Cognitive Impairment and Real-World Functioning in Multiple Sclerosis (MS): Test of Everyday Cognitive Ability (TECA)

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Objective

To evaluate the Test of Everyday Cognitive Ability (TECA) as a measure of real-world cognitive functioning in multiple sclerosis (MS).

Background

MS is one of the most common neurological disorders affecting approximately 400,000 individuals in the United States. Among the variable symptoms affecting MS patients, cognitive impairment is experienced by more than 50%. Despite the fact that cognitive measures have been established to detect cognitive deficits, there are a lack of measures that can assess the real-world experience of cognitive impairment in MS.

The Activities of Daily Living (ADL) has been previously employed in aging and dementia studies to evaluate the real-world experience of impaired patients. These previous trials in evaluating real-world experience have been confined by both their mild degree of difficulty and their small number of tasks. This has limited their application in MS populations.

TECA, the response to these shortcomings, is a robust battery consisting of 10 items of sufficient difficulty to reflect a range of performance in MS populations. By presenting subjects with common situations and props such as a grocery shelf with food items, coin currency, and prescription bottles, the TECA places cognitive tasks, such as processing speed, visual scanning, and working memory, in the context of everyday situations (Figure 1).

Figure 1. The TECA's tasks involves a group of props, including a simulated grocery shelf.

Methods

The TECA was administered to 177 MS participants with 129 experiencing mild cognitive impairment (defined by SDMT performance of 1 SD below norms) and a group of 49 healthy control participants (Table 1). Additional cognitive measures were also administered (Table 2) as part of a cognitive battery.

Each of the ten test items has a defined time limit. The completion time is combined with the accuracy of an individual's response (no error, mild error, major error) to produce a score for each item. Examples of mild response error are explicitly stated within the TECA's instructions to provide consistent scoring among testers. The scores of each task were transformed to z-scores using the normative data of the control group at baseline. Composite scores were created by averaging z-scores across all ten items.

Results

Sample Characteristics: The MS participants were diagnosed with relapsing remitting (76%), primary progressive (20%) or secondary progressive (4%) disease and ranged from minimal to severe neurologic disability (Expanded Disability Status Scale (EDSS) median score of 3.0, range of 0.0 to 8.0).

Additionally, the sample consisted of native English speakers (excluding those who learned English after 12 years of age) which is reflected in the relatively high WRAT reading scaled scores.

Table 1: Sample Demographics				
	MS (n=177)		Healthy Controls (n=49)	
Gender	Male	27% (47)	Male	45% (22)
	Female	73% (130)	Female	55% (27)
Age (years)	Mean	46 ± 14	Mean	24 ± 8.4
	Range	18 to 69	Range	18 to 64
WRAT Reading	Mean	103.6 ± 8.92	Mean	109.4 ± 7.20

TECA Characteristics: For the test-retest sample, the TECA had overall good reliability. The internal reliability as predicted by Cronbach's α for the 10 tasks (n=16) =0.71; Spearman brown split half value of 0.69. In the full sample, alternate form test-retest reliability coefficient was found to be r=0.67, p<0.001.

MS vs. Controls: As expected, TECA performance discriminated between MS and controls groups. The MS group performed more poorly, with mean composite scores of -0.90 ± 1.42 (n =176) vs. healthy controls = -0.005 ± 0.48 (n=49, t=-4.31, p<0.001).

Validity: TECA performance was correlated to performance on standard, common neuropsychological tests, the TECA links clinically-based measures and real-world functioning.

Table 2: Test Performance and correlation to TECA performance.				
Measure	Mean Normative z Score	Impairment	Correlation to TECA Performance (r)	Sample Size (n)
SDMT	-0.84 ± 1.09	Mildly Impaired	0.54*	224
BVMT-R Total Trials	-0.55 ± 1.42	Low average	0.35*	209
SRT Total Trials	-0.72 ± 1.43	Low average	-0.31*	155
PASAT (2 second)	-0.98 ± 1.02	Mildly Impaired	-0.32*	146
*p<.001				

Predictors of TECA Performance: A higher EDSS score predicted a poorer TECA score (r=-0.25, p=0.002, n=153). TECA performance is positively correlated to other cognitive measures (Table 2). Neither age nor education predicted TECA score (Age, r=-0.27, p<0.001, n=225; Education, r=0.16, p=0.015, n=225).

Conclusion

- The TECA is a reliable, valid measure of cognitive impairment in daily functioning in MS.
- The TECA presents a quantifiable method of measuring real-world deficits in individuals with MS.
- Further development of the measure is underway to enhance its sensitivity to real-world deficits.

References

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