

Brief Computerized Measures of Information Processing Speed are Sensitive in Multiple Sclerosis Across the Lifespan

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Objective

To measure two computer-based cognitive processing speed measures, Cogstate information processing speed or IPS, interhemispheric integration time or IIT, compared to the standard Symbol Digit Modalities Test (SDMT) in pediatric- and adult-onset multiple sclerosis (MS).

Background

Cognitive impairment is a significant symptom directly affecting the lives of more than half of all MS patients. Measures that may be able to detect impairment, even a minimal amount, are needed to meet the clinical need presented.

The SDMT, a brief 90 second measure, is often used to screen for cognitive impairment as well as an outcome measure. Computerized measures offer more precise and sensitive measurement.

The Cogstate Brief Battery is widely-used assessment that includes measures of processing speed. Interhemispheric integration time (IIT) has become of interest to researchers and clinicians of MS as the corpus callosum (CC), the largest white matter structure in the brain that mediates interhemispheric transfer, has been implicated in cases of cognitive impairment. Since MS is a neurodegenerative disease that targets white matter, the CC is a structure monitored by clinicians through radiological scans.

Methods

Adult- and pediatric-onset MS (n=36, 32=RRMS, 4=SPMS) participants were compared to healthy controls (n=30). Analyses were adjusted for age using normative data.

Table 1: Demographics and Clinical Characteristics

Characteristics	MS Patients	Healthy Controls
Gender (% Female)	69.4	63.3
Age (Years)	31.4±16.5	18.3±6.0
Education (Years)	13.2±2.7	12.1±5.2
WRAT Standard Score	101.6±11.3	108.3±9.2
EDSS (Median)	2	-

All participants were administered the SDMT along with the Cogstate Detection and Identification tests (taken together as a composite score), and an experimental task measuring interhemispheric integration time (IIT).

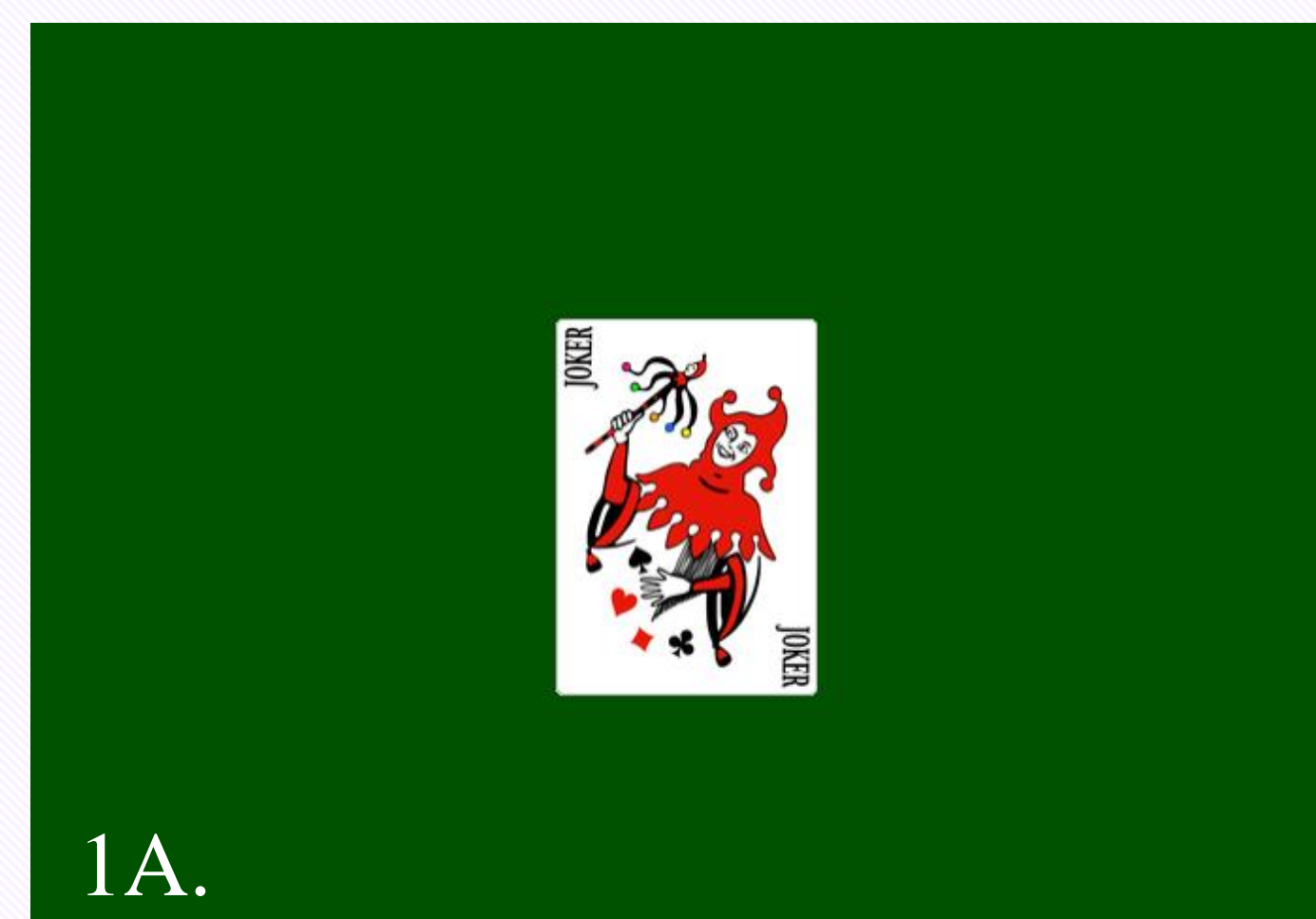
The Cogstate tasks present cognitive tasks in the form of a card deck. The Detection task acts as a simple reaction time task evaluating motoric response speed to a simple stimulus. The Identification task is a choice reaction time task, requiring subjects to differentiate between two card colors as quickly as possible.

The IIT task required subjects to indicate detection of a stimulus presented in either the left or right visual field via a response with the contralateral hand.

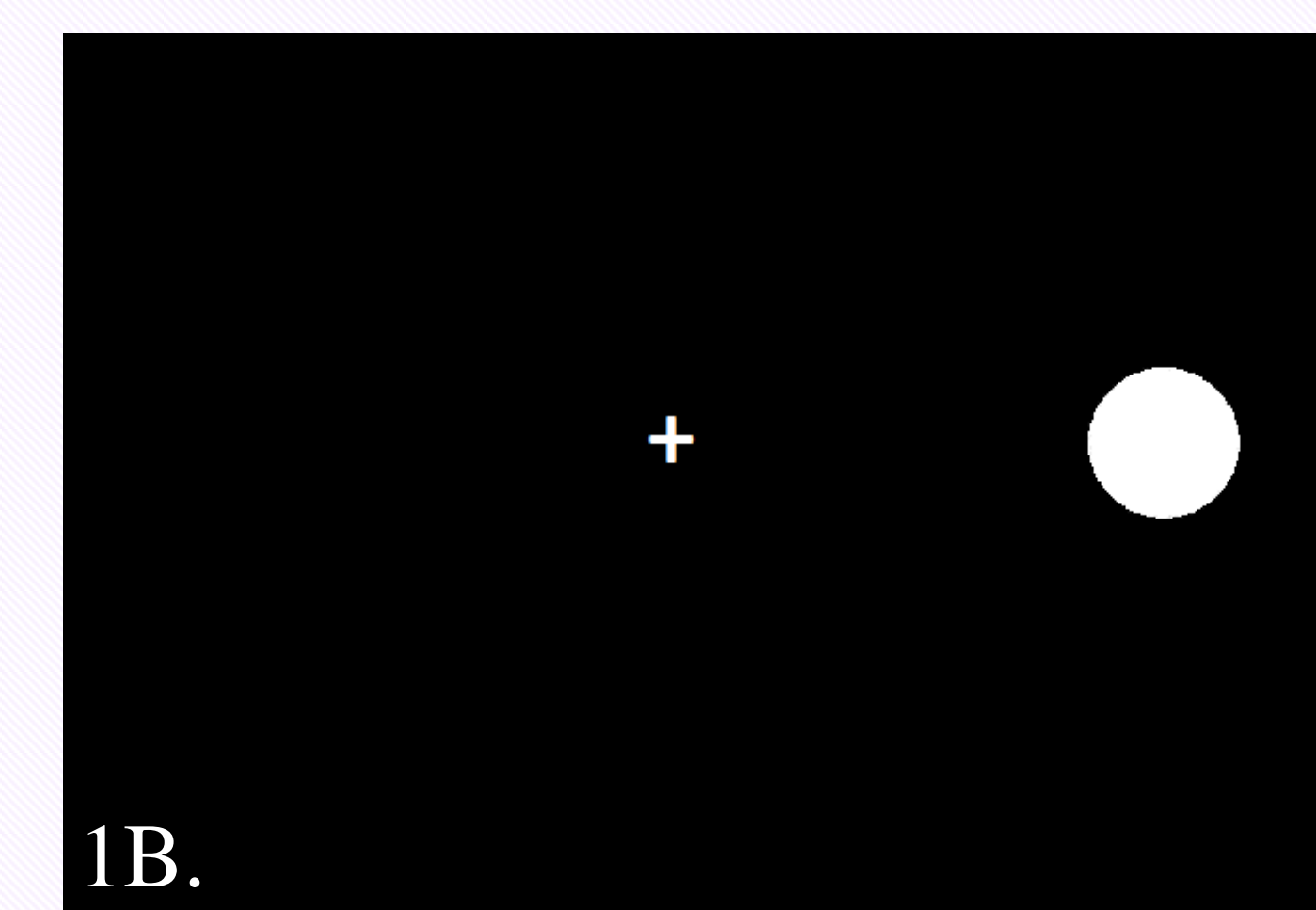
The SDMT and Cogstate IPS composite score were converted to age-adjusted z-scores for analyses, with impairment defined as a z-score less than -1.5.

Figure 1: Still of Computerized Measures

1A. Cogstate Detection Task



1B. Interhemispheric Integration Task



Results

Both groups were administered the SDMT, the Cogstate Brief Battery, and the IIT Task. The computerized tasks, but not SDMT, significantly differed between the MS and HC groups. (Table 2)

Additionally impairment rates were compared between the adult and healthy control samples for the SDMT and Cogstate Brief Battery. (Table 3)

Table 2: Differentiating between Multiple Sclerosis and Healthy Controls

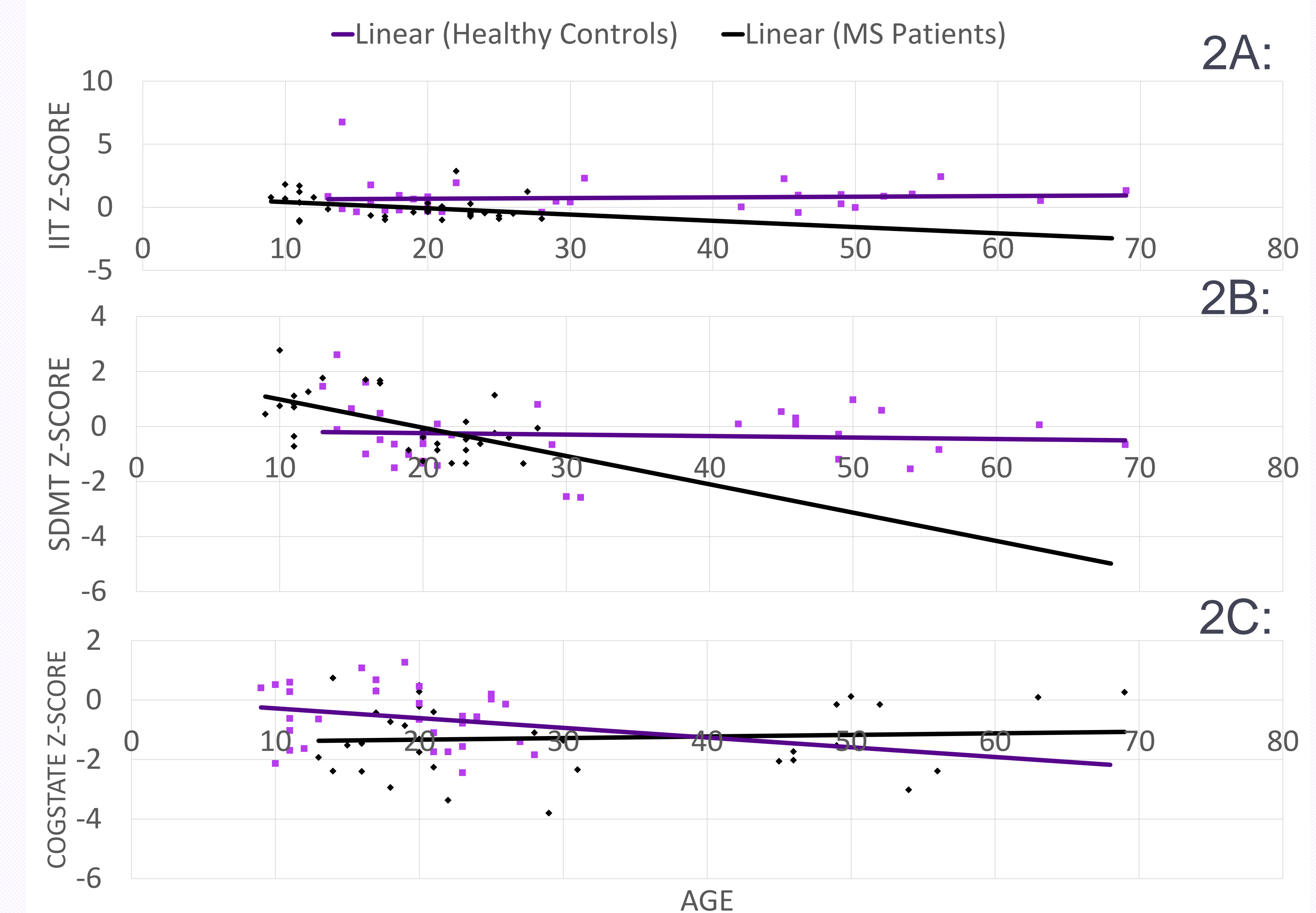
Measure	MS (n=36)	HC (n=30)	p value
SDMT (z-score)	-0.30±1.10	0.13±1.11	0.3
Cogstate (z-score)	-1.25±1.20	-0.55±1.01	0.015*
IIT (milliseconds)	462±14	387±11	0.021*

Table 3: Scores across the lifespan

POMS Sample:	MS Patients:	Healthy Controls:
SDMT	0%	0%
Cogstate	50.0%	23.1%
Adult Sample:	MS Patients:	Healthy Controls:
SDMT	10.7%	0%
Cogstate	42.9%	29.4%

As seen in the following graph (Figure 2), regressions show that IIT and Cogstate scores are the strongest predictors of benefit, while the HC group performed at expected for a healthy population (with average results falling in line with average values for age group).

FIGURE 2: EFFECT OF AGE ON MEASURE PERFORMANCE



Conclusion

- Computerized processing speed measures are more sensitive in both pediatric and adult-onset MS than the SDMT.
- Adult and pediatric impairment rates are more consistent with published values when detected with the use of computerized measures.

References

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