Physiological vs Perceived Stress on Cognition in Multiple Sclerosis

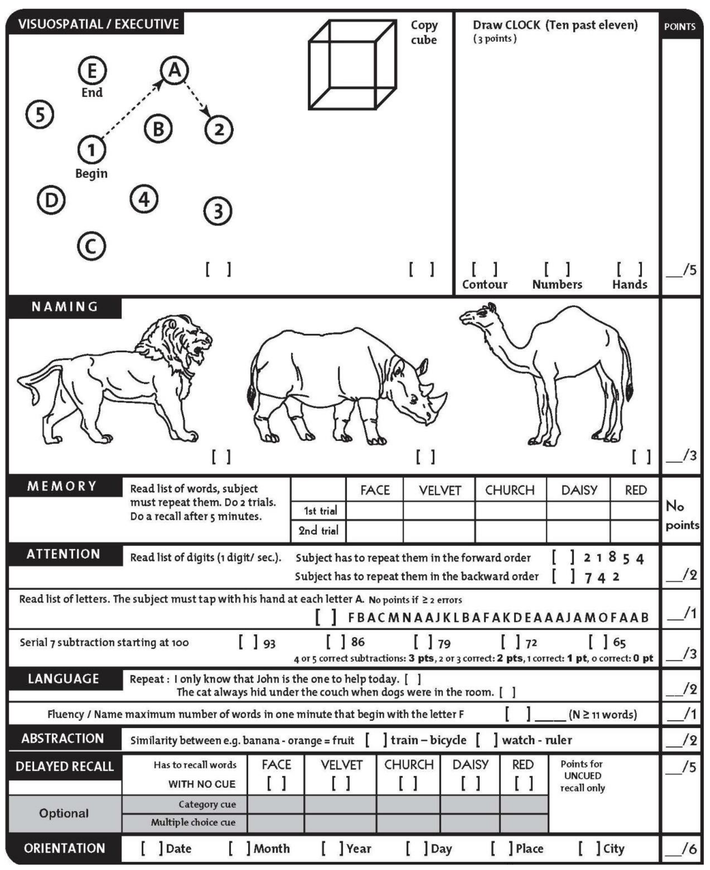
Malcolm Sundell; Isabelle Mermilliod; Shannin Moody, PhD; Deidre Devier, PhD

LSUHSC School of Medicine, Department of Neurology – New Orleans, LA.

Introduction

- Multiple Sclerosis (MS) is an autoimmune neurodegenerative disease of the central nervous system manifesting in chronic inflammation and demyelination.
- Despite its heterogenous symptom profile, nearly half of individuals with MS will have cognitive impairment affecting their memory, attention, spatial perception, and other parameters (1).
- While the exact etiology of MS is unknown and likely multivariate, stressful life events can predispose the diagnosis or exacerbation of MS (2).
- Further, the disease itself can impart undue stress by hindering one's daily activities, work performance, and social engagement.
- We hypothesize that participants with higher self-reported stress will demonstrate poorer performance on on our cognitive assessment.
- We also foresee an effect of physiological levels of stress on these cognitive deficits, suggesting that higher cortisol levels could further impair cognition in people with MS.

MoCA



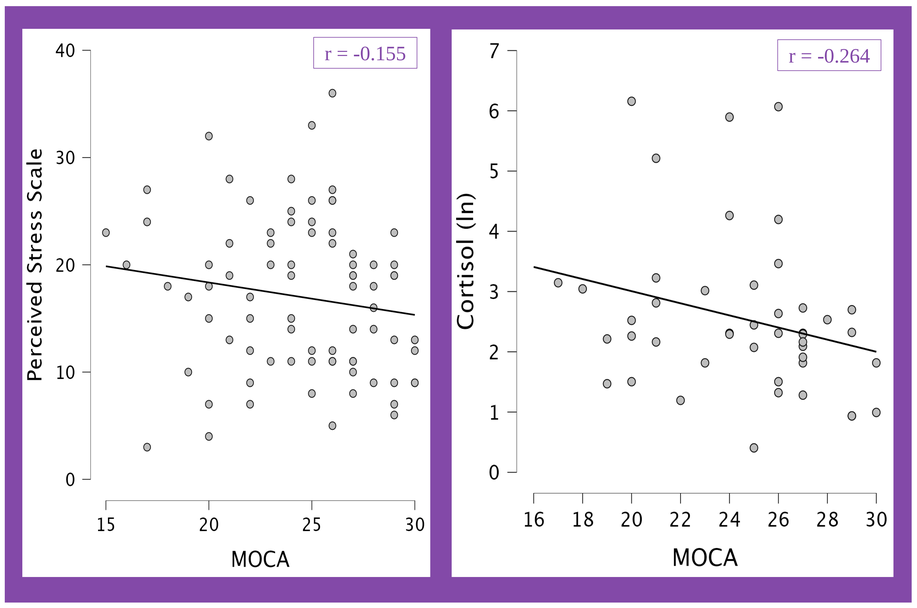
Methods

- A total of 83 participants with MS were enrolled in this study.
- (64 female and 19 male participants, 42 white and 41 black participants)
- Participants were assessed for cognitive function using the Montreal Cognitive Assessment (MoCA).
- Participants completed the Perceived Stress Scale (PSS), a questionnaire evaluating the degree of stress in their daily life and circumstances.
- Physiological stress was measured using a 3-centimeter hair sample to reliably determine mean cortisol concentration over the prior 3 months, then set to a log scale.
- A Pearson Correlation was run on the dataset, including additional demographic data (disease duration, gender, age, education, race).
- With these correlations in mind, a more focused regression was completed for cortisol's impact on the MoCA and included a comparison group of healthy controls (HC).

Correlations

	Dx Duration	Gender	Age	EDU	Race	MOCA	Cortisol (ln)
1. Dx Duration	—						
	—						
2. Gender	-0.317 **	—					
	0.004	—					
3. Age	0.605 ***	-0.201	—				
	< .001	0.069	—				
4. Education	0.177	-0.118	0.193	—			
	0.112	0.29	0.08	—			
5. Race	-0.289 **	0.252 *	-0.479 ***	-0.312 **	—		
	0.008	0.022	< .001	0.004	—		
6. MOCA	-0.058	-0.107	-0.011	0.348 **	-0.255 *	—	
	0.613	0.346	0.924	0.002	0.023	—	
7. Cortisol (ln)	0.257	-0.24	-0.144	-0.182	0.035	-0.264	—
	0.089	0.112	0.346	0.231	0.822	0.08	—
8. PSS	-0.144	0.079	-0.217 *	-0.058	-0.099	-0.155	0.139
	0.196	0.478	0.049	0.603	0.375	0.17	0.362

* p < .05, ** p < .01, *** p < .001



Results

Effect on MoCA	*Multiple Sclerosis*		*Healthy Control*	
	r	**R^2**	**r**	**R^2**
	0.459	0.21	0.754	0.568
	t	**p**	**t**	**p**
Cortisol (ln)	-2.13 *	0.04	-1.73	0.102
Age	-1.584	0.121	0.437	0.667
Gender	1.607	0.116	-2.136	0.048
Race	0.94	0.353	3.63 **	0.002
Education	1.139	0.262	-1.063	0.303

- Our analysis revealed that while both perceived stress and physiological stress showed trends correlating to decreased cognitive function, only that of cortisol was significant.
- Of note, self reported stress levels on the PSS did not correlate with our measured cortisol levels from hair samples.
- Incidentally, we found that race and education were significantly correlated with MoCA results (despite the assessment controlling for years of education).
- When looking into the focused regression, cortisol accounts for a significant difference in MoCA scores that could not be otherwise explained by demographic data of age, gender, race, or education.
- Finally, the comparison group revealed that race predicted MoCA scores for healthy controls, while cortisol was insignificant (contradictory to our results for MS).

Conclusion

- This study suggests a negative impact of physiological stress on cognitive impairment in MS, while perceived stress appears to play a less significant role.
- Because our measures of physiological and perceived stress did not correlate with each other, we are more certain that these two measures capture distinct aspects of the stress experience.
- Future studies may look to optimize a questionnaire to better capture perceived stress or look beyond cortisol to other physiological measures of stress.

References

1. Benedict RHB, Amato MP, DeLuca J, Geurts JJG. Cognitive impairment in multiple sclerosis: clinical management, MRI, and therapeutic avenues. Lancet Neurol. 2020 Oct;19(10):860-871. doi: 10.1016/S1474-4422(20)30277-5
2. Pereira, G.M., Becker, J., Soares, N.M. et al. Hair cortisol concentration, cognitive, behavioral, and motor impairment in multiple sclerosis. J Neural Transm 126, 1145–1154 (2019). doi.org/10.1007/s00702-019-02040-w

This research project was supported through the LSU Health Sciences Center, School of Medicine.