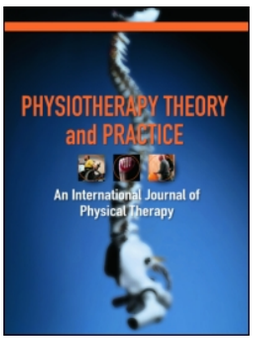

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Inter-observer reliability of trained physiotherapists on the Functional Status Score for the Intensive Care Unit Chilean-Spanish version

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ABSTRACT

Purpose: Evaluate inter-observer reliability of trained physiotherapists administering the Chilean-Spanish version of the Functional Status Score for the Intensive Care Unit (FSS-ICU).

Methods: Six adult patients in a medical-surgical ICU were assessed and video-recorded by 1 of 2 expert physiotherapists. Twelve physiotherapists were then trained using recommended Spanish-language FSS-ICU materials. The 12 physiotherapists independently scored the FSS-ICU for the 6 video-recorded patients. Intraclass Correlation Coefficient (ICC) was used to evaluate the inter-observer reliability, and modified Bland-Altman plots evaluated agreement between the physiotherapists and experts.

Results: This study was performed between May and August 2018. The FSS-ICU total score had a median score of 18 (range: 6 to 34) for the 6 patients. The ICC of the total score was 0.96 (95% CI, 0.92 to 1.00), and for each of the 5 individual FSS-ICU tasks, the ICC ranged between 0.87 and 0.92. The modified Bland–Altman plot revealed a mean difference of 0.6 (95% limits of agreement: −3.3 to 4.5).

Conclusions: Twelve trained physiotherapists had excellent inter-observer reliability when administering the Chilean-Spanish FSS-ICU using videos of six critically ill patients, and had excellent agreement with an expert, revealing differences within the established minimal important difference. These findings provide new data supporting clinimetric properties of the Chilean-Spanish FSS-ICU.

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Introduction

Critical illness and an associated intensive care unit (ICU) stay may cause a decline in patients' muscle strength and physical functioning that last long after hospital discharge (Fan et al., 2014; Herridge et al., 2011). Physiotherapists are challenged with early detection of impairments in physical functioning that has lead to a growing number of associated measurement instruments (Parry et al., 2015; Parry, Huang, and Needham, 2017). Most of these ICU instruments include functional mobility as a primary domain (González-Seguel, Corner, and Merino-Osorio, 2019). The following four outcome measure instruments have demonstrated robust clinimetric properties for use in the ICU: 1) Physical Function in Intensive Care Unit Test-scored; 2) Chelsea Critical Care Physical Assessment Tool; 3) ICU Mobility scale; and 4) Functional Status Score for the ICU (FSS-ICU) (Parry, Huang, and Needham, 2017; Parry, Nydahl, and Needham, 2018). Of these, the FSS-ICU is the only measure that specifically evaluates the level of physical assistance required for five functional activities, including in-bed activities, out-of-bed activities, and walking. The existing clinimetric data of FSS-ICU in the ICU setting include responsiveness, validity and inter-observer reliability (da Silva et al., 2017; Hiser et al., 2018; Huang et al., 2016; Ozcan Kahraman et al., 2019; Ragavan, Greenwood, and Bibi, 2016).

According to the COnsensus-based Standards for the selection of health status Measurement Instruments (Mokkink et al., 2010), inter-observer reliability informs about the accuracy of two or more evaluators when using a measurement instrument, allowing improved clinical

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Supplemental data for this article can be accessed here.

interpretation of the potential differences between the evaluators. The inter-observer reliability of the: English (Hiser et al., 2018; Ragavan, Greenwood, and Bibi, 2016), Portuguese (da Silva et al., 2017), and Turkish (Ozcan Kahraman et al., 2019) version of the FSS-ICU has previously reported Intraclass Correlation Coefficient (ICC) values between 0.98 and 0.99 for the FSS-ICU total score. The available information on inter-observer reliability has been obtained from single-site ICU studies (Hiser et al., 2018). This could limit the generalizability of results to other countries, since cross-cultural translation and adaptation of an instrument does not ensure that the clinimetric properties of the original version are preserved (Beaton, Bombardier, Guillemin, and Ferraz, 2000). The FSS-ICU was recently translated and adapted to Chilean-Spanish (González-Seguel et al., 2019), which necessitates evaluating the reliability of evaluators who use this Spanish version of the FSS-ICU to determine if there are potential misinterpretations in clinical practice. Therefore, the aim of this study was to evaluate inter-observer reliability of trained physiotherapists administering the Chilean-Spanish version of the FSS-ICU.

Methods

Design

A cross-sectional study was conducted to measure the inter-observer reliability of physiotherapists in a 12-bed academic medical-surgical ICU. This study follows ethical standards of the Helsinki Declaration and was approved by the Research Ethics Committee of Facultad de Medicina de la Clínica Alemana de Santiago Universidad del Desarrollo (Nº 2017–104). In reporting this study, the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist was used (von Elm et al., 2014).

Participants

The inclusion criteria were practising physiotherapist trained at a University recognized by the Chilean state with at least 2 years of clinical experience in critical care. Physiotherapists who were not available to participate in the training and those who did not currently work in the ICU were excluded. Eligible physiotherapists agreed to participate in the reliability measurement and provided written informed consent. These physiotherapists had to experience using the FSS-ICU in clinical practice but had not received instruction or formal training.

Two weeks before the reliability assessment, the physiotherapists received 3-hours of in-person standardized training led by two reference physiotherapists with expertise in FSS-ICU (ACM and FGS, both with more than 3 years of experience in clinical use of the FSS-ICU and previously participated in the translation and cross-cultural adaptation of the FSS-ICU in Chile) (González-Seguel et al., 2019). This training focused on standardizing measurement of the FSS-ICU with emphasis on the FSS-ICU instructions, discussion of clinical scenarios, use of the existing Chilean-Spanish training materials (FSS-ICU pocket card, full version, frequently asked questions document, and instructional video, all freely available at www.improvelto.com). In addition, during the training session, a multiple-choice knowledge questionnaire was administered. This questionnaire provided various clinical scenarios to ensure correct knowledge and application of the FSS-ICU. The questions of this questionnaire were designed by the researchers (ACM and FGS) based on the frequently asked questions and training video of the FSS-ICU. During the two-week period after completion of the training, the two reference physiotherapists were available to address questions of the trained physiotherapist in applying the FSS-ICU in their clinical practice in the ICU.

Outcome measure

The FSS-ICU was created to measure physical functioning in the ICU and evaluates the level of physical assistance required by the patient for five mobility tasks: (1) rolling; (2) supine to sit transfer; (3) sit to stand transfer; (4) sitting at the edge of bed; and (5) walking (Huang et al., 2016; Zanni et al., 2010). Each task is scored using an 8-point ordinal scale that ranges from 0 (unable to perform the activity) to 7 (complete independence). The total score is a sum of scores from each task, ranging from 0 to 35 points, where a lower score indicates greater functional limitations (Huang et al., 2016). This measure has an estimated completion time of 10 to 30 min, depending on the patient's functional performance. To carry out the reliability assessment in this study, the Chilean-Spanish version of the FSS-ICU was used (González-Seguel et al., 2019).

Procedure

Since it is not feasible, in the ICU setting, to gather a group of physiotherapists for a direct and repeated evaluation of the same patient, the FSS-ICU evaluation was video-recorded for purposes of this study. All patients agreed to participate and provided written informed consent before being video-recorded. The inclusion criteria of participating patients were: more than 18 years old and invasive mechanical ventilation during the current hospitalization.

The exclusion criteria were: previous functional dependence (i.e. patients who previously did not walk based on report of the family), do not resuscitate order, paralysis or amputation of any limb. Before each evaluation, clinical stability was reviewed according to the existing criteria (Conceição et al., 2017) to allow evaluation of at least three activities of the FSS-ICU. In order to guarantee that patients understood the instructions of the FSS-ICU, they had to correctly answer five simple commands according to existing criteria: 1) open and close your eyes; 2) look at me; 3) open your mouth and stick out your tongue; 4) nod your head; and 5) raise your eyebrows when I have counted up to five (De Jonghe et al., 2002).

One of the two reference physiotherapists used the FSS-ICU to evaluate a total of six critically ill patients in the medical-surgical ICU, while the second physiotherapist video recorded the evaluation. The patient evaluation and video recording roles for the two reference physiotherapists alternated between patients. The video frame included the floor, the bed and the necessary height to visualize the whole body of the patient in the room or in the ICU corridor according to their physical capacity. After each evaluation, the score of the five FSS-ICU tasks was agreed between both reference physiotherapists, with the result of this consensus becoming the reference score.

To measure the FSS-ICU across a wide range of scores, patients with three levels of strength were selected as previously measured by one of the reference physiotherapist on the same day of video recording. Strength was evaluated using the Medical Research Council Sum Score (MRC-SS) (De Jonghe et al., 2002; Fan et al., 2010). Two patients were selected from each of these categories (Vanpee, Hermans, Segers, and Gosselink, 2014): severe ICUAW (MRC-SS ≤ 35), non-severe ICUAW (MRC-SS 36 to 47), and no ICUAW (MRC-SS 48 to 60) (Hermans et al., 2012).

To evaluate inter-observer reliability, the 12 physiotherapists met 2 weeks after the training to review the videos of six patients, and score the FSS-ICU. The physiotherapists individually scored each item and calculated the total score of the FSS-ICU on a record sheet, using the Chilean pocket card as a memory aid. The physiotherapists scored the FSS-ICU at the same time and were blinded to the score of the reference rater. Any information that the physiotherapists could not determine from the video was provided to everyone whenever requested (i.e. the distance or any condition that prevented scoring a task for any other reason other than weakness).

Data analysis

The sample size was calculated based on existing recommendations (Bonett, 2002), for a k = 12 (12 raters), a 2-sided *p*-value = 5%, and power = 80%, yielding a sample size of 6 patients. Data are presented as count (percentage) or median (inter-quartile range (IQR), or minimum – maximum) to summarize the characteristics of the physiotherapists. To evaluate inter-observer reliability among physiotherapists, we used the two-way random effects, absolute agreement, single rater/measurement model of the Intraclass Correlation Coefficient (ICC 2,1) according to the Shrout and Fleiss classification (Koo and Li, 2016; Shrout and Fleiss, 1979), with a 95% confidence interval (CI). The qualitative interpretation of the ICC was classified as "poor" (≤0.40), "moderate" (0.41–0.60), "good" (0.61–0.80), or "excellent" (≥0.81) (Dwyer, Hardy, Peat, and Baur, 2011). As a secondary analysis, the inter-observer agreement was calculated via a quadratic weighted Kappa (Cohen, 1968), for the FSS-ICU total score and for each FSS-ICU task, with qualitative interpretation as per existing criteria (Landis and Koch, 1977). Modified Bland–Altman plots were used to assess agreement between the FSS-ICU scores of each trained physiotherapist and the reference rater. In this modified Bland–Altman plot, it is assumed that the reference rater score is measured without error and is used for the X-axis, with the difference between each of the 12 physiotherapists and reference rater on the Y-axis. Descriptive analyses and reliability calculations were performed using version 15.0 of STATA/IC® (StataCorp).

Results

This study was conducted from May to August 2018. Fourteen clinical physiotherapists completed the training and 12 participated in reliability evaluation for all six patients resulting in a total of 72 assessments. Participants had a median (IQR) age of 35 (32 to 41) years, 7.5 (6 to 10) years of clinical experience in critical care, and 1.5 (1.4 to 2.1) years of experience using the FSS-ICU without prior training (Table 1).

The MRC-SS scores of the six patients were 24, 33, 36, 40, 50 and 52 and the median FSS-ICU total score, as evaluated by the 12 physiotherapists, was 18 (range: 6 to 34) (Table 2). For the FSS-ICU total score, the ICC was 0.96 (95% CI, 0.92 to 1.00). All five FSS-ICU tasks had an ICC > 0.75 (Table 3), with the lowest for walking (0.87; 95% CI, 0.75 to 1.00) and the highest for supine to sit transfer and sit to stand transfer 0.92 (95% CI, 0.82 to 1.00) and 0.92 (95% CI, 0.83 to 1.00), respectively. Weighted Kappa scores for the FSS-ICU total score and each task ranged from 0.79 to 0.87 (Table 3), representing "substantial" or "almost perfect" strength of agreement.

The modified Bland-Altman plot of the FSS-ICU total score revealed a mean difference of 0.6 (95% limits

Table 1. Characteristics of physiotherapists for inter-observer reliability evaluation of the FSS-ICU Chilean-Spanish version.

	All physiotherapists (n = 12)
Age *(years)*	35 (32–41)
Female	7 (58%)
Critical care physiotherapy specialist DENAKE	7 (58%)
Critical care experience *(years)*	7.5 (6–10)
Experience using FSS-ICU *(years)*	1.5 (1.4–2.1)

Data are presented as median (IQR).
FSS-ICU, Functional Status Score for the Intensive Care Unit; DENAKE, National Association of Accreditation of Specialist Physiotherapist, acronym in Spanish: *Asociación Nacional de Acreditación de Kinesiólogos Especialistas*; IQR, interquartile range [25–75].

Table 3. Inter-observer reliability among physiotherapists (n = 12) for each component and total score of FSS-ICU Chilean-Spanish version.

Item	Intraclass Correlation Coefficient (2,1) (95% CI)	SEM*	Weighted κ Statistic
Rolling	0.88 (0.77–1.00)	0.06	0.79
Supine to sit transfer	0.92 (0.82–1.00)	0.05	0.82
Sitting at the edge of bed	0.89 (0.78–1.00)	0.06	0.81
Sit to stand transfer	0.92 (0.83–1.00)	0.04	0.81
Walking	0.87 (0.75–1.00)	0.06	0.87
Total score	0.96 (0.92–1.00)	0.02	0.86

*Standard error of the two-way random effects, absolute agreement, single rater/measurement model of the Intraclass Correlation Coefficient
FSS-ICU, Functional Status Score for the Intensive Care Unit; SEM, standard error of measurement

of agreement: −3.3 to 4.5) between the scores of the 12 physiotherapists and the reference score (Figure 1). The Bland–Altman plots of the individual task of the FSS-ICU demonstrated the follow mean difference (95% limits of agreement): rolling: −0.1 (−1.8 to 1.6); supine to sit transfer: −0.2 (−1.5 to 1.1); sit to stand transfer: 0.5 (−1.3 to 2.4); sitting at the edge of bed: 0.3 (−1.5 to 2.1); and walking: 0.1 (−1.6 to 1.7) (Supplementary Material).

Discussion

The inter-observer reliability of the Chilean-Spanish version of the FSS-ICU was excellent (ICC 0.96 [95% CI, 0.92 to 1.00]) among 12 trained physiotherapists who routinely work in the ICU setting. This finding was consistent with previously published data (da Silva et al., 2017; Hiser et al., 2018; Ozcan Kahraman et al., 2019; Ragavan, Greenwood, and Bibi, 2016). Ragavan, Greenwood, and Bibi (2016) reported an ICC of 0.99 (95% CI, 0.98 to >0.99) among six physiotherapists who scored 31 patients. da Silva et al. (2017) and Ozcan Kahraman et al. (2019) measured the interobserver reliability between two physiotherapists who scored 30 (ICC 0.88 [95% CI, 0.73 to 0.95]) and 50 patients (ICC 0.99 [95% CI, 0.98 to >0.99]), respectively. In a study by Hiser et al. (2018), an ICC of 0.99 (95% CI, 0.998 to >0.99) was reported among eight physiotherapists who scored 76 patients.

In this study, 12 physiotherapists were trained before the reliability evaluation. This training included observation of a video of patients evaluated using the FSS-ICU, which allowed physiotherapists to familiarize themselves with this type of evaluation. Based on the results of this study, the suggest that videos may be helpful for reliability training in settings where it is difficult to bring together many raters (i.e. ICU).

As a secondary objective, inter-observer agreement was also reported via the weighted κ statistic. This statistic showed an "almost perfect" strength of agreement (κ = 0.87). The weighted κ statistic results for the total FSS-ICU score in our study was similar to scores for individual FSS-ICU tasks as published by Hiser et al. (2018). Although the ICC is commonly used to evaluate the interobserver reliability of ordinal scales, the Weighted κ Statistic may be better suited to ordinal

Table 2. Characteristics of patients for inter-observer reliability evaluation of the FSS-ICU Chilean-Spanish version.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Age *(years)*	58	51	21	86	55	60
Gender	Male	Male	Female	Female	Female	Male
APACHE II severity score	31	22	36	48	4	10
Admission diagnosis	Septic arthritis	Respiratory-cardiac arrest	Bone marrow transplant	ARDS	COPD	Liver transplant
Diagnosis of shock at ICU admission	Yes	Yes	Yes	Yes	No	Yes
ICU stay *(days)*	73	30	65	13	9	14
Invasive mechanical ventilation *(days)*	21	25	4	8	5	1
MRC-SS strength score *(range: 0 to 60 points)*	24	33	36	40	50	52
FSS-ICU total score *(range: 0 to 35 points)**	10 (9–11)	12 (11.3–13)	18 (17–19)	17 (16–18)	31 (29–32)	30 (30–31)
Rolling*	2 (1–3)	3 (3–3)	6 (5–6)	6 (6–6)	7 (7–7)	6.5 (6–7)
Supine to sit transfer*	1 (1–2)	2 (2–2)	3 (3–3)	3 (3–3)	7 (6–7)	6 (6–6)
Sitting at the edge of bed*	3 (2–4)	4.5 (4–6)	7 (6–7)	7 (6–7)	7 (7–7)	7 (7–7)
Sit to stand transfer*	2 (2–2)	2 (1–2)	3 (3–3)	2 (1.3–2)	7 (6–7)	6 (6–7)
Walking*	2 (2–2)	0 (0–0)	0 (0–0)	0 (0–0)	4 (4–4)	4 (4–5)

* Values correspond to the median (IQR) obtained by the rating of 12 physiotherapists.
APACHE II, Acute Physiology And Chronic Health Evaluation II; ARDS, acute respiratory distress syndrome; COPD, chronic obstructive pulmonary disease; FSS-ICU, Functional Status Score for the Intensive Care Unit; ICU, intensive care unit; MRC-SS, Medical Research Council Sum Score.

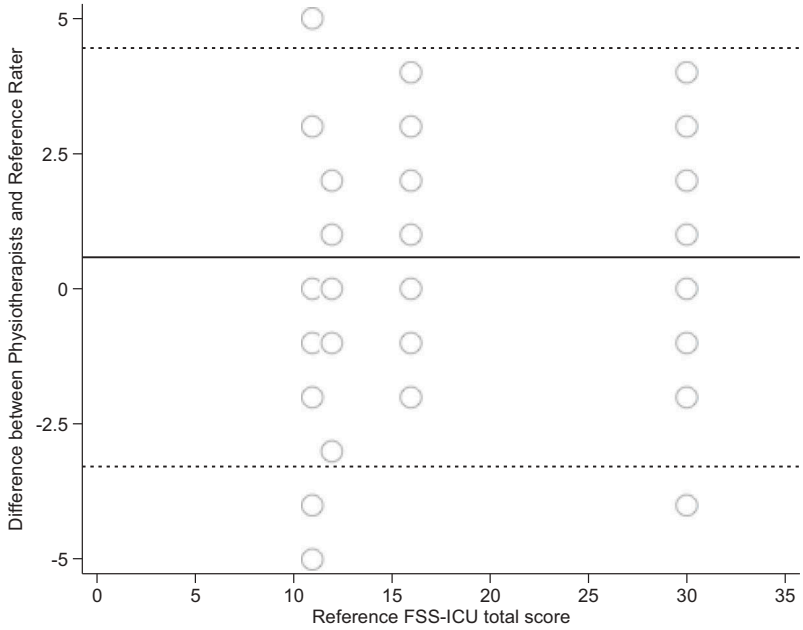

Figure 1. Modified Bland–Altman plot for agreement in FSS-ICU total score between 12 physiotherapists and a reference rater. The X-axis represents the score of the reference rater.

The Y-axis represents the differences between the 12 physiotherapists and reference rater. The solid line represents the mean difference and the 2 dotted-lines represent upper and lower limits of agreement around the mean difference. The thickness of the edges of each circle is proportional to the number of physiotherapists with that data point.

scales (Gisev, Bell, and Chen, 2013; Kottner et al., 2011). In this study, the ICC statistic was used in order to facilitate comparison with the studies that previously used the ICC (da Silva et al., 2017; Hiser et al., 2018; Ragavan, Greenwood, and Bibi, 2016).

Similar to previous data (Hiser et al., 2018), the modified Bland–Altman plot of our study demonstrated a limit of agreement up to 4.5 points, which is within the minimally important difference range of 2 to 5 points established in the original version of the FSS-ICU (Huang et al., 2016). In our modified Bland–Altman plot, none of the physiotherapists had more than a 5-point difference with the reference rater for the FSS-ICU total score.

This study has potential limitations. First, the findings were obtained based on the evaluations from a single center by physiotherapists with previous experience in the application of the FSS-ICU, which could limit generalizability. Second, reliability was evaluated for a small sample size (6 patients) across the 12 physiotherapists. However, the authors selected patients with three levels of FSS-ICU scores to include low, medium and high scores. Finally, physiotherapists scored the FSS-ICU through videos and not through in-person evaluations. However, the scores of the physiotherapists were compared with the scores of an expert who evaluated in-person.

Although the available information on inter-observer reliability is based on four studies, it is suggested to measure the reliability for any new translated and culturally adapted version of an instrument. To strengthen the available clinimetric data on the FSS-ICU and to facilitate correct use in clinical practice and research among Spanish-speakers, future research is suggested to measure additional clinimetric properties of the version adapted to Spanish (e.g. construct validity).

In conclusion, 12 clinical physiotherapists demonstrated excellent inter-observer reliability when administering the Chilean-Spanish version of FSS-ICU using video recordings of six critically ill patients with low, medium and high FSS-ICU scores. The clinical physiotherapists also had excellent agreement compared to the reference rater, revealing differences within the established minimally important difference of the FSS-ICU.

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Competing Interests

The authors declare that they do not have conflicts of interest.

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