

real-time) using ecological momentary assessment (EMA).

Participants and Methods: Forty-five persons with MS completed EMA four times per day for three weeks. For each EMA, participants completed mobile versions of the Trail-Making Test part B (mTMT-B) and a finger tapping task, as well as surveys about symptom severity. Trait (usual levels of a symptom) and state (when symptom level was higher or lower than the individual's usual levels) aspects of each symptom's severity were calculated. Multilevel models were conducted to account for within-person clustering, with performance on the mTMT-B and self-reported rating of cognitive dysfunction as primary outcomes.

Results: A total of 3,174 EMA sessions were collected; compliance rate was 84%. There was significant intra-day variability in mTMT-B performance, anxiety, fatigue, and pain. More severe state depressive symptoms predicted lower performance on the mTMT-B in real-time. Self-reported difficulties with sleeping the night before predicted mTMT-B performance the following day. In contrast, state (but not trait) fatigue, depression, anxiety, and pain all predicted self-reported cognitive dysfunction in real time. Further, state self-reported cognitive dysfunction (but not mTMT-B performance) was associated with a higher perceived sense of accomplishment.

Conclusions: Self-reported cognitive dysfunction was more susceptible to influences of other MS symptoms (especially when the symptom is more severe than the individual's usual levels) and better predicted perceived sense of accomplishment than objectively measured executive functioning in real-time. Objective executive functioning performance was sensitive to effects of depressive symptoms and sleep difficulties. The current study demonstrated the feasibility of assessing real-time associations among MS symptoms using smartphone-administered EMA.

Categories: Multiple Sclerosis/ALS/Demyelinating Disorders

Keyword 1: cognitive functioning

Keyword 2: technology

Keyword 3: teleneuropsychology

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43 Symptoms of Apathy in Older Adults with Multiple Sclerosis

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Objective: Multiple sclerosis (MS) is a chronic neurodegenerative autoimmune disease of the central nervous system. Apathy is significantly higher in adults with MS compared to healthy populations. Apathy is a lack of motivation that can cause dysfunctions in each step of goal-directed behaviors. Apathy is associated with diminished ability to perform activities of daily living, tasks requiring normal executive function, and quality of life. Across various neurodegenerative disorders, apathy has been regarded as a predictor of poor cognition and functional outcomes. However, the severity of apathy and its association with cognitive function in older adults with MS have not been reported. This study's objective was to address this gap of knowledge. Hence, we evaluated: 1) the severity of apathy symptoms in older adults with MS compared to healthy older adults and, 2) the association of apathy symptoms and global cognitive functioning in older adults with MS compared to controls.

Participants and Methods: Participants were community-residing older adults (age ≥ 60 ys) enrolled in a cohort study, "Brain Predictors of Mobility and Falls in Older Adults with Multiple Sclerosis." Healthy controls (n=59; mean age=66.25 \pm 3.37; %female=47.5) and persons with MS (n=69; mean age=64.58 \pm 3.88; %female=62.3) were included in the analysis. Using McDonald criteria, MS diagnosis was physician-confirmed by medical record review, apathy symptoms were assessed through 4 apathy symptom questions on the 30-item Geriatric Depression Scale (GDS), and global cognitive functioning was assessed using the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Covariates included age, gender, years of education, global health score (GHS), and depression (GDS w/out apathy questions). For the first objective, a linear regression model was used with a bi-level group status variable (MS vs controls) serving as a predictor of apathy symptoms. For the second objective, two linear regression models stratified by group status were run with apathy symptoms as a predictor of global cognitive functioning.

Results: The presence of MS was significantly associated with worse apathy ($\beta=.34$, $p < .001$) and it remained significant after adjusting for covariates ($\beta=.19$, $p=.03$). Additionally, apathy was negatively associated with global cognition in persons with MS ($\beta=-.32$, $p=.01$) and this association remained significant after adjusting for covariates ($\beta=-.33$, $p=.01$) except depression ($\beta=-.27$, $p=.08$). The association of apathy and global cognitive functioning was not significant in healthy controls ($\beta=.01$, $p=.95$).

Conclusions: This study is the first to report worse apathy symptoms in older persons with MS compared to healthy controls. Additionally, worse apathy symptoms were associated lower global cognitive functioning in older adults with MS but not in healthy controls.

Categories: Multiple

Sclerosis/ALS/Demyelinating Disorders

Keyword 1: apathy

Keyword 2: cognitive functioning

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44 Low Modularity Contributes to Reduced Semantic Network Organization in Multiple Sclerosis

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Objective: Word finding difficulty is a prevalent cognitive symptom in multiple sclerosis (MS). Word finding relies on retrieving concepts and word forms from the long-term store.

Neuropsychological assessment of word finding difficulty in persons with MS (pwMS) is typically characterized by semantic errors and decreased speed in naming tests, along with decreased semantic verbal fluency scores. Despite this, there is significant heterogeneity in the detection of verbal fluency deficits across studies in the MS literature. This may be partially due to disease-related heterogeneity and/or low sensitivity of commonly used scoring approaches. We investigate the latter in the present study.

Semantic network analysis, derived from graph theory, provides a fine-grained approach to understanding semantic retrieval by utilizing information about the co-occurrence of words produced on semantic verbal fluency tasks.

Analysis results in a graphical quantification of the conceptual-lexical store. A preliminary study found that semantic networks from Spanish-speaking pwMS had fewer associative connections and more central connective pathways, which if affected, may lead parts of the network to become inaccessible for retrieval. However, their investigation was limited in the generalizability of their findings, as they excluded pwMS who have cognitive impairment (CI), which represents a significant proportion of pwMS. We sought to investigate network differences in an English-speaking MS sample, without exclusion based on CI, using widely-used metrics of micro-, meso-, and macroscopic structure. We hypothesize the MS network will be less efficiently organized, thus characterized by higher average shortest path length (ASPL), lower clustering coefficient (CC) and lower modularity (Q).

Participants and Methods: 53 persons with MS and 44 neurologically healthy controls (HC) were recruited as a part of an ongoing study (NMSS RG-1907-34364 & RG-1901-33304). As a part of a larger battery, participants were administered the semantic verbal fluency subtest of the Controlled Oral Word Association Test. Responses were analyzed using a network-analysis R suite.

Results: The MS and HC networks were characterized by having similar average shortest path lengths (ASPL MS = 2.466, ASPL HC = 2.463, $F(1,1997)=0.281$, $p=0.596$), indicating they require similar numbers of edges to be traversed to reach other nodes in the network. This suggests similar efficiency of information transfer. Clustering coefficient was not significantly different between the MS and HC networks (CC MS = 0.742, CC HC = 0.742, $F(1,1997)=0.10$, $p=0.919$), suggesting similar local interconnectivity. The MS network had significantly lower modularity compared to the HC network (Q MS = 0.497, Q HC = 0.502, $F(1,1997)=16.678$, $p<0.001$). This means that sub-communities of the network were less segregated into densely connected sub-graphs.

Conclusions: Contrary to expectation, ASPL and CC were not significantly different between groups. The absence of finding lower CC was consistent with prior findings. Consistent with our hypothesis, the MS network had lower modularity. This may suggest that pwMS were unable to use categorical clustering to aid in retrieval from the lexicon. Specifically, low modularity coupled with similar CC may suggest the structure of the MS lexicon is characterized