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Research Article

Psychometric Properties of the Functional Independence Measure (FIM) in Iranian Patients With Traumatic Brain Injury

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Abstract

Background: The functional independence measure (FIM) is a practical tool for the evaluation of motor and cognitive independence, which has been validated in different languages; its Persian version has not been studied so far.

Objectives: In this cross-sectional study, the validity, reliability, and replicability of FIM for Iranian patients with traumatic brain injuries (TBIs) were determined.

Patients and Methods: Forty patients with acute TBI that were hospitalized in emergency ward for evaluation of inter-rater reliability for the test replicability and 185 sub-acute TBI patients that were in the neurosurgery ward of Poursina educational hospital in Rasht were selected in the assessment of other psychometric indices by the consecutive sampling method. The tests used include the FIM for measuring motor and cognitive functioning, the Barthel Index for measuring physical disability, the mini mental state examination (MMSE), and questions on the physical dimension of quality of life in the short form health survey (SF-36) were used. Statistical analyses were performed using Intraclass correlation coefficient (ICC), Cronbach's Alpha and Pearson correlation coefficients, independent t-tests, and hierarchical regression analyses.

Results: The inter-rater reliability was acceptable on admission and at discharge (ICC = 0.779 to 0.895). The internal consistency of FIM and its subscales were excellent ($\alpha \geq 0.97$). The results for criterion validity by adjusting the values of GCS on admission and at discharge showed that the FIM motor dimension could predict a significant proportion of the variance of Barthel index scores; and the physical health components of quality of life and overall physical component of SF-36 (PCS) and FIM cognitive dimension could predict a significant proportion of the variance of MMSE scores (all $P < 0.05$). FIM and its subscales were correlated with the above variables in expected directions (all $P < 0.01$). In known-groups validity, patients with physical trauma and cognitive impairment obtained lower motor ($t = 2.09$, $P = 0.038$) and cognitive ($t = 3.36$, $P < 0.0001$) FIM scores compared to the groups with no physical trauma or cognitive impairment.

Conclusions: This Persian version of the FIM can be used as a valid, reliable, and replicable instrument for research and rehabilitation purposes in TBI patients.

Keywords: Traumatic Brain Injury, Psychometrics, Disability Evaluation, Cognition

1. Background

Patients who survive traumatic brain injuries (TBIs) often suffer from high levels of physical, cognitive, and behavioral symptoms that can severely affect their quality of life (1). The majority of TBI survivors are young and at active working age; thus, long-term disabilities can reduce their participation in social activities and cause high social and economic costs. These patients are often referred to rehabilitation centers to reduce their level of morbidity, improve their functional outcomes such as daily activities, and facilitate their transition from medical centers to home environments and access to self-care (2). The lifetime costs of TBI are high, and the influence of an effective treatment for this devastating disorder is economically remarkable not only for the patients' families but for society and the overall health care system (3).

One of the most widely accepted tool for measuring the outcome and disability of hospitalized patients and rehabilitation centers is the functional independence measure (FIM). It is the most useful instrument for measuring a patient's performance and the effectiveness of a rehabilitation program; it evaluates daily activities, extensively covering cognitive and motor domains (4). This instrument was devised to solve the problem of the long-term absence of a single method for disability assessment and for creating unified data based on rehabilitation outcomes. FIM is the product of the American association of rehabilitation medicine and physical medicine and rehabilitation academy of America research (5, 6). This scale has 18 items: 13 motor, 5 cognitive. For grading, a multidisciplinary team observed individual patient functions at 18 activities and evaluated his/her ability to complete each activity, scoring from 1 to 7, where 7 indicates complete independence/normal functioning and 1 indicates complete dependence/needing help in all activities. The difference between the scores ranged from 18 (complete dependence) to 126 (complete independence). FIM can be maximized in rehabilitation centers, hospitals, clinics, nursing homes, and private care centers during admission and discharge (6, 7).

Clinically appropriate validity and reliability have been reported for the FIM approach. For example, inter-rater reliability, test-retest reliability, and internal consistency (Cronbach's alpha coefficient) were reported desirable. A high internal coefficient correlation (ICC), which indicates a strong agreement among group scores and an agreement between evaluators (kappa coefficient), was found for FIM (8-10). Several studies have confirmed the predictive validity of motor FIM (11-13). The cognitive dimension of FIM includes the independence in cognitive functioning to the possible rate. Zwecker et al. (14) reported satisfactory concurrent validity for cognitive FIM.

A high number of accidents occur in Iran (15). New attention has been given to cognitive and motor outcomes in victims suffering from TBI (16), and, because of improvements in emergency medicine and neurosurgical procedures, the survival rate of TBI patients has increased. Thus, the introduction and validation of the Persian version of the instruments is useful and necessary for rehabilitating interventions and examining the outcomes. For this purpose, FIM is widely used and confirmed, yet its Persian translation has not been adapted. Its reliability and validity has not been tested in Iranian patients.

2. Objectives

A) Determine the inter-rater reliability for test replicability (test-retest); B) Determine the internal consistency for FIM and its subscales; C) Examine the criterion validity (concurrent and predictive); D) Validate the FIM construct (convergent and known groups) in TBI Iranian patients

3. Patients and Methods

3.1. Procedure

This study was performed in two phases in the Poursina educational hospital in Rasht, the largest trauma hospital in Northern Iran, from 2011 - 2012. Forty patients with acute TBI were selected by convenience sampling and the FIM was conducted on them during admission and discharge by a nurse and a psychiatric nurse. Initially, we aimed to determine the replicability of the FIM scores and agreement between the raters and reliability of scores of the two nurses in tests (on admission and discharge). In this phase, those patients with inclusion criteria were evaluated based on the diagnosis of a neurosurgeon or emergency medicine physician (EMP) and by reviewing their hospital records at a maximum 72 hours after their admission by FIM. Once again, at discharge, FIM was conducted on the same patients. In the second phase, 185 sub-acute TBI patients were selected through a cross-sectional study by non-probable and consecutive sampling methods before discharge so that the internal consistency of the FIM and other criterion and construct validity indices could be assessed.

Glasgow coma scale (GCS) was recorded during admission and discharge before the FIM test was conducted. This instrument is a multi-dimensional measure that evaluates self-care, sphincter control, transferring devices, locomotion (with 13 motor items), communication, and social cognition (with five cognitive items) (5). The Barthel index (17), which measures the performance of activities of daily living (ADL) or functional disability, and the mini mental State examination (MMSE) (18) for cognitive screening and cognitive performance measurement were used. In this study, the physical component (PCS) from the short-form health survey questionnaire (SF-36) (19) was used to evaluate the physical dysfunction of patients. Low scores on this component represent a physical dysfunction. The reliability and validity of the scale by Guilfoyle et al. (20) were studied on 514 TBI patients.

3.2. Preparing the FIM for Translation Into Persian

To translate the FIM, first its English version was rendered into Persian by two researchers and then separately translated from Persian into English by two English translators. Then, the four translated versions were compiled, and the final version of Persian FIM was designed. To examine the content validity and applicability of the Persian version for TBI patients, two neurologists, four nurse researchers, one neurosurgeon, and one anesthesiologist from Guilan University of Medical Sciences in Rasht, Northern Iran, were asked for their comments. After that, the original Persian FIM was prepared.

3.3. Eligibility and Recruitment

The inclusion criteria for all TBI patients in both stages included age $\geq$ 16 years, glasgow coma scale (GCS) < 15, focal or diffuse damage to brain tissue caused by an external mechanical force, loss of consciousness (LOC) for more than 1 minute, length of post-traumatic amnesia

(PTA) over 20 minutes, radiographic findings or CT scan findings showing TBI (skull fractures, intracranial bleeding, and/or brain acute abnormalities). The exclusion criteria included patients with clinical or radiological findings manifesting a spinal cord injury, any neurological disease before the TBI or brain injury with non-traumatic origin (brain tumors, stroke, aneurism, and other cerebrovascular accidents), patients in a vegetative state or with severe loss of consciousness so that they were unable to answer; suffered from movement or balance disorders, arthritis, knee and joint fractures before their TBI; did not want to enter the study for any reason; and had a hospital stay of longer than 1 week.

This study was approved by the research ethics committee of Poursina educational hospital in Rasht. At the beginning of the evaluation of TBI patients, the participants were informed about the reasons and procedure of the research. They were assured that their information would be confidential and their refusal to participate would not affect their medical procedure. First, informed consent was obtained from all of the participants, and then assessments were performed.

3.4. Statistical Analyses

To determine the inter-raters reliability for the FIM tests' replicability and the correlation rate between the scores given by the two evaluators to each of the 40 patients in the pilot phase was used in the intra-class correlation coefficient (ICC) with a two-way random effect by absolute agreement. To determine the internal consistency to the overall physical and cognitive FIM, Cronbach's alpha coefficient was used. To examine the criterion and construct validity and factor structure of the FIM, the Pearson correlation, independent t-test, and hierarchical multiple regression analysis were used. All of the statistical analyses were performed by a significance level of less than $P < 0.05$ using PASW software version 22.

4. Results

4.1. Study I (Inter-Rater Reliability)

In the pilot phase, 40 TBI patients with a mean age of 31.10 $\pm$ 14.65 participated in the- 32 men (80%) and eight women. The average length of stay in the emergency department or neurosurgery ward was 4.35 $\pm$ 3.29 (approximately 80 hours) and varied from 1 to 20 days. The mean consciousness level based on GCS during admission and discharge were 10.70 and 12.50, respectively, which indicates a significant increase in the level of consciousness of the patients assessed at discharge compared to admission ($t = -4.23$, $df = 39$, $P < 0.0001$). After admission and controlling for traumatic condition in the neurosurgery ward, FIM was performed immediately by two raters. Once again, it was retested on the same 40 patients by the same two raters before discharge. The reliability of the scoring for the two raters on the total 18-question FIM scale during admission and discharge was strong (ICC = 0.779, 95% CI = 0.494 - 0.897). The reliability of the scoring for the two raters on 13-item motor and 5-item cognitive subscales was strong (ICC = 0.708, 95% CI = 0.390 - 0.858) and excellent (ICC = 0.895, 95% CI = 0.825 - 0.940).

4.2. Study II

In the second phase of the study, 185 TBI patients in ranging in age from 16 to 85 (with a mean age of 37.45 $\pm$ 17.42) participated in the study. These patients were hospitalized in emergency and neurosurgery wards for 48 and 96 hours, respectively (2 and 4 days). The average education level of these patients was 7.31 $\pm$4.49 years, in a range between 0 to 16 years. Tables 1 and 2 shows the findings from the demographic and clinical variables of TBI patients.

4.3. Internal Consistency and Item-Total Correlation

As seen in Table 3, the corrected item-total correlation values for each item was strong ($P < 0.0001$), which represents the internal consistency and reliability of the items in the Persian version of FIM. Cronbach's alpha coefficient for the items and motor and cognitive subscales for 185 samples were 0.978, 0.979, and 0.989, respectively, which indicates a high level of internal consistency of items and a high coherence of FIM.

Before performing regression analyses to examine the interrelationships between FIM and its subscales with other tools, there was a significant direct relationship (convergent and concurrent validity). The correlation coefficients were calculated between 12 variables (Table 4).

4.4. Convergent and Concurrent Validity

As seen in Table 4, there is theoretically a strong correlation between the FIM total score and its subscales with other variables -in other words, a significant and expected direct relationship exists between higher FIM motor independence and higher scores on the Barthel index (i.e., less disability), better physical functioning, less pain, better general health status, and higher PCS ($P < 0.0001$). An expected significant direct relationship was also found between the FIM cognitive independence subscale scores, MMMSE scores, and GCS scores in TBI victims during admission and discharge ($P < 0.0001$).

Table 5 shows hierarchical regression analyses to assess the criterion validity and how much of the motor and cognitive FIM (as predictor variables) can explain the variable

Table 1. [Part 1] Demographic and Clinical Features in TBI Patients (N = 185)

Variables	No. (%)
Gender	
Male	171 (92.4)
Female	14 (7.6)
Marital status	
Single	66 (35.7)
Married	118 (63.8)
Unknown	1 (0.5)
Admission GCS	
8 or fewer	19 (10.3)
9 to 12	21 (11.3)
13 to 15	145 (78.4)
Discharge GCS	
8 or less	4 (2.2)
9 to 12	9 (4.8)
13 to 15	173 (93)
Cause of TBI	
Accident	27 (14.7)
Motorcycle	91 (49.2)
Pedestrian	15 (8.1)
Fall	16 (8.6)
Violence	5 (2.7)
Hit the object	11 (5.9)
Back fall	18 (9.7)
Cycling	1 (0.5)
Unknown	1 (0.5)
Skull fracture	
No	118 (63.8)
Linear	47 (25.4)
Depressed	16 (8.6)
Basilar	2 (1.1)
Synthetic	1 (0.5)
Unknown	1 (0.5)
Hemisphere lesion	
No	20 (10.8)
Left	59 (31.9)
Right	78 (42.2)
Bilateral	25 (13.5)
Unknown	3 (1.6)

changes of physical disability, physical functioning, bodily pain, general health, and PCS (as criterion variables for FIM motor independence) and MMSE (as criterion variables for FIM cognitive independence). These regression analyses were performed after controlling for confounders. The Pearson correlation coefficients between the criterion variables and potential confounding factors such as level of consciousness (GCS during admission and discharge) were calculated. Table 4 reflects the results of the correlation coefficients. Then, the set of variables statistically related to criterion variables ($P \leq 0.05$), their impact on the relationship between FIM motor and cognitive independence, and their criterion variables were controlled (Table 5).

The results of the hierarchical regression analysis reveals that the GCS values during admission and discharge could explain the variance in disability scores. On physical functioning and bodily pain, the GCS during admission was significant. Considering the sign of standardized regression coefficients (β) in first steps, patients with higher level of consciousness following TBI reported less physical disability in terms of the Barthel index. Higher GCS, especially during admission, is accompanied by better physi-

Table 2. [Part 2] Demographic and Clinical Features in TBI Patients (N = 185)

Variables	No. (%)
Lesion location	
No	17 (9.2)
Frontal	49 (26.5)
Temporal	54 (29.2)
Parietal	15 (8.1)
The series	10 (5.4)
Multiple locations	36 (19.5)
Unknown	4 (2.2)
Focal injury	
No	9 (4.9)
Brain contusion	43 (23.2)
EDH	36 (19.5)
SDH	19 (10.3)
SAH	17 (9.2)
IVH	1 (0.5)
ICH	8 (4.3)
Several focal damages	46 (24.9)
Unknown	6 (3.2)
Diffused injury	
No	124 (67)
Edema	57 (30.8)
Diffused axonal injury	1 (0.5)
DAI and edema	2 (1.1)
Unknown	1 (0.5)
Physical damage	
No	27 (36.2)
Yes	118 (63.8)
Had neurosurgery	
No	44 (23.8)
Yes	141 (76.2)

cal functioning and milder bodily pain. After removing the confounding effect of the control variables, regression analyses in the second step showed that the FIM motor independence subscale scores could significantly predict the variance of all criterion variables from 4% - 86%. The β values of these variables indicate that the more independent motor function, after controlling for confounders, predicts lower levels of disability and better physical functioning, less bodily pain, better general health, and a higher PCS.

Hierarchical regression analysis of MMSE in the first step, the level of consciousness variable (GCS values during admission and discharge) can explain the variance in MMSE scores. In the second step, the results indicated that the scores of the FIM cognitive independence subscale explained 40% of the variance in MMSE scores. The β values of this variable revealed that more cognitive independence was associated with better cognitive function.

4.6. Known Group Validity

One method of determining the construct validity is to investigate the known group differences. Here, our main hypothesis was that TBI patients with accompanying injuries and orthopedic trauma, compared to TBI patients who do not have such problems, have less motor independence. Also, TBI patients with cognitive impairment (i.e., patients who scored 23 or below on the MMSE) compared to TBI patients without this impairment have less cognitive independence. Figure 1, using independent t-tests, indicates the differences between the groups in terms of FIM motor and cognitive independence subscales.

According to Figure 1A, the independent t-test results with unequal variances showed a significant difference between the two groups of TBI patients with and without physical trauma. This means that patients with accompanying injuries and orthopedic trauma had less motor independence compared to the other group during discharge

Table 3. Mean, Standard Deviation, Item-Total Correlation and FIM Internal Consistency

Items	Mean ± SD	Corrected Item-Total Correlation[a]	Cronbach's Alpha if Item Deleted
Eating	5.07 ± 1.67	0.80	0.977
Grooming	4.31 ± 1.65	0.89	0.976
Bathing	4.25 ± 1.61	0.91	0.976
Dressing			
Upper	4.35 ± 1.57	0.90	0.976
Lower	4.32 ± 1.57	0.91	0.976
Toileting	4.10 ± 1.62	0.88	0.976
Bladder	6.47 ± 1.46	0.66	0.976
Bowel	6.61 ± 1.41	0.60	0.978
Bed/Chair/Wheelchair	3.96 ± 1.59	0.89	0.978
Bath/Shower	3.96 ± 1.58	0.89	0.979
Toilet	3.95 ± 1.58	0.89	0.976
Walk/Wheelchair	3.88 ± 1.60	0.88	0.976
Stairs	3.85 ± 1.61	0.87	0.976
Comprehension	6.18 ± 1.65	0.79	0.976
Expression	6.15 ± 1.76	0.79	0.976
Social interaction	6.06 ± 1.70	0.80	0.976
Problem solving	5.89 ± 1.81	0.81	0.977
Memory	5.91 ± 1.75	0.8	0.977
FIM total	89.35 ± 24.97	-	0.978
Motor subscale	59.14 ± 18.41	-	0.979
Cognitive subscale	30.20 ± 8.50	-	0.989

[a] $P < 0.0001$ for all correlation.

Table 4. Pearson Product-Moment Correlation Coefficient for Different Variables in Patients With TBI (N = 185)

Variables	M ± SD	1	2	3	4	5	6	7	8	9	10	11	12
1. FIM total	89.35 ± 24.97	1											
2. Motor subscale	59.14 ± 18.40	0.97[a]	1										
3. Cognitive subscale	30.20 ± 8.50	0.84[a]	0.68[a]	1									
4. Barthel Index	58.89 ± 22.70	0.90[a]	0.93[a]	0.63[a]	1								
5. Admission GCS	12.89 ± 2.60	0.56[a]	0.49[a]	0.59[a]	0.44[a]	1							
6. Discharge GCS	14.36 ± 1.54	0.65[a]	0.56[a]	0.71[a]	0.55[a]	0.62[a]	1						
7. MMSE	25.10 ± 7.24	0.50[a]	0.39[a]	0.62[a]	0.29[a]	0.44[a]	0.40[a]	1					
8. Physical functioning	76.39 ± 28.25	0.58 [a]	0.61[a]	0.37[a]	0.53[a]	0.31[a]	0.28[a]	0.24[a]	1				
9. Role physical	90.16 ± 29.51	0.38a	0.44a	0.17b	0.48a	0.15b	0.12	0.10	0.58a	1			
10. Bodily pain	48.31 ± 20.35	0.41[a]	0.44[a]	0.25[a]	0.37[a]	0.30[a]	0.16[b]	0.13	0.47[a]	0.33[a]	1		
11. General health	40.23 ± 8.45	0.23[a]	0.21[a]	0.23[a]	0.17[b]	0.17[b]	0.17[b]	0.21[a]	0.27[a]	0.15[a]	0.19[a]	1	
12. PCS	31.83 ± 5.67	0.39[a]	0.43[a]	0.18[b]	0.45[a]	0.14	0.14	0.12	0.74[a]	0.84[a]	0.024	0.001	1

Abbreviations: GCS, Glasgow coma scale; PCS, physical component summary.
[a] $P < 0.01$.
[b] $P < 0.05$.

(mean of 55.64 versus 61.13). Based on t-test with unequal variance, it was found that TBI patients with and with-

Table 5. Hierarchical Regression Analyses for Predicting Criterion Variables Based on FIM Motor and Cognitive Subscales (N = 185)

Control and Predictive Variables	β[a]	P Value	$\triangle R^2$[b]	Model Summary		
				R^2	F	P
Physical Disability (Barthel Index)[c]						
Step 1:				0.87	$F_{[3,179]} = 394.13$	< 0.0001
Admission GCS	0.19	0.016	0.29[d]			
Discharge GCS	0.41	0.0001				
Step 2:						
[Motor independence]	0.92	0.0001	0.86[d]			
Physical Functioning[c]						
Step 1:				0.38	$F_{[3,178]} = 36.57$	< 0.0001
Admission GCS	0.22	0.015	0.10[d]			
Discharge GCS	0.14	0.106				
Step 2:						
[Motor independence]	0.64	0.0001	0.37[d]			
Role Physical[c]						
Step 1:				0.20	$F_{[2,179]} = 22.32$	< 0.0001
Discharge GCS	0.15	0.048	0.016			
Step 2:						
[Motor independence]	0.48	0.0001	0.19[d]			
Bodily Pain[c]						
Step 1:				0.21	$F_{[3,176]} = 15.27$	< 0.0001
Admission GCS	0.20	0.027	0.04[e]			
Discharge GCS	0.05	0.611				
Step 2:						
[Motor independence]	0.48	0.0001	0.19[d]			
General Health[c]						
Step 1:				0.05	$F_{[3,178]} = 3.19$	< 0.025
Admission GCS	0.10	0.245	0.03[e]			
Discharge GCS	0.10	0.287				
Step 2:						
[Motor independence]	0.15	0.08	0.04[e]			
Physical Quality of Life (PCS)[c]						
Step 1:				0.19	$F_{[1,179]} = 41.95$	< 0.0001
[Motor independence]	0.44	0.0001	0.18[d]			
Cognitive Functioning (MMSE)[c]						
Step 1:				0.41	$F_{[3,176]} = 40.64$	< 0.0001
Admission GCS	0.31	0.0001	0.21[d]			
Discharge GCS	0.21	0.011				
Step 2:						
[Cognitive independence]	0.62	0.0001	0.40[d]			

[a] Standardized regression coefficient.
[b] adjusted R squared.
[c] Criterion variables.
[d] P < 0.0001.
[e] P < 0.05.

out cognitive impairment were significantly different (Figure 1B), meaning that patients with cognitive impairment show less cognitive independence (mean of 23.06 versus 33.07).

5. Discussion

In this study, validity, reliability, and replicability of FIM were examined in Iranian patients with acute and subacute TBI. In the first phase of this research, the results show that the FIM total score and its motor and cognitive

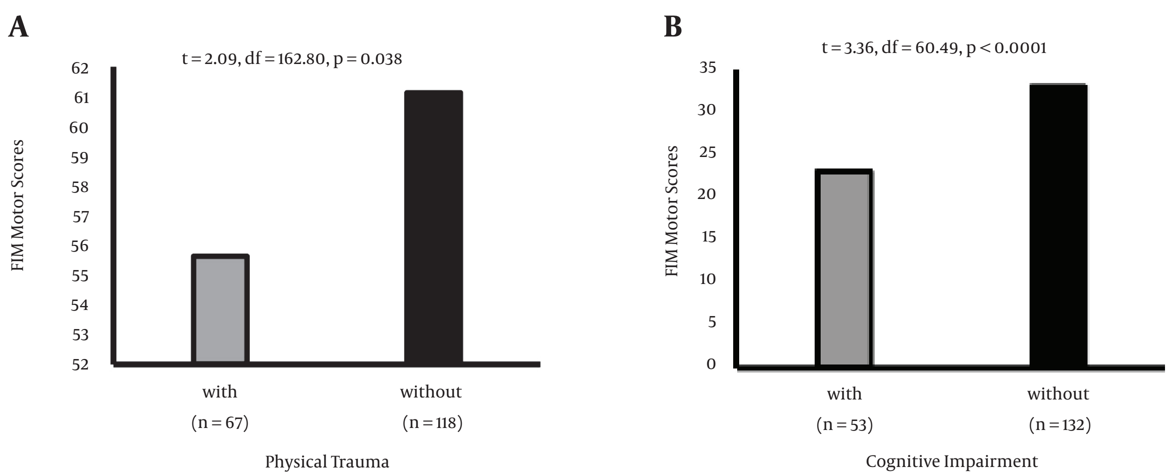

Figure 1. A, Differences between TBI patients with and without physical trauma in terms of FIM motor; B, TBI patients with and without cognitive impairment (MMSE score $\leq$ 23) in terms of FIM cognitive.

subscales in TBI patients, according to Portney and Watkins (21), had an acceptable degree of inter-rater reliability and repeatability. In line with this, many studies found similar results (6, 8, 9). In the second phase, several psychometric characteristics were evaluated. Consistent with previous findings (8, 10), FIM and Cronbach's alpha coefficient and its subscales were calculated $\geq$ 0.97 for TBI patients. These values were high and indicated that the tool is eligible for internal consistency, according to Nunnally and Bernstein (22).

The results from the construct validity for FIM (to investigate the difference in known groups) are shown in Figure 1A and B. In the first step for the FIM motor subscale, as expected, the results showed that TBI patients with accompanying injuries and orthopedic trauma, compared to the opposite group, had lower motor independence ($t = 2.09$, $P = 0.038$). In the second step, when investigating the construct validity of the cognitive FIM, stronger results were obtained. TBI patients with cognitive impairment (MMSE $\leq$ 23) showed lower cognitive independence compared to the opposite group ($t = 6.36$, $P < 0.0001$).

Table 3 indicates good convergent and concurrent validity of FIM and its motor dimension (23). In assessing the criterion validity of the predictive type, the results of the present study that are consistent with previous studies (11-13) reveal that the motor dimension of FIM, even after adjusting GCS values during admission and discharge, could explain the Barthel disability index, the physical dimension, and SF-36 physical component summary scores (Table 4). This suggests that physical rehabilitation interventions to improve the motor independence of TBI patients (regardless of GCS rates during admission and discharge) may lead to improved quality of life and reduce the extent of the disability. In addition, in several studies, particularly in the elderly and patients that have suffered from a stroke, it was concluded that physical rehabilitation can improve functional independence (24).

Along with prior studies (11, 12, 14), this research shows a strong correlation between the cognitive dimension of FIM and MMSE scores (Table 3), which indicates an excellent concurrent validity of the cognitive FIM in TBI patients ($r = 0.62$, $P < 0.0001$). In the predictive validity, the results of the hierarchical regression analyses show that, by controlling for GCS values during admission and discharge, the FIM cognitive subscale could predict the overall cognitive functioning of patients with TBI in term of MMSE. This finding implicitly suggests that the cognitive rehabilitation of TBI patients may lead to increased cognitive independence (Table 4). Furthermore, Heruti et al. (25) found that the impaired cognitive status of elderly patients who have suffered from a stroke will have negative impacts on their rehabilitation outcomes.

This research demonstrates the replicability or inter-rater reliability in a pilot study at two times (admission and discharge) for FIM. This study highlights the need for motor and cognitive rehabilitation interventions to improve physical disabilities, quality of life, and cognitive impairments in TBI patients. The Persian version of FIM is a valid, reliable, and replicable instrument for use with TBI Iranian patients.

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Footnotes

Authors' Contribution: Research design, supervision of the study, data analysis, writing the article: Sajjad Rezaei; advisor and editor: Anoush Dehnadi-Moghadam; data collection, evaluation of TBI patients: Naeima Khodadadi and Pardis Rahmatpour.

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