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Statistical Modeling of Multiple Sclerosis Patients' Cognitive Data

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Multiple Sclerosis (MS) is a devastating autoimmune disease that affects a person's physical and cognitive function. Immune system cells which normally attack pathogens and foreign cells instead target the nerves of the central nervous system. The myelin sheaths of nerve cells are left scarred and inflamed, lessening their ability to transmit electrical impulses. An attack on such an important and fundamental body system leads to a broad and complex set of symptoms: difficulty walking, worsened hand dexterity, loss of memory, slowed processing speed, and the like. MS and its effects on cognition are still not fully understood and many studies have and continue to be conducted on their relationship. Previous models of cognition have found links to depression, fatigue and anxiety as well as measures of disease progression (Beier, et al., 2015; Bol et al., 2010; Chiaravalloti & DeLuca, 2008; D'Alisa, et al., 2006; Göksel Karatepe, et al., 2011; Nunnari, et al., 2015; Sanfilipo, et al., 2006).

This study created predictive regression models for MS patients' cognitive function on previously collected data. Data was obtained from the Accelerate Cure Project's online survey site iConquerMS™. Collection of data was self-reported and gathered through online surveys made of free-response and Likert scale questions. The intent was to find predictors of cognition in a large sample applicable to the general population of MS patients in the US. Along with variables previously considered by other studies, there was interest in Body Mass Index (BMI) and fitness variables measured by self-reported quantities of strenuous, moderate, and mild exercises in one week.

Excel files were entered into SAS, and data was cleaned. Univariate, bivariate, and regression analysis were then performed on the cleaned data. Two extreme outliers were removed for having disparate cognition and communication ability scores that did not follow general trends in the data. This left the final sample size at 1079 which was split into two groups: 60% for training the model and 40% for testing the model. Selection of the model followed a best subsets approach in which a model with an R2 of 0.574 and 3 variables was chosen. The R^2 associated with the test data was 0.552, showing little loss in predictive power.

The final model for predicting cognitive scores contained three variables: communication ability, anxiety, and fatigue. The predictive power of anxiety and fatigue are consistent with previous findings in the literature, but communication ability is not as common. Chiaravalloti and DeLuca (2008) found that impairment of oral motor ability had a significant impact on cognition for MS patients. It is unknown whether the relative significance for communication ability occurred in our data because there is a connection between cognition and communication ability or if similarities in survey responses lead to measuring the same response twice. Fitness variables were not included possibly due to the inaccuracy of measurements.

This study includes two additional analyses: an examination of the reasons why participants drop off on repeated surveys and a regression analysis of the MSOAC placebo database for cognitive test scores. Future studies could investigate the relationship between communication and the cognitive ability of MS patients.

*This scholar and faculty mentor have requested that only an abstract be published.