

# Signal detection theory may be useful for characterizing cognitive fatigue in multiple sclerosis patients

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Dr. Wylie is the director of the Rocco Ortenzio Neuroimaging Center at Kessler Foundation. Credit: Kessler Foundation

Using signal detection theory, Kessler Foundation researchers have furthered their understanding of the mechanisms of cognitive fatigue in a recent neuroimaging study comparing participants with multiple sclerosis (MS) and controls. Researchers found an association between signal detection theory metrics, subjective "state" fatigue, and brain activation patterns in both groups. The MS group showed greater effects of fatigue as evidenced by their response bias patterns.

These findings were reported in *Frontiers in Behavioral Neuroscience* on March 16, 2022, in the open access article "Signal Detection Theory as a Novel Tool to Understand Cognitive Fatigue in Individuals with Multiple Sclerosis." The authors are Cristina Almeida Flores Román, Ph.D., John DeLuca, Ph.D., Bing Yao, Ph.D., Helen M. Genova, Ph.D., and Glenn Wylie, DPhil, of Kessler Foundation.

Because subjective feelings of cognitive fatigue fail to correlate with objective measures of performance, researchers have sought to identify an objective behavioral measure that co-varies with the subjective experience of fatigue. Prior research at Kessler Foundation showed that signal detection metrics (perceptual certainty and response bias) correlated with changes in cognitive fatigue as well as with activation in the striatum of the [basal ganglia](#)—an area of the [brain](#) Kessler researchers have previously identified as sensitive to changes in cognitive fatigue. They continued their investigation in this study of MS, which is often complicated by symptoms of fatigue, including cognitive fatigue.

The study was conducted at the Rocco Ortenzio Neuroimaging Center at Kessler Foundation, which is dedicated solely to rehabilitation research. Researchers used a demanding working memory paradigm to induce cognitive fatigue in 50 participants, 30 with MS and 20 controls. All participants underwent structural and functional magnetic resonance imaging (fMRI) and were assessed using the visual analog scale of fatigue (VAS-F) at baseline and after each block of the tasks.

"We demonstrated that response bias was related to subjective state fatigue in MS," said lead author Dr. Román, National MS Society postdoctoral fellow at Kessler Foundation. "This reinforces our previous finding of the same relationship in controls and provides additional support for this signal detection theory metric as an objective measure of cognitive fatigue."

Cognitive fatigue is a feature of many neurodegenerative conditions, including MS, according to Dr. Wylie, director of the Ortenzio Center. "By building on this promising avenue of

research, we are establishing the basis for a new set of tools," he explained, "which will help us develop effective interventions for treating this disabling condition in a wide range of individuals and ameliorate its impact on their daily functioning, employment, and quality of life."

**More information:** Signal Detection Theory as a Novel Tool to Understand Cognitive Fatigue in Individuals with Multiple Sclerosis, *Frontiers in Behavioral Neuroscience* (2022). DOI: [10.3389/fbeh.2022.828566](https://doi.org/10.3389/fbeh.2022.828566)

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