

# Neuroimaging study sheds light on mechanisms of cognitive fatigue in MS

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A new study by Kessler Foundation scientists sheds light on the mechanisms underlying cognitive fatigue in individuals with multiple sclerosis. Cognitive fatigue is fatigue resulting from mental work rather than from physical labor. Genova H et al: Examination of cognitive fatigue in multiple sclerosis using functional magnetic resonance imaging and diffusion tensor imaging" was published on Nov. 1 in *PlosOne*. This is the first study to use neuroimaging to investigate aspects of cognitive fatigue. The study was funded by grants from the National MS Society and Kessler Foundation.

The study investigated the neural correlates of cognitive fatigue in MS utilizing three neuroimaging approaches: [functional magnetic resonance imaging](#) (fMRI), which allows researchers to look at where in the [brain activation](#) is associated with a task or an experience; [diffusion tensor imaging](#) (DTI), which allows researchers to look at the health of the brain's white matter; and voxel-based morphometry (VBM), which allows researchers to investigate structural changes in the brain. These three approaches were used to examine how likely it is for an individual to report fatigue ("trait" fatigue), as well as the fatigue an individual feels in the moment ("state" fatigue). This study is the first to use neuroimaging to investigate these two, separable aspects of fatigue.

"We looked specifically at the relationship between individuals 'self-reported fatigue and objective measures of cognitive fatigue using state-of-the-art neuroimaging," explained Helen M. Genova, Ph.D., research scientist in Neuropsychology & Neuroscience Research at Kessler

Foundation. "The importance of this work lies in the fact that it demonstrates that the subjective feeling of fatigue can be related to brain activation in specific brain regions. This provides us with an objective measure of fatigue, which will have incalculable value as we begin to test interventions designed to alleviate fatigue."

In Experiment 1, patients were scanned during performance of a task designed to induce cognitive fatigue. Investigators looked at the brain activation associated with "state" fatigue. In Experiment 2, DTI was used to examine where in the brain white matter damage correlated with increased "trait" fatigue in individuals with MS, as assessed by the Fatigue Severity Scale (FSS). The findings of Experiments 1 and 2 support the role of a striato-thalamic-frontal cortical system in fatigue, suggesting a "fatigue-network" in MS.

"Identifying a network of fatigue-related brain regions could reframe the current construct of cognitive fatigue and help define the pathophysiology of this multifaceted yet elusive symptom of MS," said John DeLuca, Ph.D., VP of Research & Training at Kessler Foundation. "Replication of these findings with larger sample sizes will be an important next step."

**More information:** Dobryakova E, DeLuca J, Genova HM, Wylie GR. Neural correlates of cognitive fatigue: cortico-striatal circuitry and effort-reward imbalance. *Int Neuropsychol Soc.* 2013 Sep;19(8):849-53.

Provided by Kessler Foundation

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