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ORIGINAL ARTICLE

Reliability and Validity of the Japanese Perme ICU Mobility Score: An Initial Psychometric Evaluation

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Objectives: The Perme ICU Mobility Score is widely used to assess functional status, but no version of this assessment tool has been validated for use in Japan. This study aimed to translate the Perme Score into Japanese and evaluate its reliability and validity. **Methods**: Following forward–backward translation, the Japanese Perme Score was tested at ICU discharge. Inter-rater reliability was examined using weighted kappa coefficient. Construct validity was assessed through correlations with the Medical Research Council Sum Score (MRC-SS), Functional Status Score for the ICU (FSS-ICU), and ICU Mobility Scale (IMS). Predictive validity for activities of daily living (ADL) independence (Barthel Index ≥85) and discharge destination was evaluated using Receiver operating characteristic (ROC) analysis. Floor and ceiling effects were also analyzed. **Results**: In 69 patients, the Japanese Perme Score showed high inter-rater reliability (κ=0.83). It showed moderate correlation with FSS-ICU (rho=0.61) and IMS (rho=0.73), and it showed weak correlation with MRC-SS (rho=0.36). Predictive validity for ADL independence and home discharge yielded AUCs of 0.76 and 0.73, respectively. A ceiling effect was noted in 10% of cases, with no floor effect. **Conclusion**s: The Japanese Perme Score is a reliable, valid instrument for evaluating physical function at ICU discharge.

Key Words: critical illness; intensive care unit; outcome assessment; physical function; rehabilitation

INTRODUCTION

Advances in the management of critically ill patients have improved survival but highlighted the long-term sequelae faced by survivors, collectively referred to as post-intensive care syndrome (PICS).[1,2] PICS encompasses physical, psychological, and cognitive impairments, with physical dysfunction being particularly concerning: approximately 30% of patients remain symptomatic 6 months after ICU discharge, which negatively impacts both survival and quality of life.[3,4]

Rehabilitation strategies aimed at preventing PICS are often insufficient if confined to the ICU, underscoring the need for continued intervention after discharge.[5] The identification of patients that require follow-up rehabilitation requires assessment of physical function at ICU discharge. Among the available tools, four scales are commonly recommended: the Physical Function in ICU Test (PFIT), the Chelsea Criti-

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cal Care Physical Assessment Tool (CPAx), the Functional Status Score for the ICU (FSS-ICU), and the ICU Mobility Scale (IMS).[6] When assessing ICU patients, scales must accommodate altered consciousness caused by sedation or delirium, allow for simple bedside use in patients with mobility restrictions from devices, and enable monitoring of functional changes over time. Although several ICU-specific scales have been developed, their psychometric properties remain insufficiently validated, making it unclear which is most appropriate.[7] Furthermore, because key instruments such as PFIT and CPAx were developed in English, linguistic and cultural differences may affect interpretation and clinical applicability.[8,9]

The Perme ICU Mobility Score (Perme Score), developed by Perme in 2014, is designed to objectively evaluate patient mobility in the ICU.[10] This 15-item tool is notable for incorporating "mental status" and "barriers to mobility," which are dimensions often overlooked in other scales, thereby accounting for impaired consciousness and the presence of treatment devices frequently encountered in ICU settings. In addition, by assessing endurance, the Perme Score offers unique value as one of the few ICU-specific functional assessment instruments. Its inter-rater reliability has been confirmed across the original and translated versions, and its validity has been demonstrated through associations with ICU length of stay and in-hospital mortality.[11–13]

However, the Japanese version of the Perme Score has not yet been validated. This study aimed to evaluate its reliability and validity in Japanese ICU patients. We hypothesized that the Japanese Perme Score would provide a reliable and valid measure of physical function at ICU discharge. To test this, we translated the original scale into Japanese, assessed inter-rater reliability and measurement error, and examined construct and predictive validity by analyzing correlations with other physical function assessments and determining cutoff values for discharge destination and independence in activities of daily living (ADL).

MATERIALS AND METHODS

Study Design and Setting

This prospective study was conducted in the mixed medical–surgical ICU of Okayama University Hospital between June 2023 and March 2024. The protocol followed the COSMIN (Consensus-based Standards for the Selection of Health Measurement Instruments) guidelines for evaluating measurement properties of assessment tools, including the use of COSMIN terminology.[14]

Participants

Eligible participants were adults (≥18 years) admitted to the ICU for at least 3 days. Patients were assessed at ICU discharge if they were conscious, defined as meeting at least three of the five criteria proposed by De Jonghe et al.[15] (open eyes, stick out tongue, raise eyebrows, grasp hand, and lift foot). Exclusion criteria included pre-existing walking impairments, terminal illness, trauma requiring prolonged bed rest, paralysis or disability from neuromuscular disease or stroke, and ICU readmission. Patients were also excluded if simultaneous assessment by two evaluators was not feasible.

Ethics

This study was approved by the Ethics Committee of Okayama University Hospital (approval number: K2210-038). Given that data collection was conducted within the scope of routine clinical care, informed consent was obtained through an opt-out procedure. Details of the procedure are available on our facility's website (https://okadaireha.jp/), with related documents accessible at https://okadaireha.jp/wp-content/uploads/2023/05/onegai19.pdf.

Translation and Back-translation

The Perme Score was translated into Japanese using a structured, multi-step process. Step 1: with permission from the original author, independent translations were performed by a healthcare professional fluent in Japanese and a certified translator, then consolidated by another healthcare professional. Step 2: six bilingual ICU professionals (two physicians, two nurses, two physical therapists) reviewed the draft for accuracy and clarity. Step 3: the revised Japanese version was back-translated into English by a certified translator. Step 4: the back-translated version was reviewed by the original author, with feedback incorporated into further revisions. This iterative process continued until no discrepancies remained. The final Japanese Perme Score is available on the Japanese Society for Early Mobilization website (https://www.rishou.org/activity-new/scaletool#/).

Data Collection

Demographic and clinical data were obtained from medical records, including age, sex, body mass index (BMI), diagnosis category, Acute Physiological and Chronic Health Evaluation II (APACHE II) score, and Sequential Organ Failure Assessment (SOFA) score at ICU admission. Functional assessments [Japanese Perme Score, Medical Research Council Sum Score (MRC-SS), FSS-ICU, and IMS] were conducted within 2 days of ICU discharge, and

the Barthel Index (BI) was assessed at hospital discharge. The Japanese Perme Score was independently scored by two physical therapists (S.K. and T.I.), each with over 10 years of ICU experience. To minimize patient burden, for each patient, one physical therapist performed the assessment while the other observed and simultaneously completed the score. The evaluators did not participate in the translation process. The roles of assessor and observer were alternated between patients to minimize bias. In addition, MRC-SS, FSS-ICU, IMS, and BI were routinely assessed in ICU clinical practice by rehabilitation staff. The IMS and MRC-SS were evaluated at ICU discharge, whereas the BI was assessed at hospital discharge.

Psychometric Assessment of Japanese Perme Score

Inter-rater Reliability

Inter-rater reliability of the Japanese Perme Score at ICU discharge was evaluated by two physical therapists. Systematic and measurement errors were also examined.

Construct Validity

Construct validity was assessed by comparing the Japanese Perme Score at ICU discharge with the MRC-SS, FSS-ICU, and IMS. The MRC-SS evaluates strength in six muscle groups of the upper and lower extremities bilaterally, rated on a 0–5 scale, with higher scores indicating greater strength. The FSS-ICU assesses five basic functional activities using an 8-point scale, where 0 indicates complete dependence and 7 indicates full independence, consistent with the Functional Independence Measure. The IMS consists of 11 levels ranging from 0 (no activity) to 10 (independent ambulation without aid).[8)]

Predictive Validity

Predictive validity was evaluated using the BI at hospital discharge and the discharge destination. A BI of 85 or higher was considered indicative of functional independence.[16)] Discharge destinations were classified as home or transfer to another hospital or nursing facility. Patients who died during hospitalization were excluded.

Floor and Ceiling Effects

Floor and ceiling effects were assessed at ICU discharge, defined as the proportion of patients achieving the minimum score (0 points) or maximum score (32 points) on the Japanese Perme Score.

Data Analysis and Statistics

Continuous variables were summarized as medians with interquartile ranges (IQRs), and categorical variables were summarized as number and percentage. Data normality was examined using the Shapiro–Wilk test. Sample size estimation was performed with support from the Kobe University Clinical and Translational Research Center, based on a prior report.[17)] Nawa et al.[18)] reported an Intraclass Correlation Coefficient (ICC) of 0.988 [95% confidence interval (CI), 0.977–0.999; CI width, 0.021]. Assuming slightly lower reliability for the Japanese version (ICC, 0.97; CI width, 0.04), the required sample size was calculated to be 69 participants.

Inter-rater reliability was assessed using the weighted kappa coefficient. Bland–Altman analysis was conducted to calculate mean difference (bias) and 95% limits of agreement (mean difference ± 1.96 SD), with plots generated to visualize agreement and detect systematic or proportional error. Construct validity was evaluated using Spearman's rank correlation coefficients between the Japanese Perme Score, MRC-SS, and FSS-ICU. Predictive validity for ADL independence (based on BI) and discharge destination was analyzed using Receiver operating characteristic (ROC) curves, with sensitivity, specificity, and area under the curve (AUC) reported. The optimal cutoff was determined using the Youden index. Analyses for validity and floor/ceiling effects were based on the results of the primary evaluator (S.K.). All statistical analyses were performed in R software (version 4.0.3; R Foundation for Statistical Computing, Vienna, Austria), with significance set at $P<0.05$.

RESULTS

A total of 69 patients were analyzed (**Fig. 1**), and their baseline characteristics are presented in **Table 1**. The mean (± standard deviation) age was 68 ± 12 years, with 51 patients (74%) being male. The median [IQR] APACHE II and SOFA scores at ICU admission were 19 [10–21] and 6 [3–8], respectively. Thirty patients (44%) required mechanical ventilation during their ICU stay. The most common reason for ICU admission was gastrointestinal surgery (n = 36, 52%), followed by cardiac surgery (n = 12, 17%) and respiratory failure (n = 5, 7%). The median [IQR] length of ICU and hospital stay were 5 [4–9] days and 26 [19–39] days, respectively. At discharge, 46 patients (67%) returned home.

Reliability

Inter-rater agreement results are summarized in **Table 2**. The Japanese Perme Score demonstrated high concordance

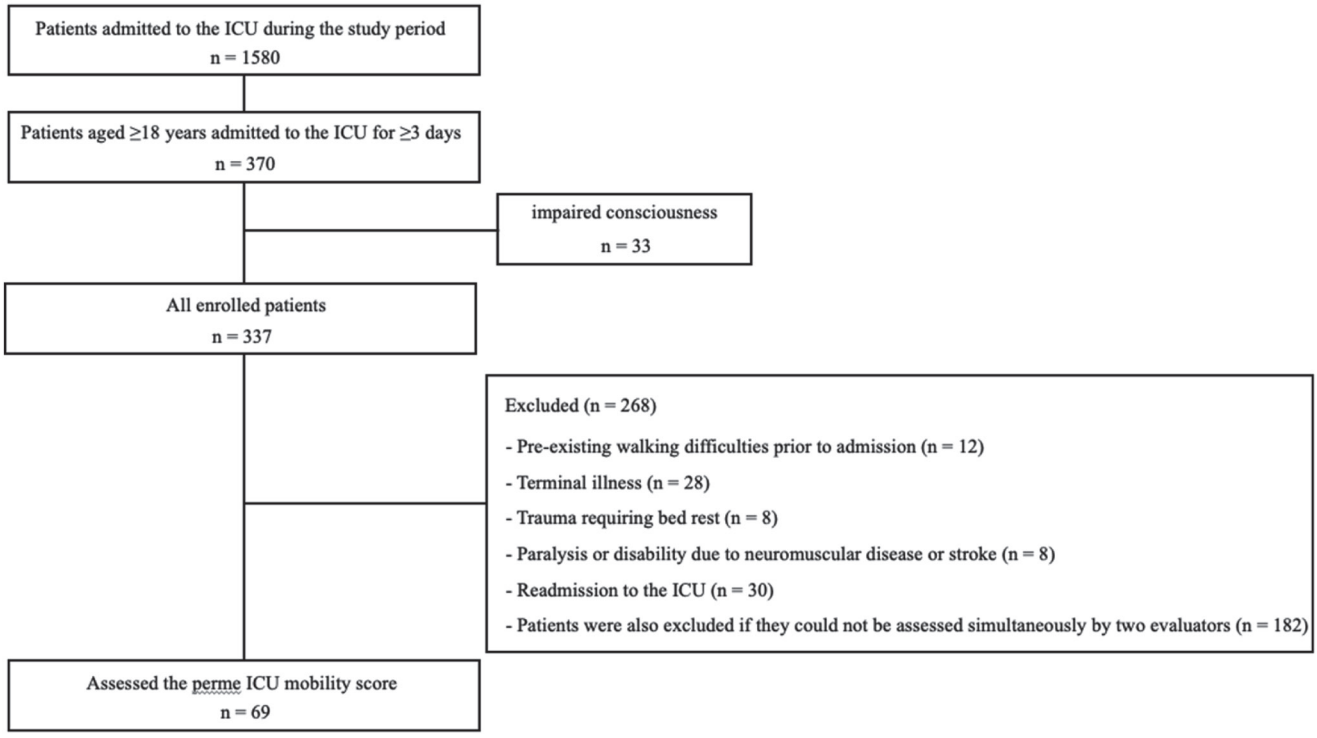

Fig. 1. Flowchart of patient recruitment.

Table 1. Patient characteristics

Variable	Total number (n=69)
Age, years	68±12
Male sex	51 (74)
BMI, kg/m^2	23.1±4.3
APACHE II score at ICU admission	19 [10–21]
SOFA score at ICU admission	6 [3–8]
Charlson Comorbidity Index ≥2	19 (27)
Mechanical ventilation during ICU stay	30 (44)
ICU admission reason	
Gastrointestinal surgery	36 (52)
Cardiac surgery	12 (17)
Respiratory failure	5 (7)
Sepsis	1 (1)
Other	15 (22)
Length of ICU stay, days	5 [4–9]
Length of hospital stay, days	26 [19–39]
ICU readmission	2 (3)
Discharge destination	
Home	46 (67)
Transfer	22 (32)
Death	1 (1)

Data are presented as mean±standard deviation, median [interquartile range], or number (percentage).

at ICU discharge, with a weighted kappa coefficient (κ) of 0.83. Most subitems showed strong agreement, although the coefficients for "mental status" (κ=0.39) and "functional strength" (κ=0.66) were lower. Only "potential mobility barriers" showed a statistically significant mean difference (MD, −0.12; 95% CI, −0.22 to −0.01).

Construct and Predictive Validity

The analysis of construct and predictive validity included 69 cases, showing low-to-moderate correlations between the Japanese Perme Score and the other three tools (**Table 3**). Predictive validity for ADL independence (BI ≥85) yielded an AUC of 0.76, with a cutoff of 27.5 points giving 52.2% sensitivity and 87.0% specificity (**Fig. 2**). For home discharge, the AUC was 0.73, with 66.7% sensitivity and 71.7% specificity at a cutoff of 28.5 points. Comparative analyses showed AUCs for ADL independence (BI ≥85) of 0.86 (MRC-SS), 0.82 (FSS-ICU), and 0.69 (IMS) and AUCs for discharge destination of 0.66 (MRC-SS), 0.71 (FSS-ICU), and 0.74 (IMS) (**Fig. 3**).

Floor and Ceiling Effects

No overall floor effect was observed for the Japanese Perme Score, but a ceiling effect was present in seven pa-

Table 2. Analysis of inter-rater agreement rate for the Perme Score

Perme Score	Kappa coefficient	ICC	MD	95% CI	LoA
Total score	0.83	1.0	−0.14	−0.31 to 0.02	−1.21 to 1.50
Mental status	0.39	0.40	0.04	−0.01 to 0.09	−0.36 to 0.44
Potential mobility barriers	0.89	0.90	−0.12	−0.22 to −0.01	−0.97 to 0.74
Functional strength	0.66	0.53	−0.04	−0.16 to 0.08	−1.02 to 0.93
Bed mobility	0.97	0.98	−0.04	−0.13 to 0.04	−0.75 to 0.66
Transfers	0.98	0.99	−0.04	−0.16 to 0.07	−0.96 to 0.87
Gait	0.99	0.99	−0.02	−0.04 to 0.01	−0.25 to −0.22
Endurance	0.98	0.98	−0.03	−0.09 to 0.03	−0.50 to 0.44

Inter-rater agreement rate was assessed by weighted kappa coefficient and Bland–Altman analysis [Mean difference (MD), 95% CI, limits of agreement (LoA)].

Table 3. Construct validity of the Perme Score at ICU discharge

Variable	rho	95% CI	P value
MRC-SS	0.36	0.13–0.36	<0.01
FSS-ICU	0.61	0.45–0.75	<0.01
IMS at ICU	0.73	0.60–0.83	<0.01

tients (10%). At the item level, apart from "potential mobility barriers," most domains showed ceiling effects in more than half of the participants. Conversely, modest floor effects were noted for "gait" and "endurance," each affecting 17% of patients (**Table 4**).

DISCUSSION

This study evaluated the reliability and validity of the Japanese Perme Score at ICU discharge. The findings indicate that the score has high inter-rater reliability and moderate validity in critically ill patients. Inter-rater discrepancies were observed primarily in "potential mobility barriers," underscoring the need for careful assessment in this domain. The Japanese Perme Score correlated well with established measures of muscle strength and physical function at ICU discharge and demonstrated predictive validity for ADL independence and discharge destination, with minimal floor and ceiling effects overall. These results suggest that the Japanese Perme Score is a practical and reliable tool for functional evaluation at ICU discharge and may support

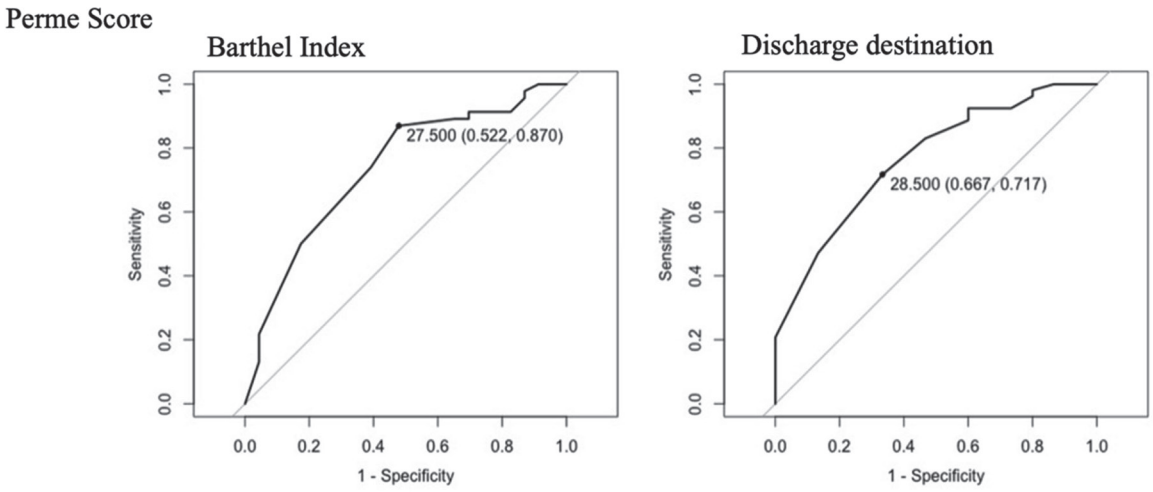

Fig. 2. Receiver operating characteristic (ROC) curves illustrating the predictive validity of the Perme Score at ICU discharge for Barthel Index ≥85 (left) and discharge destination (right). Final analysis cohort: n=69. Curves show cutoff values, sensitivity, and specificity.

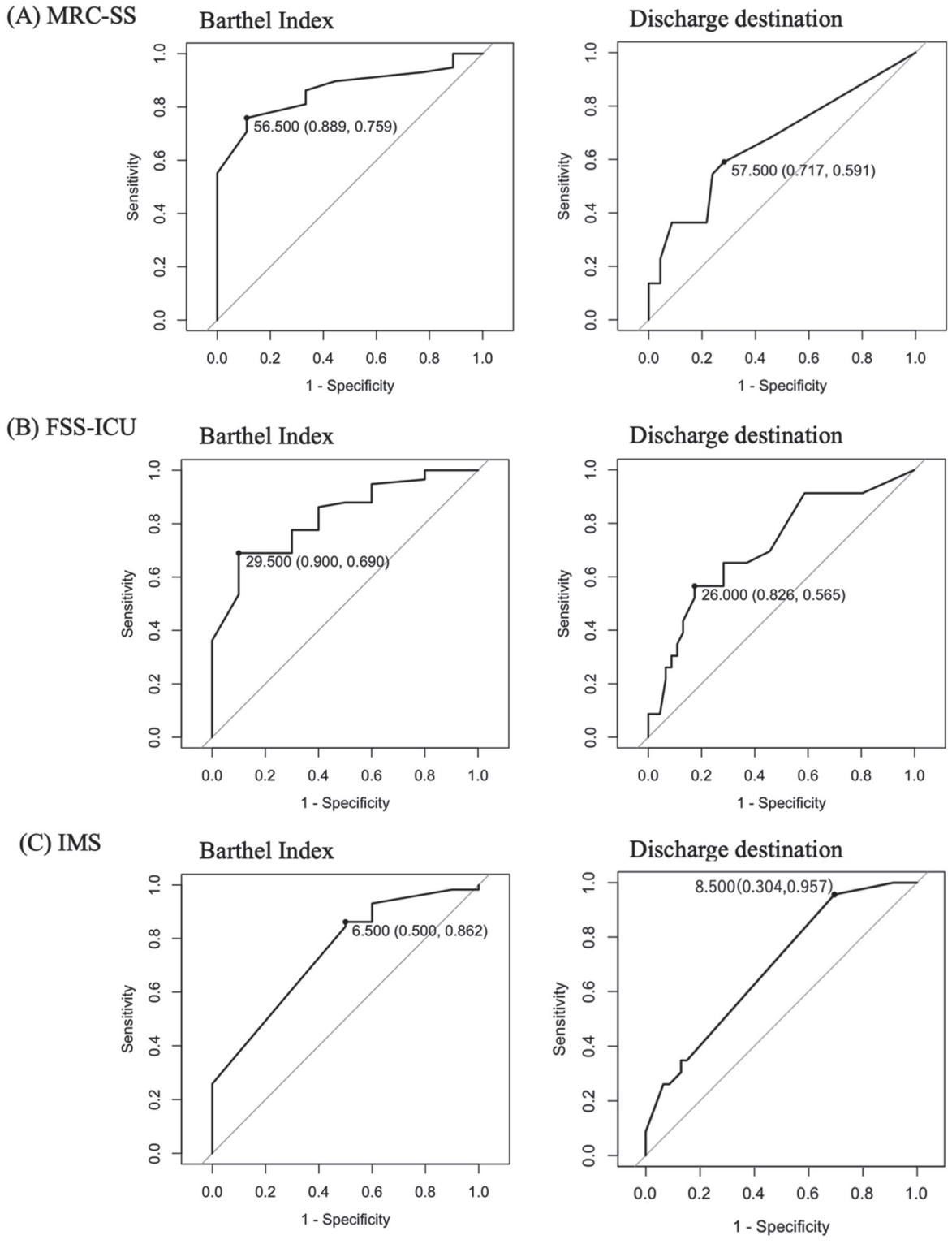

Fig. 3. Receiver-operating-characteristic (ROC) curves depicting the predictive validity of (A) MRC-SS, (B) FSS-ICU, and (C) IMS score at ICU discharge for Barthel Index ≥85 (left) and discharge destination (right). Final analysis cohort: n=69. Curves show cutoff values, sensitivity, and specificity.

Table 4. Floor and ceiling effects on the Perme Score

Score component	Maximum score	Minimum score
Total score	7 (10)	0 (0)
Mental status	65 (94)	0 (0)
Potential mobility barriers	8 (12)	1 (1)
Functional strength	62 (90)	0 (0)
Bed mobility	52 (75)	4 (6)
Transfers	57 (83)	9 (13)
Gait	57 (83)	12 (17)
Endurance	40 (58)	12 (17)

Data presented as number (percentage).

rehabilitation planning and post-ICU follow-up care. To our knowledge, this is the first study to characterize its clinical utility in Japan.

High inter-rater agreement has also been reported in other translated versions of the Perme Score,[11,12,19] and our findings are consistent with these reports. The main limitation in agreement was for "mental status," for which the original version reported kappa values between 0.00 and 0.27,[10] and the German version similarly noted reduced consistency.[20] Ambiguity in descriptors such as "lethargic" or "awake and alert" may contribute to variability. Establishing standardized criteria—for example, defining "unresponsive" as eyes remaining closed without stimulation—could reduce subjectivity. Additionally, targeted training for evaluators may further improve reliability for this item.

Although a slight mean difference was observed in "potential mobility barriers," this difference was less than 1 point and remained within an acceptable range. This item evaluates factors such as pain, intravenous therapy, and medical devices. With the exception of pain, most aspects are objectively observable and therefore carry low risk of measurement error. Variability is most likely linked to pain assessment, particularly when patient complaints are vague or subject to differing evaluator interpretations. Although pain-related items are inherently prone to fluctuations, the observed difference was minimal and unlikely to meaningfully influence interpretation of the overall score.

In assessing construct validity, the Japanese Perme Score showed moderate correlations with the IMS and FSS-ICU, both of which capture broader aspects of physical function in critically ill patients. By contrast, its correlation with the MRC-SS, a measure of muscle strength, was weaker. Previous studies have reported wide variability in correlations between the MRC-SS and functional measures ($r = 0.4$–0.92),[21,22] likely reflecting differences in the constructs being assessed. Whereas the MRC-SS focuses on isolated muscle strength, the Perme Score incorporates performance-based items and mobility barriers (e.g., lines, tubes, mechanical ventilation), which may limit mobility independently of strength. This distinction helps explain the lower correlation observed between the Japanese Perme Score and the MRC-SS.

At ICU discharge, the Japanese Perme Score demonstrated good discriminatory ability for predicting both ADL independence and home discharge. Previous studies have reported AUCs of 0.75–0.80 for the FSS-ICU[23] and 0.73 for the IMS[24] in predicting discharge to home. In this study, the Perme Score showed comparable performance to the FSS-ICU (**Fig. 3**), with AUCs of 0.76 and 0.82, respectively, for ADL independence, and 0.73 and 0.71, respectively, for home discharge. For ADL independence (BI ≥85), the MRC-SS yielded the highest AUC (0.86). The slightly lower predictive accuracy of the Perme Score may reflect its inclusion of non-physical function items (e.g., "mental status" and "potential mobility barriers"), whereas the MRC-SS focuses solely on muscle strength, which is more directly linked to ADL independence. For discharge destination, the predominance of gastrointestinal surgery cases may have influenced results, because transfers were often related to oral intake difficulties. Importantly, because this study was primarily powered for reliability analysis, the predictive validity findings should be interpreted with caution. Regarding measurement effects, floor and ceiling effects were acceptable overall, although ceiling effects occurred in six of seven items and floor effects occurred in two items, suggesting that individual item scores require careful interpretation.

This study has several limitations. First, because all assessments were conducted by physical therapists with extensive ICU experience, the findings may not be fully generalizable to other healthcare professionals, such as nurses or less experienced therapists. Second, the study population included a high proportion of postoperative gastrointestinal surgery patients, which may have introduced selection bias and restricted the broader applicability of the results. Third, the need for simultaneous evaluation led to patient exclusions, potentially affecting both sample size and generalizability. Additionally, the inability to conduct simultaneous evaluations in some patients increased the number of exclusions, and these constraints may have impacted the results and their generalizability. Third, to reduce the burden on patients, one patient's Perme Score assessment was conducted solely through observation. This approach may have resulted in an

overestimation of inter-rater reliability. Finally, this study did not assess the minimal detectable change or the minimal clinically important difference, underscoring the need for further research in these areas.

CONCLUSION

The Japanese Perme Score was shown to be a reliable and valid tool for assessing physical function at ICU discharge. It demonstrated high inter-rater reliability, meaningful correlations with established functional measures, and predictive value for ADL independence and discharge destination. Although ceiling effects were present in some items, the overall measurement properties support its clinical applicability in ICU settings. Further research should examine its use across more diverse ICU populations and among a wider range of healthcare professionals.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Herridge MS, Azoulay É: Outcomes after critical illness. N Engl J Med 2023;388:913–924. https://doi.org/10.1056/NEJMra2104669, PMID:36884324
2. Needham DM, Davidson J, Cohen H, Hopkins RO, Weinert C, Wunsch H, Zawistowski C, Bemis-Dougherty A, Berney SC, Bienvenu OJ, Brady SL, Brodsky MB, Denehy L, Elliott D, Flatley C, Harabin AL, Jones C, Louis D, Meltzer W, Muldoon SR, Palmer JB, Perme C, Robinson M, Schmidt DM, Scruth E, Spill GR, Storey CP, Render M, Votto J, Harvey MA: Improving long-term outcomes after discharge from intensive care unit: report from a stakeholders' conference. Crit Care Med 2012;40:502–509. https://doi.org/10.1097/CCM.0b013e318232da75, PMID:21946660
3. Solverson KJ, Grant C, Doig CJ: Assessment and predictors of physical functioning post-hospital discharge in survivors of critical illness. Ann Intensive Care 2016;6:92. https://doi.org/10.1186/s13613-016-0187-8, PMID:27646108
4. Herridge MS, Chu LM, Matte A, Tomlinson G, Chan L, Thomas C, Friedrich JO, Mehta S, Lamontagne F, Levasseur M, Ferguson ND, Adhikari NK, Rudkowski JC, Meggison H, Skrobik Y, Flannery J, Bayley M, Batt J, Santos C, Abbey SE, Tan A, Lo V, Mathur S, Parotto M, Morris D, Flockhart L, Fan E, Lee CM, Wilcox ME, Ayas N, Choong K, Fowler R, Scales DC, Sinuff T, Cuthbertson BH, Rose L, Robles P, Burns S, Cypel M, Singer L, Chaparro C, Chow CW, Keshavjee S, Brochard L, Hebert P, Slutsky AS, Marshall JC, Cook D, Cameron JI, RECOVER Program Investigators (Phase 1: towards RECOVER) Canadian Critical Care Trials Group: The RECOVER program: disability risk groups and 1-year outcome after 7 or more days of mechanical ventilation. Am J Respir Crit Care Med 2016;194:831–844. https://doi.org/10.1164/rccm.201512-2343OC, PMID:26974173
5. Nakanishi N, Liu K, Hatakeyama J, Kawauchi A, Yoshida M, Sumita H, Miyamoto K, Nakamura K: Post-intensive care syndrome follow-up system after hospital discharge: a narrative review. J Intensive Care 2024;12:2. https://doi.org/10.1186/s40560-023-00716-w, PMID:38217059
6. Parry SM, Huang M, Needham DM: Evaluating physical functioning in critical care: considerations for clinical practice and research. Crit Care 2017;21:249. https://doi.org/10.1186/s13054-017-1827-6, PMID:28978333
7. 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;19:127. https://doi.org/10.1186/s13054-015-0829-5, PMID:25888469

8. Hodgson C, Needham D, Haines K, Bailey M, Ward A, Harrold M, Young P, Zanni J, Buhr H, Higgins A, Presneill J, Berney S: Feasibility and inter-rater reliability of the ICU Mobility Scale. Heart Lung 2014;43:19–24. https://doi.org/10.1016/j.hrtlng.2013.11.003, PMID:24373338
9. Hoyer EH, Friedman M, Lavezza A, Wagner-Kosmakos K, Lewis-Cherry R, Skolnik JL, Byers SP, Atanelov L, Colantuoni E, Brotman DJ, Needham DM: Promoting mobility and reducing length of stay in hospitalized general medicine patients: a quality-improvement project. J Hosp Med 2016;11:341–347. https://doi.org/10.1002/jhm.2546, PMID:26849277
10. Perme C, Nawa RK, Winkelman C, Masud F: A tool to assess mobility status in critically ill patients: the Perme Intensive Care Unit Mobility Score. Methodist DeBakey Cardiovasc J 2014;10:41–49. https://doi.org/10.14797/mdcj-10-1-41, PMID:24932363
11. Wilches Luna E, Hernández N, Siriani de Oliveira A, Kenji Nawa R, Perme C, Gastaldi AC: Perme ICU Mobility Score (Perme Score) and the ICU Mobility Scale (IMS): translation and cultural adaptation for the Spanish language. Colomb Med (Cali) 2018;49:265–272. https://doi.org/10.25100/cm.v49i4.4042, PMID:30700919
12. 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;42:429–434. https://doi.org/10.1590/s1806-37562015000000301, PMID:28117473
13. Nawa RK, De Camillis ML, Buttignol M, Kutchak FM, Pacheco EC, Gonçalves LH, Garcia LM, Timenetsky KT, Forgiarini Júnior LA: Clinimetric properties of the Perme Intensive Care Unit Mobility Score—a multicenter study for minimum important difference and responsiveness analysis. Colomb Med (Cali) 2023;54:e2005580. https://doi.org/10.25100/cm.v54i3.5580, PMID:38089826
14. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, Bouter LM, de Vet HC: The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. J Clin Epidemiol 2010;63:737–745. https://doi.org/10.1016/j.jclinepi.2010.02.006, PMID:20494804
15. De Jonghe B, Sharshar T, Lefaucheur JP, Authier FJ, Durand-Zaleski I, Boussarsar M, Cerf C, Renaud E, Mesrati F, Carlet J, Raphaël JC, Outin H, Bastuji-Garin S, Groupe de Réflexion et d'Etude des Neuromyopathies en Réanimation: Paresis acquired in the intensive care unit: a prospective multicenter study. JAMA 2002;288:2859–2867. https://doi.org/10.1001/jama.288.22.2859, PMID:12472328
16. Higuchi S, Kabeya Y, Matsushita K, Taguchi H, Ishiguro H, Kohshoh H, Yoshino H: Barthel Index as a predictor of 1-year mortality in very elderly patients who underwent percutaneous coronary intervention for acute coronary syndrome: better activities of daily living, longer life. Clin Cardiol 2016;39:83–89. https://doi.org/10.1002/clc.22497, PMID:26720494
17. Machin D, Campbell M, Tan SH, Tan SB: Sample size tables for clinical research. 3rd ed. Wiley, 2009.
18. Nawa RK, Lettvin C, Winkelman C, Evora PR, Perme C: Initial interrater reliability for a novel measure of patient mobility in a cardiovascular intensive care unit. J Crit Care 2014;29:475.e1–475.e5. https://doi.org/10.1016/j.jcrc.2014.01.019, PMID:24630690
19. Stan DC, Boncuț M, Miron MR, Sandor I, Perme C: Perme Intensive Care Unit Mobility Score and ICU Mobility Scale: translation into Romanian and cross-cultural adaptation for use in Romania. Health Sports Rehabil Med 2024; 25:4–8.
20. Nydahl P, Wilkens S, Glase S, Mohr LM, Richter P, Klarmann S, Perme CS, Nawa RK: The German translation of the Perme Intensive Care Unit Mobility Score and inter-rater reliability between physiotherapists and nurses. Eur J Physiother 2018;20:109–115. https://doi.org/10.1080/21679169.2017.1401660
21. Connolly BA, Jones GD, Curtis AA, Murphy PB, Douiri A, Hopkinson NS, Polkey MI, Moxham J, Hart N: Clinical predictive value of manual muscle strength testing during critical illness: an observational cohort study. Crit Care 2013;17:R229. https://doi.org/10.1186/cc13052, PMID:24112540
22. 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;94:1499–1507. https://doi.org/10.2522/ptj.20130451, PMID:24810863

23. Huang M, Chan KS, Zanni JM, Parry SM, Neto SC, Neto JA, da Silva VZ, Kho ME, Needham DM: Functional Status Score for the ICU: an international clinimetric analysis of validity, responsiveness, and minimal important difference. Crit Care Med 2016;44:e1155–e1164. https://doi.org/10.1097/CCM.0000000000001949, PMID:27488220

24. Tymkew H, Norris T, Arroyo C, Schallom M: The use of physical therapy ICU assessments to predict discharge home. Crit Care Med 2020;48:1312–1318. https://doi.org/10.1097/CCM.0000000000004467, PMID:32639412