Developing a Cognition Measure Using Items from Three Federally Mandated Assessments in Post-Acute Care for Stroke Survivors

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Research Objective

- To create a measure detecting change in cognitive deficits for post-acute care (PAC) stroke survivors

Background

- Stroke is a main cause of disability
- Cognitive impairment occurs in up to 50% of adults post-stroke
- Stroke survivors receive therapy services in post-acute care (PAC) settings:
  - Inpatient Rehabilitation Facility,
  - Skilled Nursing Facility, and/or
  - Home Health Agencies
- Each PAC setting uses different items to measure cognition

Psychometric properties of cognitive constructs within federally mandated assessment tools for PAC are insufficient

Study Design

Prospective, multi-center observational cohort study of 147 stroke survivors receiving rehabilitation from PAC providers from 2005-2010.

Outcome Measure: All participants were scored on three federally mandated assessments:

- Functional Independence Measure (FIM),
- Minimum Data Set 2.0 (MDS), and
- Outcome and Assessment Information Set (OASIS)

Analytic Procedures

Data Cleaning: Rescored some items to reflect the same directionality

Example of Rescoring Using Items Reflected in Cognitive Measure

***MDS Long & Short Term Memory**

Original Rating Scale

0=Memory Okay 1=Memory Problem

Rescoring of Rating Scale

0=Memory Problem 1=Memory Okay

Data Analysis: Partial Credit Rasch Model conducted using Winsteps.

- PCM allows for each item to have its own rating scale structure.
- Rasch model estimates the abilities of the persons and the difficulty of the items.

Results

- Participants average age 78.7 ± 0.68
  - 65% male, 90% white, 48% widowed
  - >50% lived with others while 40% lived alone
- Six items reflect a unidimensional cognitive measure with a good person separation reliability of 0.87 (Table 1)
- Distinguishes people amongst three ability levels.

Cognitive Measure Items

Short Term Memory (MDS) — **Harder Items**

Problem Solving (FIM)

Memory (FIM)

Decision Making (MDS)

Cognitive Function (OASIS)

Long Term Memory (MDS) — **Easier Items**

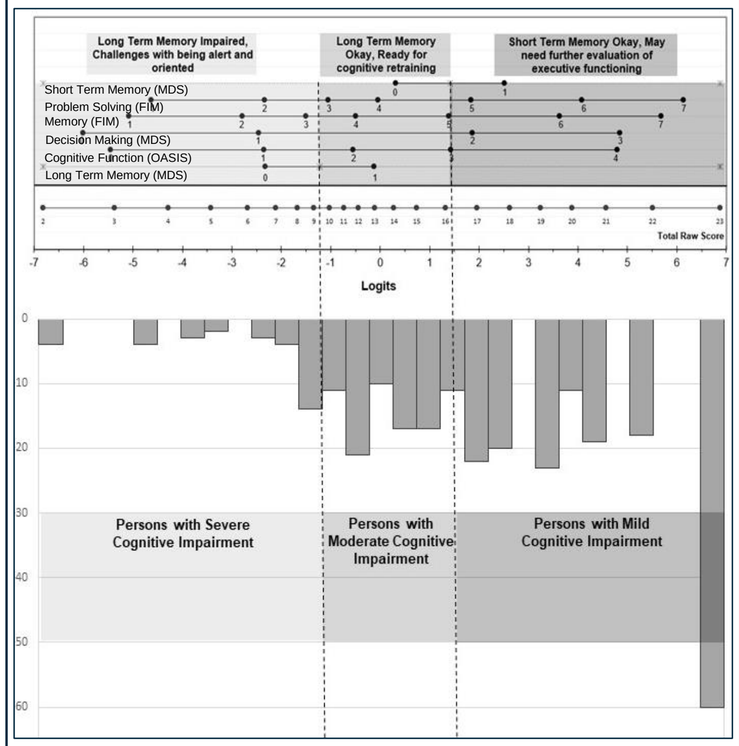
Principal Findings

Table 1. Rasch Summary of the Psychometric Properties

Analysis	Items	Rating Scale Steps	Person Mean (SD) logits	RMSE	Adj. SD	SI	PSR	Number of Misfitting Items	PCA Eigenvalue 1st contrast (%)	Ceiling Effect n (%)	Floor Effect n (%)
1. Calibration sample, all MDS, OASIS, FIM Cognition & Communication Items, unanchored	26	35	-0.11 (0.84)	.38	0.75	1.97	0.79	3	8.52 (8.7)	N/A	N/A
2. Calibration sample, Removed 13 items, unanchored (n=145)	13	28	1.93 (1.90)	0.60	1.80	3.01	0.90	1	2.33 (5.3%)	19 (13.1%)	N/A
3a. Communication: Calibration sample, Removed 19 items, unanchored (n=145)	7	21	2.27 (1.85)	0.78	1.68	2.14	0.82	1	1.88 (8.5)	24 (16.6)	N/A
3b. **Cognition**: Calibration sample, Removed 20 items; unanchored (n=145)	6	18	1.48 (2.52)	0.90	2.35	2.62	0.87	0	1.96 (8.0)	31 (21.4)	2 (1.4)
4. **Cognition:** Validation sample, Removed 20 items, anchored floating item 7 (n=139)	6	18	1.57 (2.46)	0.87	2.30	2.66	0.88	0	2.10 (8.8)	29 (20.9)	2 (1.4)
5. **Cognition:** Full Sample, Removed 20 items, anchored floating item 7 (n=284)	6	18	1.53 (2.49)	0.88	2.33	2.64	0.87	0	1.99 (8.2)	60 (21.2)	4 (1.4)

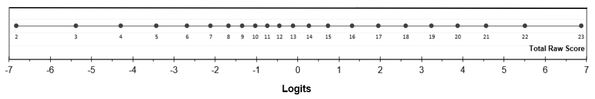
n=# of records; SD= Standard Deviation; RMSE= Root Mean Square Error; SI= Separation Index; PSR= Person Separation Reliability; PCA= Principal Components Analysis

Figure 2. Items arranged in hierarchical order with rating scale steps and person distribution mapped to the total raw score.



- *Moderate cognitive impairment:* **potential for significant cognitive gains**
- *Mild cognitive impairment:* further evaluation & treatment of executive functioning

Figure 1. Six Items Define a Cognitive Measure with a Score Ranging from 2-23



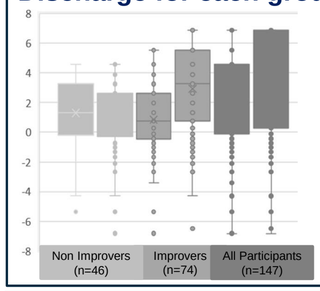
The cognitive measure raw score range of 2 to 23 aligns to the Rasch logits of -6.82 to 6.87.

Table 2. Generating Indices of Responsiveness

Participants	SEM	ES *pooled SD	SRM	MDC_{95}	MCID 0.20/0.33/0.50 SD
All participants (n=147)	1.17	0.25 (CI: 0.15, 0.36)	0.41	3.0	0.65/1.07/1.62
Improvers (n=74)	1.03	0.72 (CI: 0.56, 0.93)	1.19	2.8	0.57/0.94/1.43
Non-improvers (n=46)	0.89	-0.26 (CI: -0.39, -0.16)	-0.71	2.6	0.50/0.82/1.24

- PSR of 0.87 used to calculate SEM and MDC_{95} (Table 1)
- Good SRM when participants delineated

Figure 3. Box & Whisker Plot for Admission & Discharge for each group



Non-Improvers

- 22% exceed 0.50SD MCID
- 8% exceed the MDC_{95}

Improvers

- 43% exceed 0.50SD MCID
- 24% exceed MDC_{95}

Conclusions

- First attempt to delineate a cognitive construct using items in federally mandated assessments
- Advancement in measuring cognition is needed to determine the impact of cognitive training

Funding Source & References

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