

# Cognitive Impairment is Associated with Behavioral Problems in Pediatric Multiple Sclerosis (MS)



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## Objective

To characterize the behavioral problems in pediatric MS and their link to cognitive impairment.

## Background

Pediatric MS patients represent 2-5% of all MS cases, with at least one third having some degree of cognitive impairment. In adults, behavioral changes have been associated with intrinsic changes within the brain as well as the psychosocial burden of illness. However, initial studies have suggested that behavioral problems may be frequent. To clarify the most common behavioral symptoms associated with pediatric MS, and whether cognitive impairment elevates risk, we administered self- and parent-reported behavioral ratings in a large consecutively-recruited outpatient sample and compared findings to cognitive impairment and clinical disease factors.

## Methods

Participants with pediatric-onset MS were consecutively evaluated at the Lourie Center for Pediatric MS and administered the Behavioral Assessment System for Children, second edition (BASC-2), self- and parent-report forms and neuropsychological evaluation. The BASC-2 includes clinical and adaptive functioning scales, with impairment determined by scores falling greater than two standard deviations or below norms.

Cognitive impairment was defined as having one-third of more test scores  $\geq 1$  standard deviation from age normative means.

**Table 1. Demographic and Clinical Features of Sample (n=145)**

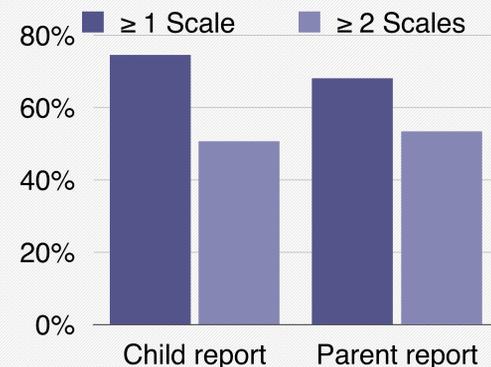
Demographic		Clinical	
<b>Female v. Male</b>	43% vs. 57%	<b>EDSS score</b>	0.0 to 6.5, median 1.0
<b>Age (mean, SD, range)</b>	51 $\pm$ 12 (19 to 69) years	<b>Disease Duration</b>	1.5 $\pm$ 2.3 (<1 to 10.3 years)
<b>Race</b>	69.6% White, 19.6% African American, 2.7% Asian, 4.5% Mixed, 3.6% Other	<b>Age at symptom onset</b>	12.2 $\pm$ 3.3 (2 to 17 years)
<b>Hispanic</b>	27.4%		

## Results

Analyses included 145 participants; Demographic and clinical characteristics are shown in Table 1. The sample's mean scores on the BASC-2 clinical scales for self- or parent-report were all within the typical range (T scores between 45 and 55), indicating no overall pattern of behavioral impairment. However, at the individual profile level, there is a high rate of scores in the At-Risk and clinically significant range (falling at least one standard deviation below the mean).

As shown in Figure 1, for self-reports, 74.4% of the sample had at least one scale in the At-Risk or clinical range, and 50.5% had two or more outside the typical range. On parent-reports, 68% had at least one scale in the At-Risk or clinical range, with 53.3% having two or more scales of concern.

**Figure 1:** Percent of Sample with Self- and Parent-Report Scales in the Clinical Range.



There was a moderate correlation of the number of clinically elevated scales rated by self and parent,  $r=0.39$ ,  $p<0.001$ . There was also generally strong agreement across in clinical elevations across the four scales shared between the two forms: depression, 78.3% agreement; anxiety, 74.2% agreement; somatization, 75.7% agreement; and attention problems, 72.3% agreement.

Behavioral findings were compared to rates of cognitive impairment determined by performance across a battery of neuropsychological tests. Those with MS had slightly higher rates of clinical elevations (at risk or clinically significant) for both self (73.6% vs. 62.5%) and parent report (69.4% vs. 64.7%).

Overall degree of cognitive impairment was predictive of behavioral problems. Multiple regression was used to determine whether age or disease factors of EDSS, disease duration, percent of impaired cognitive scores predicted number of BASC-2 clinical elevations (either at risk or clinically significant). For self-report, these factors explained 8.0% of the variance in the number of BASC-2 scale elevations, and nonsignificant ( $p=0.13$ ).

Of the predictors, only percent cognitive impairment held a significant contribution ( $\beta=0.27$ ,  $p=0.01$ ). For the parent report form, this model explained only 3% of the variation in BASC-2 clinical elevations ( $p=0.54$ ), with none of the variables having a uniquely significant contribution.

Percent cognitive impairment also significantly correlated with total elevations on the self-report form,  $r=0.28$ ,  $p=0.005$  (but not parent form).

**Table 2:** Impairment Rates on Representative Neuropsychological Measures.

Cognitive Domain	Test	Percent Impaired*
General Intellectual	WASI-4	8.2
Language	EOWPVT	11.9
	WIAT-II Pseudoword	12.7
Attention/Processing	Digit Span	27.4
	Coding Digit/Symbol	34.8
Verbal Learning and Recall	CVLT Learning	16.4
	CVLT Delay	24.4
Visuomotor Functioning	Beery VMI	42
	Pegboard	40

\*Score < 1 SD from age normative mean

## Conclusion

- Behavioral concerns are frequent among pediatric MS participants but vary across individuals.
- Cognitive impairment is associated with greater risk of behavioral problems and poorer functioning.
- Reported behaviors falling in an impaired range varied greatly across individuals; no one dominant symptom emerged for the entire group.

## References

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