours of training from a senior physical therapist with five years of experience in ICU and who had received specific training in the performance of both assessment tools. The training session included didactic lectures and practical training using simulated ICU patients. After this training session, the assessors evaluated consecutive eligible ICU patients using the PFIT-s and DEMMI instruments. The assessors performed their tests independently and were blinded to the scores obtained by the other therapist. The two scales and the raters were randomized per balanced incomplete blocks using sealed envelopes. All assessments were performed within a 12-hour period, which enabled adequate rest in between assessments to minimize patient fatigue.

Description of the Physical Function ICU Test-scored (PFIT-s) and de Morton Mobility Index (DEMMI)

The PFIT-s was developed for the ICU setting, and examines four activities: 1) Assistance (sit-to-stand level of assistance: 0, 1, or 2 people needed), 2) Cadence (maximal marching on the spot duration and number of steps), 3) Shoulder (flexion strength), and 4) Knee (extension strength), with the last two items based on the greatest of left and right using the Oxford grading system, ranging from 0 – no visible or palpable muscle contraction through to 5 – normal strength. In individuals with greater than movement against gravity (Oxford grade 3), strength was assessed isometrically (at one point in range). The isometric technique was used because this is the preferred method for manual muscle strength testing in ICU.[18] Both interval and ordinal scoring is available. The PFIT-s score ranges from 0 (unable to perform activities) to 10 (high physical functioning).[6]

The DEMMI is composed of 15 items. Eleven items are dichotomous (scored 0 or 1) and four items are scored as 0, 1, or 2. There are 15 hierarchical mobility activities (three are bed based, three chair based, four involve static balance, two are walking-related, and three involve dynamic balance).[8] Patients are rated on their ability as either able/unable or able/partial/unable to perform the tasks.[8] The total score is converted with Rasch Analysis to an interval score range from 0 to 100, where 0 represents poor mobility and 100 indicates high levels of independent mobility.[9]

Assessments were performed only at ICU discharge. Baseline demographics were recorded, including age, gender, body mass index (BMI), admission diagnosis, comorbidities, severity of illness (Acute Physiological and Chronic Health Evaluation - APACHE II) within the first 24 h of ICU admission). Additionally, ICU and hospital length of stay (LOS) and mechanical ventilation (MV) duration (in days) were recorded.

Peripheral muscle strength

Knee extension and handgrip strength were assessed using a digital dynamometer - Manual Muscle Tester (Microfet®, Hoogan Scientific, UTAH, USA). Peripheral muscle strength assessments were conducted with patients in sitting position. Three trials were performed for both limbs according to published protocols, and the highest value of the three trials of both limbs was used as the score.[19,20] Peripheral muscle strength values were reported in kilograms (Kg), with higher values indicating greater muscle strength.

Functional Status Score for Intensive Care Unit (FSS- ICU)

The FSS-ICU is an outcome measure of physical function assessment specially designed for ICU patients, and involves five functional tasks (rolling, supine to sit transfer, sit to stand transfer, sitting on the edge of bed, and walking). Each task is evaluated using an 8-point ordinal scale ranging from 0 (unable to attend or complete task due to weakness) to 7 (complete independence). The FSS-ICU total score is the sum of the scores of all five items, ranging 0-35. The higher scores indicate better functional status. This scale was translated and cross-culturally adapted to Brazilian Portuguese.[12]

Statistical analysis

The study sample comprised 60 patients. Aiming to enhance the generalizability of findings, sample sizes ≥50 participants are recommended for studies assessing clinimetric properties of measurements.[21] The one-sample Kolmogorov-Smirnov test was used to verify the normality of the data. Parametric data are presented as mean and standard deviation, whereas non-parametric data are presented as median and interquartile range. The Intraclass Correlation Coefficient (ICC) using the method of absolute agreement was calculated to evaluate the reliability between the two evaluators (interrater reliability). An ICC greater than 0.75 indicates good-to-excellent reliability.[22] The data measured by one rater across two trials for both scales (DEMMI and PFIT-s) were used to assess the intra-rater reliability, whereas the data measured by two raters for the same group of individuals were used to assess the interrater reliability.

Concurrent construct validity was evaluated using the Spearman's correlation coefficients between both the DEMMI and PFIT-s scores and other variables. To evaluate the convergent validity, a correlation between the DEMMI and PFIT-s with handgrip, knee extension

strength, and the FSS-ICU score were calculated. To assess the divergent validity, correlations with body mass index (BMI) and the APACHE II were calculated.

The proportion of patients who had a minimum (floor) and maximum (ceiling) score was calculated for ICU discharge to determine the presence of a floor or ceiling effect at this time. Floor or ceiling effects are considered to be present if >15% of respondents achieved the lowest or highest possible score, respectively.[23]

RESULTS

Sixty patients were enrolled in this study. Table 2 displays their demographic characteristics.

In the analysis of conceptual equivalence, the DEMMI and PFIT-s scales were understood by the professionals responsible for the translation and back-translation, and the instruments were considered adequate for translation into Brazilian Portuguese. In the meeting held to reach a consensus translation version for both scales, four discrepancies were observed and resolved. The proposed solutions are described in Table 3.

In the back-translation, a couple of differences were identified in the comparison with the original versions. In the PFIT-s, the term *cadence* in the original version was back-translated as *rhythm*. In the DEMMI, the term *sit to stand without using arms* was back-translated as *sit to stand with no arms*. In the pretesting stage, the physical therapists did not report any uncertainties or problems with interpretation affecting their performance; therefore, no additional adjustments were done in the Brazilian Portuguese version. The final electronic versions of the DEMMI and PFIT-s Brazil can be found in the Supplementary Material.

Table 2. Baseline characteristics of the patients enrolled in this study.

Patient characteristics	
Age (years)	42 ±17
Gender (male) n (%)	24 (60%)
APACHE II mean ±SD	19 ± 4
Admission category, n (%)	
• Surgical	17 (43%)
• Trauma	23 (54%)
FCI score	2 [1-4]
BMI (kg/m^2), median [IQR]	25 [23-32]
ICU-AW diagnosis, n (%)	24 (60%)
Time to awakening (days)	5 [4-9]
MV duration (days)	7 [4-11]
ICU LOS (days)	10 [5-16]
Hospital LOS (days)	15 [7-16]
PFIT-s at ICU discharge (0-10 range) mean ±SD	6.55 ±2.06
DEMMI at ICU discharge (0-100 range) mean ±SD	42.6 ±23.80
FSS-ICU at ICU discharge (0-35 range) mean ±SD	26 ±6
Knee extension strength (kg), mean ±SD	18 ±6

ADL: activities of daily living; APACHE II: Acute Physiology and Chronic Health Evaluation II; BMI: Body Mass Index; DEMMI: De Morton Mobility Index; FCI: Functional Comorbidity Index; ICU: intensive care unit; ICU-AW: intensive care unit acquired weakness; kg: kilograms; LOS: length of stay; MV: mechanical ventilation; FSS: Functional Status Score for the ICU; n: number; PFIT-s: Physical Function in ICU Test-scored. The values are expressed as n (%), mean ± standard deviation or median [interquartile range].

Table 3. Discrepancies observed by the Expert Committee between the translation versions (T1 and T2) of the de Morton Mobility Index (DEMMI) and the Physical Function in ICU Test-scored (PFIT-s) – Brazilian Version, and the proposed solutions (T12).

Modified Item	T1 and T2	T12 – Proposed Solutions
Assistance (PFIT-s)	T1 – Assistência T2 – Auxílio	Assistência
Sit to Stand (PFIT-s and DEMMI)	Sentar e Levantar Sentado para em pé	Sentar e levantar
Walk 4 steps backwards	T1- Caminhar 4 passos para trás T2- Andar 4 passos para trás	Andar 4 passos para trás
Roll onto side	T1- Rolar para os lados T2 Virar-se para o lado	Rolar para os lados

T1: Translator 1; T2: Translator 2; T12: consensus-based translation; DEMMI: De Morton Mobility Index; PFIT-s: Physical Function ICU Test-scored.

Table 4. Interrater agreement and internal consistency between the Physical Function ICU Test-scored (PFIT-s) and the de Morton Mobility Index (DEMMI).

Instrument	Assessor 1 Median [min-max]	Assessor 2 Median [min-max]	Reproducibility ICC (95% CI)
PFIT-s			
Sit-to-stand Assistance	2 [0-3]	2 [0-3]	0.87 (0.81-0.92)
Marching on the spot	2 [0-3]	2 [0-3]	0.81 (0.79-0.84)
Shoulder Flexion Strength	2 [1-3]	2 [1-3]	0.96 (0.94-1.00)
Knee Extension Strength	2 [0-3]	2 [0-3]	0.97 (0.95-1.00)
PFIT-s Total	6 [0-12]	6 [0-12]	0.91 (0.87-0.93)
DEMMI			
Bed-based Activities	3 [0-4]	3[0-4]	0.90 (0.87-0.93)
Chair	2 [0-4]	2 [0-4]	0.92 (0.89-0.95)
Static Balance	2 [0-4]	2 [0-4]	0.95 (0.93-0.98)
Walking	2 [0-4]	2 [0-4]	0.95 (0.93-0.98)
Dynamic Balance	1 [0-3]	1 [0-3]	0.91 (0.87-0.94)
Total Score	31 [0-100]	33 [0-100]	0.90 (0.87-0.94)

ICC: Intraclass correlation coefficient; PFIT-s: Physical Function ICU Test-scored; DEMMI: de Morton Mobility Index.

Table 5. Cross-sectional relationship between the de Morton Mobility Index (DEMMI) and the Physical Function ICU Test-scored (PFIT-s) – Brazilian Version according to outcome measures and baseline characteristics.

	DEMMI score	PFIT-s score
Convergent Validity		
Knee extension strength	0.79 (p<0.05)	0.83 (p<0.05)
FSS-ICU	0.91 (p<0.05)	0.93 (p< 0.05)
Divergent Validity		
BMI	-0.09 (p>0.05)	-0.13 (p>0.05)
APACHE II	-0.21 9 p>0.05)	-0.17 (p>0.05)

BMI: Body Mass index; APACHE II: Acute Physiology and Chronic Health Evaluation II; FSS: Functional Status Score for the ICU.

Table 4 shows the interrater agreement and reliability for each domain of the DEMMI and PFIT-s. Good interrater agreement and reliability was observed for all items of in both scales.

Moderate to large criterion validity was found between the DEMMI and PFIT-s instruments and the two functional outcomes (Table 5). Both scales showed negligible correlations with body mass index and APACHE II.

There were minimal floor and ceiling effects to the PFIT-s (1 and 3%, respectively) and the DEMMI (3 and 6%, respectively) assessed at ICU discharge.

DISCUSSION

This study describes the translation and cultural adaptation to Brazilian-Portuguese of the DEMMI and PFIT-s scales for use in critically ill patients. The cross-cultural adaptation process is an approach that can be applied to many instruments developed in other cultural and linguistic settings. For Brazil, it may assist with filling the data gap on the functional evaluation of critically ill patients.

An important reason to adapt an existing assessment tool is that it is more efficient than developing a new one. There is substantial work involved in developing and validating an outcome measure or questionnaire.[24] Because this process is not simple and involves costs, it is necessary to consider whether the instrument is relevant to research and clinical practice, and whether its characteristics are adequate for the purpose, population, and context in which it is intended to be used.[25]

The ICU is a challenging environment to conduct research due to patient heterogeneity and severity of illness. In order to improve the ability to compare findings between research studies, there is now a large body of literature that validates outcomes and indeed much work engaged in finding a standardized core set of outcome measures.[5] Cross-cultural validation, such as the one conducted in this study, is an important aspect of this body of work.

The clinimetric properties found for the DEMMI and PFIT-s instruments are similar to those reported in previous studies. Sommers et al.[10] found a reliability of 0.93 and low ceiling and floor effects at ICU discharge (2.6%), closely corroborating the results of this study results. Similarly to the results of the present study, Parry et al.[4] observed strong correlation between the PFIT-s and muscle strength, but high ceiling effects

(10.3% *vs.* 3%, respectively). These differences can be explained by the difference in the ICU populations investigated - the sample of this study was composed of younger surgical and trauma patients. New studies addressing whether different populations influence functional outcomes should be conducted for better understanding.

The PFIT-s is recommended for the evaluation of critically ill patients,[6,10] whereas the DEMMI has received relatively little attention within the ICU setting.[26] Sommers et al.[10] have demonstrated that the DEMMI is valid and reliable for critically ill patients. Interrater reliability of the Dutch and German translations of the DEMMI was considered excellent (ICC≥0.90), which confirms the reliability results of the DEMMI for Brazil obtained in the present study.[27,28] Denehy et al.[6] demonstrated that the PFIT-s is safe, valid, responsive to change, and predictive of key outcomes, and recommended its adoption to test physical function in ICU. Additionally, Skinner et al.[29] reported the reliability of the PFIT-s for critically ill patients, corroborating the findings of this study, which showed that the PFIT-s presents excellent reproducibility (ICC>0.90).

Recent studies have used the PFIT-s as a key functional outcome to examine early rehabilitation within the ICU setting. Parry et al.[30] demonstrated that functional electrical stimulation cycling in critically ill patients may improve physical function evaluated by the PFIT-s. Nordon-Craft et al.[7] reported that the PFIT-s is feasible and safe to evaluate physical function in ICU patients who are alert and able to follow commands. More recently, this scale has been recommended as one of the four key physical functioning measurement tools for evaluation of physical functioning within the ICU setting[3,31]. The DEMMI still requires further use and evaluation in the ICU environment. Thus, the cross-cultural adaptation of these scales will assist Brazilian physical therapists with obtaining valid and reliable physical function assessments in this population.

It is worth noting that this study was conducted at a single center. However, the findings in this sample are consistent with those obtained in previously published research from Australia, the USA, and the Netherlands,[6,10] lending support to the results of this study.

The versions of the DEMMI and PFIT-s adapted to Brazilian Portuguese proved to be valid, easy to understand, and able to be feasibly implemented in the ICU clinical setting. It is expected that, by providing a consistent and reliable assessment tool, this study will contribute to improvement of the functional assessment of individuals with critical illness in both research and clinical practice in Brazil.

REFERENCES

1. Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. N Engl J Med. 2014;371(3):287-8. http://dx.doi.org/10.1056/NEJMc1406274. PMid:25014703.

2. Parry SM, Puthucheary ZA. The impact of extended bed rest on the musculoskeletal system in the critical care environment. Extrem Physiol Med. 2015;4(1):16. http://dx.doi.org/10.1186/s13728-015-0036-7. PMid:26457181.

3. Parry SM, Nydahl P, Needham DM. Implementing early physical rehabilitation and mobilisation in the ICU: institutional, clinician, and patient considerations. Intensive Care Med. 2017 PMid:28842731.

4. Parry SM, Denehy L, Beach LJ, Berney S, Williamson HC, Granger CL. Functional outcomes in ICU: what should we be using? An observational study. Crit Care. 2015;19(1):127. http://dx.doi.org/10.1186/s13054-015-0829-5. PMid:25888469.

5. Parry SM, Granger CL, Berney S, Jones J, Beach L, El-Ansary D, et al. Assessment of impairment and activity limitations in the critically ill: a systematic review of measurement instruments and their clinimetric properties. Intensive Care Med. 2015;41(5):744-62. http://dx.doi.org/10.1007/s00134-015-3672-x. PMid:25652888.

6. Denehy L, de Morton NA, Skinner EH, Edbrooke L, Haines K, Warrillow S, et al. A physical function test for use in the intensive care unit: validity, responsiveness, and predictive utility of the physical function ICU test (scored). Phys Ther. 2013;93(12):1636-45. http://dx.doi.org/10.2522/ptj.20120310. PMid:23886842.

7. Nordon-Craft A, Schenkman M, Edbrooke L, Malone DJ, Moss M, Denehy L. The physical function intensive care test: implementation in survivors of critical illness. Phys Ther. 2014;94(10):1499-507. http://dx.doi.org/10.2522/ptj.20130451. PMid:24810863.

8. de Morton NA, Davidson M, Keating JL. Validity, responsiveness and the minimal clinically important difference for the de Morton Mobility Index (DEMMI) in an older acute medical population. BMC Geriatr. 2010;10(1):72. http://dx.doi.org/10.1186/1471-2318-10-72. PMid:20920285.

9. Morton NA, Davidson M, Keating JL. The de Morton Mobility Index (DEMMI): an essential health index for an ageing world. Health Qual Life Outcomes. 2008;6(1):63. http://dx.doi.org/10.1186/1477-7525-6-63. PMid:18713451.

10. Sommers J, Vredeveld T, Lindeboom R, Nollet F, Engelbert RH, Van der Schaaf M. de Morton mobility index is feasible, reliable, and valid in patients with critical illness. Phys Ther. 2016;96(10):1658-66. http://dx.doi.org/10.2522/ptj.20150339. PMid:27081202.

11. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine. 2000;25(24):3186-91. http://dx.doi.org/10.1097/00007632-200012150-00014. PMid:11124735.

12. Silva V, Araujo JAN, Cipriano G Jr, Pinedo M, Needham DM, Zanni JM, et al. Brazilian version of the Functional Status Score for the ICU: translation and cross-cultural adaptation. Rev Bras Ter Intensiva. 2017;29(1):34-8. http://dx.doi.org/10.5935/0103-507X.20170006. PMid:28444070.

13. Kawaguchi YM, Nawa RK, Figueiredo TB, Martins L, Pires-Neto RC. Perme intensive care unit mobility score and ICU mobility scale: translation into portuguese and cross-cultural adaptation for use in Brazil. J Bras Pneumol. 2016;42(6):429-34. http://dx.doi.org/10.1590/s1806-37562015000000301. PMid:28117473.

14. Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the reporting of observational studies in epidemiology (STROBE): explanation and elaboration. Int J Surg. 2014;12(12):1500-24. http://dx.doi.org/10.1016/j.ijsu.2014.07.014. PMid:25046751.

15. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford P, Knol DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international delphi study. Qual Life Res. 2010;19(4):539-49. http://dx.doi.org/10.1007/s11136-010-9606-8. PMid:20169472.

16. Mokkink L, Terwee C, Knol D, Stratford P, Alonso J, Patrick D, et al. The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: a clarification of its content. BMC Med Res Methodol. 2010;10(22):22. http://dx.doi.org/10.1186/1471-2288-10-22. PMid:20298572.

17. De Jonghe B, Sharshar T, Lefaucheur JP, Authier FJ, Durand-Zaleski I, Boussarsar M, et al. Paresis acquired in the intensive care unit: a prospective multicenter study. JAMA. 2002;288(22):2859-67. http://dx.doi.org/10.1001/jama.288.22.2859. PMid:12472328.

18. Parry SM, Berney S, Granger CL, Dunlop DL, Murphy L, El-Ansary D, et al. A new two-tier strength assessment approach to the diagnosis of weakness in intensive care: an observational study. Crit Care. 2015;19(1):52. http://dx.doi.org/10.1186/s13054-015-0780-5. PMid:25882719.

19. Bohannon RW. Reference values for extremity muscle strength obtained by hand-held dynamometry from adults aged 20 to 79 years. Arch Phys Med Rehabil. 1997;78(1):26-32. http://dx.doi.org/10.1016/S0003-9993(97)90005-8. PMid:9014953.

20. Baldwin CE, Paratz JD, Bersten AD. Muscle strength assessment in critically ill patients with handheld dynamometry: an investigation of reliability, minimal detectable change, and time to peak force generation. J Crit Care. 2013;28(1):77-86. http://dx.doi.org/10.1016/j.jcrc.2012.03.001. PMid:22520490.

21. Terwee CB, Mokkink LB, Van Poppel MN, Chinapaw MJ, Van Mechelen W, Vet HC. Qualitative attributes and measurement properties of physical activity questionnaires: a checklist. Sports Med. 2010;40(7):525-37. http://dx.doi.org/10.2165/11531370-000000000-00000. PMid:20545379.

22. Sarwal A, Parry SM, Berry MJ, Hsu FC, Lewis MT, Justus NW, et al. Interobserver reliability of quantitative muscle sonographic analysis in the critically Ill population. J Ultrasound Med. 2015;34(7):1191-200. http://dx.doi.org/10.7863/ultra.34.7.1191. PMid:26112621.

23. Terwee CB, Bot SD, Boer MR, Van der Windt DA, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol. 2007;60(1):34-42. http://dx.doi.org/10.1016/j.jclinepi.2006.03.012. PMid:17161752.

24. Costa FA, Duggan C, Bates I. A systematic approach to cross-cultural adaptation of survey tools. Pharm Pract. 2007;5(3):115-24. http://dx.doi.org/10.4321/S1886-36552007000300004. PMid:25214927.

25. Epstein J, Santo RM, Guillemin F. A review of guidelines for cross-cultural adaptation of questionnaires could not bring out a consensus. J Clin Epidemiol. 2015;68(4):435-41. http://dx.doi.org/10.1016/j.jclinepi.2014.11.021. PMid:25698408.

26. Parry SM, Huang M, Needham DM. Evaluating physical functioning in critical care: considerations for clinical practice and research. Crit Care. 2017;21(1):249. http://dx.doi.org/10.1186/s13054-017-1827-6. PMid:28978333.

27. Jans MP, Slootweg VC, Boot CR, de Morton NA, van der Sluis G, van Meeteren NL. Reproducibility and validity of the Dutch translation of the de Morton Mobility Index (DEMMI) used by physiotherapists in older patients with knee or hip osteoarthritis. Arch Phys Med Rehabil. 2011;92(11):1892-9. http://dx.doi.org/10.1016/j.apmr.2011.05.011. PMid:22032224.

28. Braun T, Schulz RJ, Reinke J, van Meeteren NL, de Morton NA, Davidson M, et al. Reliability and validity of the German translation of the de Morton Mobility Index (DEMMI) performed by physiotherapists in patients admitted to a sub-acute inpatient geriatric rehabilitation hospital. BMC Geriatr. 2015;15(1):58. http://dx.doi.org/10.1186/s12877-015-0035-y. PMid:25935559.

29. Skinner EH, Berney S, Warrillow S, Denehy L. Development of a physical function outcome measure (PFIT) and a pilot exercise training protocol for use in intensive care. Crit Care Resusc. 2009;11(2):110-5. PMid:19485874.

30. Parry SM, Berney S, Warrillow S, El-Ansary D, Bryant AL, Hart N, et al. Functional electrical stimulation with cycling in the critically ill: a pilot case-matched control study. Crit Care. 2014;29(4):695.e1-7. http://dx.doi.org/10.1016/j.jcrc.2014.03.017.

31. Selina Mary Parry P, Huang M, Needham DM. Evaluating physical functioning in critical care: considerations for clinical practice and research. Crit Care. 2017;21:249. http://dx.doi.org/10.1186/s13054-017-1827-6.

SUPPLEMENTARY MATERIAL

Supplementary material accompanies this paper.

Teste de Função Física em Unidades de Terapia Intensiva (PFIT-s): PFIT-s Brasil.

This material is available as part of the online article at http://jornaldepneumologia.com.br/detalhe_anexo.asp?id=82