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ORIGINAL ARTICLE

Rasch Analysis of the Community Integration Measure in Persons With Traumatic Brain Injury

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Abstract

Objective: To examine the measurement properties of the Community Integration Measure (CIM) in persons with traumatic brain injury (TBI).

Design: Rasch analysis was used to retrospectively evaluate the CIM.

Setting: Rehabilitation hospital.

Participants: Persons (N=279) 1 to 15 years after a TBI.

Interventions: None.

Main Outcome Measure: CIM.

Results: The CIM met Rasch expectations of unidimensionality and reliability (person separation ratio=2.01, item separation ratio=4.52). However, item endorsibility was poorly targeted to the participants' level of community integration. A ceiling effect was found with this sample.

Conclusions: The CIM is a relatively reliable and unidimensional scale. Future iterations might benefit from the addition of items that are more difficult to endorse (ie, improved targeting).

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Many individuals with traumatic brain injury (TBI) encounter lasting impediments to satisfactory reintegration into their communities in terms of return to work,[1] recreation,[2] mobility,[3] and engaging in social relations.[4] Community integration is an important facet of recovery to consider because it is intimately connected with autonomy, productivity, and quality of life after injury. Moreover, enhanced community integration is associated with improved physical, cognitive, and psychosocial outcomes.[5] As such, reliable and valid tools to measure community integration are valuable for clinicians and researchers interested in assessing outcomes in TBI. Rasch analysis[6] is a family of statistical models used to construct and evaluate measures of latent constructs (eg, questionnaires). A number of instruments assessing rehabilitation outcomes have been subject to Rasch analysis, including the FIM instrument,[7] the National Institutes of Health Stroke Scale,[8] and the Beck Depression Inventory II.[9] The central aim of the current study was to evaluate the measurement properties of the Community Integration Measure (CIM) using Rasch analysis.

A comprehensive assessment of community integration may require >1 approach.[10] Many commonly used community integration assessment tools focus on measuring observable, objective aspects of community integration, such as the number of hours spent in recreational activities. Although those tools provide important information, they do not capture a person's subjective sense of integration within their community. Researchers have emphasized that not only should objective indicators of community integration be measured, but also "the satisfaction of persons with their participation levels."[11(p125)] There are a growing number of instruments designed to assess perceived community integration. Of these, one of the most common and well-researched instruments is the CIM.[10]

The CIM was designed to quickly assess an individual's subjective sense of integration into his or her community. It is thought to capture one's sense of participating and belonging.[10] Interestingly, although the authors of the CIM adopted a 4-factor theoretical

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model of community integration (assimilation, social support, occupation, independent living),[10] their preliminary validation study[10] was more supportive of a 1-factor solution. Psychometric properties of the CIM have since been explored using traditional psychometric methods in a variety of health populations, including oncology,[10] spinal cord injury,[12] and TBI.[13,14] A previously published analysis of the CIM in the current sample[15] showed that the CIM had adequate reliability, criterion validity, and utility when examined using a traditional psychometric approach. To date and to our knowledge, the psychometric properties of the CIM have not been examined via Rasch analysis.

A Rasch model[6] is a criterion (or set of criteria), against which data can be evaluated for conformity or fit. Rasch analysis is particularly well suited to examine whether the CIM is unidimensional in nature, as suggested in the preliminary validation study of McColl et al[10] (as opposed to the 4-dimensional theoretical model that originally guided its development).

Methods

Participants

Data for this study were deidentified archival data derived from a larger database. The study protocol was approved by the Wayne State University investigational review board. The sample included 279 individuals from the Southeastern Michigan TBI System research project, which is part of the nationwide TBI Model Systems (TBIMS) research study funded by the National Institute of Disability and Rehabilitation research. TBI is defined by the TBIMS as an injury to brain tissue caused by an external mechanical force. Any of the following indicators were taken as evidence of TBI: loss of consciousness from brain trauma, posttraumatic amnesia, skull fracture, or objective neurologic findings that could reasonably be attributed to TBI by physical or mental status examination. All participants were at least 16 years old at the time of injury, they received acute care at a designated TBIMS site within 72 hours of injury, and they received inpatient rehabilitation at the Rehabilitation Institute of Michigan. Individuals were considered for inclusion if their Glasgow Coma Scale score at admission to the emergency department was between 3 and 12 or if their Glasgow Coma Scale score was higher (13−15) but there was evidence of intracranial pathology such as hemorrhage. TBI severity was defined as days to obtain a motor score of 6 on the motor subscale of the Glasgow Coma Scale twice consecutively within a 24-hour period. The sample excluded individuals with mild or very severe injuries because these individuals either did not require inpatient rehabilitation (mild injuries) or were deemed unlikely to benefit from it (very severe injuries).

Outcome measures

Community integration measure[10]

The 10-item CIM requires participants to appraise the quality of their integration into their community using a 5-point scale: 5 (always agree), 4 (sometimes agree), 3 (neutral), 2 (sometimes disagree), and 1 (always disagree). Item content is provided in full in table 1. The CIM has a Flesch Reading Ease Score[16] of 76.2, which corresponds to a Flesch-Kincaid Grade Level[17] of 5.6.

List of abbreviations:

CIM	Community Integration Measure
RSM	rating scale model
TBI	traumatic brain injury
TBIMS	Traumatic Brain Injury Model Systems

Procedures

The Southeastern Michigan TBI System assesses a variety of outcomes at routine follow-up points: 1, 2, and 5 years postinjury and every 5 years thereafter. The CIM, along with other outcome measures, was administered at those follow-up points. Hence, some participants completed the CIM on multiple occasions. However, each participant contributed only 1 CIM administration to the dataset: the earliest administration of the CIM was analyzed.

Data analysis

The Rasch rating scale model (RSM)[18] was used to evaluate the CIM. The RSM rather than the partial credit model was used because the CIM items all share the same rating scale structure. The partial credit model is used when each item has a unique rating scale structure. Rasch analysis was implemented using Winsteps 3.80.1 software.[a] In evaluating the CIM, we examined the unidimensionality, reliability, targeting, and response categories. To assess unidimensionality, we examined infit and outfit mean squares.[19,20] These fit statistics have a theoretical range of 0 to infinity. Under good fit conditions of the data to the expectation of unidimensionality, the expected value of these fit statistics is 1. Infit and outfit mean-square ranges of 0.6 to 1.4 are reasonable for rating scales/surveys.[20] We also assessed unidimensionality of the CIM using a principal component analysis of Rasch residuals where residuals can be understood as the difference between observed and expected data values. We evaluated the internal consistency of person and item performance on the CIM by examining separation reliability estimates and separation ratios.[21] Separation reliability for persons refers to the consistency of person responses across items, whereas the separation reliability for items refers to the consistency of item performances across persons. Much like the Cronbach alpha, separation reliability estimates the ratio of the true score variance to the observed

Table 1 Demographic characteristics of the sample (N=279)

Characteristic	n	%
Sex		
Male	225	80.6
Female	54	19.4
Ethnicity		
Black	207	74.2
White	64	22.9
Latin American	4	1.4
Asian	2	0.7
Native American	2	0.7
Years of education		
<12y	124	44.5
High school diploma	137	49.0
Bachelor's degree	11	3.9
Postgraduate degree	7	2.6