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Original Article

Assessment of the Validity and Internal Consistency of a Performance Evaluation Tool Based on the Japanese Version of the Modified Barthel Index for Elderly People Living at Home

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Abstract. [Purpose] This study aimed to examine the validity and internal consistency of the Japanese version of a performance evaluation tool for activities of daily living (ADL) based on the modified Barthel Index (PET-MBI) among elderly people at home. [Subjects] The subjects were elderly people living at home in Japan. [Methods] A cross-sectional study was performed at five home care facilities for elderly people in Japan. ADL performance was evaluated for 128 participants using the PET-MBI, which included 10 self-care items. We used confirmatory factor analysis to estimate the factorial validity. We assessed data model fitness with the χ^2 statistic, the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA). Cronbach's alpha coefficient was used to determine the internal consistency. [Results] The mean age of the participants was 79.1±8.9 years. Among the 126 participants included in the analysis, 67 were women (53.2%). The single-factor model demonstrated a fair fit to the data, with the χ^2 statistic = 74.9 (df =35), GFI = 0.88, AGFI = 0.81, and RMSEA = 0.096, and the path coefficients of each item ranged from 0.44 to 0.95. The alpha coefficient of the 10-item scale was 0.93. [Conclusion] The PET-MBI for elderly people at home was well validated.
Key words: Activities of daily living, Internal consistency, Validity

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INTRODUCTION

The ability to perform activities of daily living (ADL) is an important component of quality of life for elderly individuals[1–4]. The International Classification of Functioning, Disability, and Health (ICF) defines "performance" as what an individual does in his/her current environment, whereas "capacity" is an individual's ability to execute a task or an action in a "uniform" or "standard" environment[5].

The Barthel Index (BI) is a popular instrument for assessing ADL[6, 7]. It assesses a patient's capacity to perform 10 daily tasks without assistance and provides a summed, overall BI score that reflects the patient's level of independence. Of various suggested modifications[8–11], Collins et al. specifically emphasized scoring based on performance rather than capacity[6, 8], and Shah et al. proposed a five-point scale to increase responsiveness to changes in ADL[6, 11].

Combining performance-based assessment with responsiveness to change, we established a Japanese version of the performance evaluation tool based on the modified BI (PET-MBI) for institutionalized elderly people in Japan. Given that the PET-MBI scores as zero both "needs full assistance" and "not required" for elderly self-care, reasons for a zero score are included for clarification. In particular, the item "stair climbing" was not evaluated (i.e., scored as zero because it is "not required") because very few institutionalized participants in our previous study actually needed to climb stairs in their daily lives[12]. Therefore, that study only confirmed validity and internal consistency with nine items of the PET-MBI. However, the BI and MBI are known as evaluation tools with 10 items related to self-care. The current study aimed to establish the validity and internal consistency of the 10-item PET-MBI for ADL assessment in elderly people living at home.

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SUBJECTS AND METHODS

To examine the factorial validity and internal consistency of the PET-MBI, we recruited participants from patients registered at five home care facilities (day care or home visit rehabilitation services for elderly people) in Kyoto, Shiga, and Nagano, Japan. The PET-MBI was used to evaluate 128 volunteers out of the 200 individuals registered at these five facilities (57 participants out of 109 registered patients at two day care services; 71 participants out of 91 registered patients at three home visit rehabilitation services). Participant demographics and diagnoses were extracted from medical records, and participants underwent Mini Mental State Examination (MMSE)[13, 14] testing administered by trained staff on-site. In this study, cognitively impaired participants were included because they were living at home in real settings.

An occupational therapist or physical therapist working at each service evaluated ADL performance using the PET-MBI in December 2010. Therapists obtained information about the tasks from direct observation, written records, or communication with the care manager or caregiver. For example, the therapists directly observed the participants' ADL, and they were instructed to gather information from caregivers and participants according to the PET-MBI evaluation sheets.

The study protocol was approved by the Ethics Committees of the Seijoh University Faculty of Care and Rehabilitation (2010C0014) and Kyoto University Graduate School and Faculty of Medicine, Ethics Committee (E1011). Although the five participating facilities did not have ethics committees, each facility's director approved the study, and notices of the study were posted at each facility. The objective of the study was explained to participants and their families, and written consent was obtained.

To estimate factorial validity and approximate construct validity, we performed confirmatory factor analysis (CFA) using a generalized least squares method to certify the factorial validity of the 10 items based on the PET-MBI. We assessed data model fitness with the χ^2 statistic, the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA). The goodness of fit was evaluated by the following criteria: GFI >0.85, AGFI >0.80[15], and RMSEA <0.10 (or <0.08 in reasonable approximate fit)[16]. Cronbach's coefficient alpha[17, 18] was used to determine the internal consistency of all ADL tasks. Analyses of CFA was performed with IBM SPSS Amos 19.0, and Cronbach's coefficient alpha was calculated with SPSS 17.0 J.

RESULTS

Data from 126 of the 128 participants were analyzed (data were incomplete for two patients). As shown in Table 1, 43 of the 126 (34.4%) participants achieved MMSE scores lower than 18 points, indicating cognitive impairment. The results for the 10 tasks as assessed by the PET-MBI are shown for the participants in Table 2.

Data from 126 participants were analyzed by CFA (data were incomplete for two patients). As shown in Fig. 1, the model demonstrated a fair fit to the data: χ^2 statistic = 74.9 (df =35, $p < 0.01$), GFI = 0.88, AGFI = 0.81, RMSEA = 0.096. The path coefficients for the ten items ranged from 0.44 to 0.95. Cronbach's alpha coefficient for the 10-item scale was 0.929.

Table 1. Participant characteristics (N=126)

	N	%
Female	67	53.2%
Age (mean±SD)	79.1±8.9	
< 75 years	38	30.2%
75–84 years	48	38.1%
≥ 85 years	40	31.7%
Primary diagnosis		
Cerebrovascular disease	51	40.5%
Osteoarthropathy	47	37.3%
Neuromyopathy	6	4.8%
Disuse syndrome	5	4.0%
Other	17	13.5%
Comorbidity		
Cerebrovascular disease	60	47.6%
Osteoarthropathy	67	53.2%
Neuromyopathy	14	11.1%
Disuse syndrome	15	11.9%
Hemiplegia		
Yes	44	34.9%
Mini Mental State Examination (N=125)†		
0–8	22	17.6%
9–17	21	16.8%
18–23	37	29.6%
≥ 24	45	36.0%

SD: standard deviation.
†Data from one participant who did not complete the MMSE due to aphasia were excluded from the analysis.

DISCUSSION

We confirmed satisfactory factorial validity and internal consistency of a Japanese version of the PET-MBI for elderly people living at home in Japan. Factor analysis revealed a single factor as initially hypothesized, and internal consistency was high[15, 16], although the participants in this study were not only patients with a specific disease but also elderly individuals in general needing care at home.

It has been suggested that elderly people need the opportunity to accomplish ADL tasks, and in order to maintain independence and minimize dependency levels, they should perform these tasks almost everyday[19]. Furthermore, the positive correlation between ADL and QOL is known well[20]. Although elderly residents in our previous study did not climb stairs in general[12], 34.1% (43/126) of participants in the current study climbed stairs at home with minimal assistance or independently. Concerning factorial validity, the χ^2 statistic, GFI, and AGFI indicated good fit of the model, although the results for RMSEA were suboptimal. The participants of this study were elderly people

Table 2. Description of grading for each item of the Japanese version of the performance evaluation tool based on the modified Barthel index (PET-MBI) (N=126)

Tasks	Independent		Needs minimal assistance		Needs some assistance		Attempts to do it alone but needs a lot of assistance		Needs full assistance or does not perform/performance not required	
	N	%	N	%	N	%	N	%	N	%
Toilet	71	56.3	22	17.5	13	10.3	6	4.8	14	11.1
Chair/bed transfer	86	68.3	14	11.1	9	7.1	10	7.9	7	5.6
Personal hygiene	76	60.3	15	11.9	14	11.1	9	7.1	12	9.5
Dressing	65	51.6	21	16.7	8	6.3	20	15.9	12	9.5
Ambulation	41	32.5	32	25.4	14	11.1	11	8.7	28†	22.2
Feeding	80	63.5	26	20.6	9	7.1	3	2.4	8	6.3
Bowel control	94	74.6	8	6.3	10	7.9	2	1.6	12	9.5
Bladder control	75	59.5	22	17.5	7	5.6	4	3.2	18	14.3
Self-bathing	33	26.2	12	9.5	41	32.5	27	21.4	13	10.3
Stair climbing	22	17.5	11	8.7	6	4.8	4	3.2	83	65.9

Depending on the grade for each item, scoring was performed based on Shah's MBI.
†Grading for ambulation was divided further into five grades in accordance with the wheelchair movement independence level: independent, N=6; needs minimal assistance, N=4; needs some assistance, N=3; attempts to do it alone but needs a lot of assistance, N=2; needs full assistance; and does not perform/performance not required, N=13.

who used the rehabilitation services, so the backgrounds were diverse. In the model evaluation based on such populations, the goodness of fit is likely to be low relative to those derived from homogenous populations, e.g., patients with specific disease or disability. Assuming that our model is applied for these diverse elderly populations, the present result, even though it was suboptimal, is almost acceptable in practical viewpoint. Thus, the results of internal consistency and factor analysis suggest that not a few elderly people needed to climb stairs at home and did so.

Some limitations are worth noting. First, the reliability of ADL assessment may not be generalizable to assessments by other care staff or to self-rated interviews with elderly people, because only OTs and PTs were involved in PET-MBI testing in this study. Further studies involving other healthcare workers are needed to confirm the utility of the PET-MBI. Second, among several ways to confirm the validity, only factorial validity was assessed. We did not verify conceptual validity, since the BI and MBI, items from which items were chosen to indicate the level of nursing care required by a patient[6], are known to measure functional independence in personal care and mobility. Finally, we collected some basic information about the subjects, such as information about cognitive functions, paralysis, and diagnoses, but we did not collect data regarding the degree of paralysis. Therefore, it is not clear how the degree of paralysis affects the results. However, it is considered that there is no impact on the results.

Use of the PET-MBI has some advantages in real practice. Although the PET-MBI scores as zero both "needs full assistance" and "not required" (e.g., stair climbing), the two cases have different meanings. Therefore, caution is needed when using the PET-MBI in practice, as a healthcare practitioner can readily comprehend an individual's condition based on the description of whether the zero score reflects

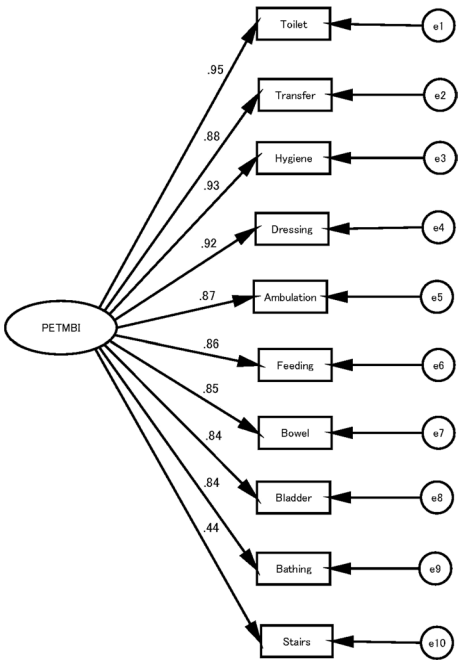

Fig. 1. Confirmatory factor analysis of the PET-MBI χ^2 statistic = 74.9 (df = 35, $p < 0.01$), GFI = 0.88, AGFI = 0.81, and RMSEA = 0.096

"cannot do" or "need not do". Moreover, checkboxes for items pertaining to environment (e.g., availability of handrails) would make it easier for clinical staff to share information and provide consistent care, although this was not examined in this study. Accordingly, the PET-MBI could be used by healthcare practitioners for evaluating the self-care

of elderly people who live at home and need to climb stairs.

In conclusion, the PET-MBI demonstrated satisfactory factorial validity and internal consistency in elderly people living at home. It allows for practitioners in home care services to evaluate and communicate ADL performance of elderly people appropriately because it reports what they actually do in their daily lives.

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