



Original Article

Application of the Korean version of the Modified Barthel Index: Development of a keyform for use in clinical practice



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Summary Objective: To demonstrate the clinical application of the Korean version of the Modified Barthel Index (K-MBI) using Rasch analysis.

Methods: A total of 276 patients with neurological disorders were assessed with the K-MBI in outpatient clinics. The Rasch partial-credit model was used to generate a keyform based on investigating the psychometric properties of the K-MBI, including dimensionality, precision (person strata and reliability), and hierarchical item difficulty. The Minimal Detectable Change (MDC) in item difficulty was used to establish right-challenging treatment goals and long-term treatment plans.

Results: The findings demonstrated that the Korean version of the MBI satisfied the assumption of unidimensionality. It also showed a hierarchical structure in terms of item difficulty, good reliability (Cronbach alpha, 0.92), and approximately five distinct person strata (4.6). The MDC (raw score, 20.1) of the item difficulty of the test items demonstrated equivalent cut-off scores for targeted short-term treatment goals on the keyform, a Rasch-derived display of patient responses. Long-term treatment goals were identified based on the test items of the keyform.

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Conclusions: The findings suggest that a Rasch keyform can be applied to clinical practice in Korean settings by identifying clinically and statistically meaningful test items and their step thresholds as short- and long-term goals.

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Introduction

In the rehabilitation area, approximately 90 activities of daily living (ADL) instruments have been developed (McHorney, 2003). Among those instruments, the Functional Independence Measure (FIM™) is commonly used in inpatient rehabilitation facilities in North America (Ottenbacher, Hsu, Granger, & Fiedler, 1996), and the Barthel Index (BI) and Modified Barthel Index (MBI) are commonly used in Europe and Asia. The MBI is originated in stroke rehabilitation but now its use has been extended to rehabilitation outcome measurement of other people with various kinds of disabilities. In South Korea, the FIM and Korean version of MBI (K-MBI) are most often used in rehabilitation hospitals. However, users of the FIM have to pay to be certified in its administration, and they are required to receive a mandatory training to use the instrument. In contrast with the FIM, the MBI and K-MBI do not require a mandatory training and a certification fee for using the instrument in any facility. For these reasons, the utilization of the MBI and K-MBI has increased. For example, the utilization of the K-MBI was 37.9% in South Korea in 2006 (Yoo, Jung, Park, & Choi, 2006), and the use of the K-MBI is expected to continue to increase in Korea.

Since the 1980s, item response theory (IRT) and the one-parameter model of the IRT, Rasch analysis, have been applied to test psychometric properties of ADL measures, including the BI and MBI (Duncan, Lai, Bode, Perera, & DeRosa, 2003; van Hartingsveld, Lucas, Kwakkel, & Lindeboom, 2006; Kucukdeveci et al., 2000; Liu, Unick, Galik, & Resnick, 2015; de Morton, Keating, & Davidson, 2008). Rasch analysis enables researchers to create a sample- and test-independent measure (Wright, 1968; Wright & Stone, 1979). A measurement construct calibrated by Rasch analysis can estimate person ability and item difficulty regardless of the person ability distributions (norms) of the target samples. In addition, person and item calibrations in a linear scale enable researchers and clinicians to perform mathematical calculations for the calibrated person and item measures (Merbitz, Morris, & Grip, 1989).

Based on a linear scale, hierarchical item difficulties can be created, and the hierarchical structures have been used in establishing logical treatment strategies and goals (Bode, Heinemann, Kozlowski, & Pretz, 2013; Linacre, 1997; Velozo, Warren, Hicks, & Berger, 2013; Velozo & Woodbury, 2011). For instance, a keyform is a visual output of Winsteps® Rasch Measurement software (Linacre, 2016), and the Rasch output provides person-ability and item difficulty on a linear measurement scale. In clinical settings, a keyform has been used to

approximate person-ability and possible treatment tasks based on subjects' responses on the test items (Bode et al., 2013; Linacre, 2016; Velozo et al., 2013; Velozo & Woodbury, 2011).

As the primary purpose of outcome measures was to precisely and accurately measure a patient's current health status and establish achievable treatment goals for the patient, clinicians should be able to easily interpret the measurement outputs. In addition, measurement outputs should suggest evidence-based rationales for clinicians in order for them to establish optimized treatment goals. Therefore, the purpose of this study is to demonstrate clinical applications of a Rasch output, keyform, in accurately measuring patient functional status and logically establishing short- and long-term treatment goals that match a patient's current functional status level as measured by the K-MBI.

Methods

Participants

The participants in this study were extracted from previous research supported by the Wonkwang University in South Korea (Hong et al., 2016). Community-dwelling adults who visited rehabilitation facilities were assessed with the K-MBI. Occupational therapists who had at least 5 years of clinical experience with the instrument assessed the patients. All participants in the study needed to 1) be adults between 18 and 89 years old, and 2) agree to release their de-identified data for research purposes. The data were collected during the 2-month data collection period (April 2015 – June 2015) from three urban rehabilitation hospitals in Gyeonggi-do and Daejeon in South Korea. All participants in the dataset signed the informed consent form for this study. As the extracted participants were de-identified, this study was considered as non-human research by the Institutional Review Board of the Wonkwang University.

Instrument

Korean version of the Modified Barthel Index (K-MBI)

The MBI is one of the ADL outcome measures, and consists of 10 items: feeding, personal hygiene (grooming), bathing, dressing, toilet transfer, bladder control, bowel control, chair/bed transfers, stair climbing, and ambulation (Shah, Vanclay, & Cooper, 1989) (see Fig. 1). In Korea, the MBI was translated into Korean (K-MBI) by bilingual psychiatrists using double translation method (back translation). The contents of test items (i.e., eating and grooming) were

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