

# Multiple Sclerosis Treatment Effectiveness

Rea Burla

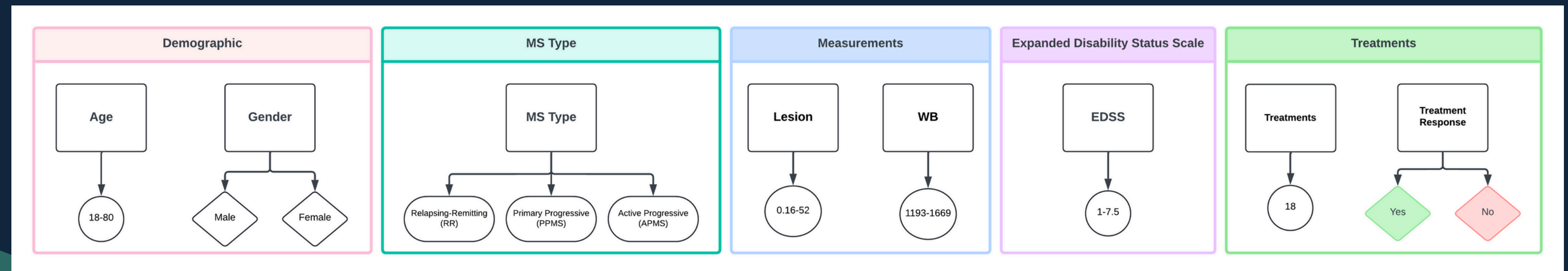
We examine the effectiveness of various Multiple Sclerosis (MS) treatments using several key metrics and patient characteristics, based on a dataset of 528 MS patients.

# Dataset

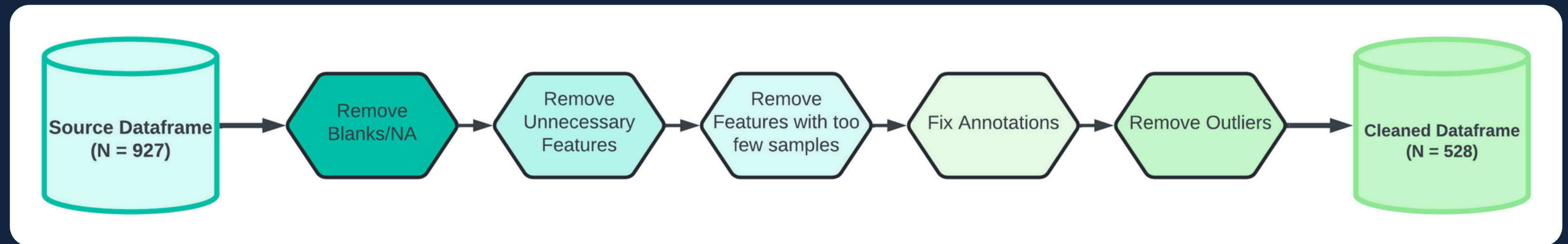
(Post-Cleaning)

The Dataset includes MS patients with various demographic and clinical characteristics.

This allows for analysis of treatment effectiveness across different patient profiles, MS types, and disability levels, providing valuable insights for personalized MS management strategies.

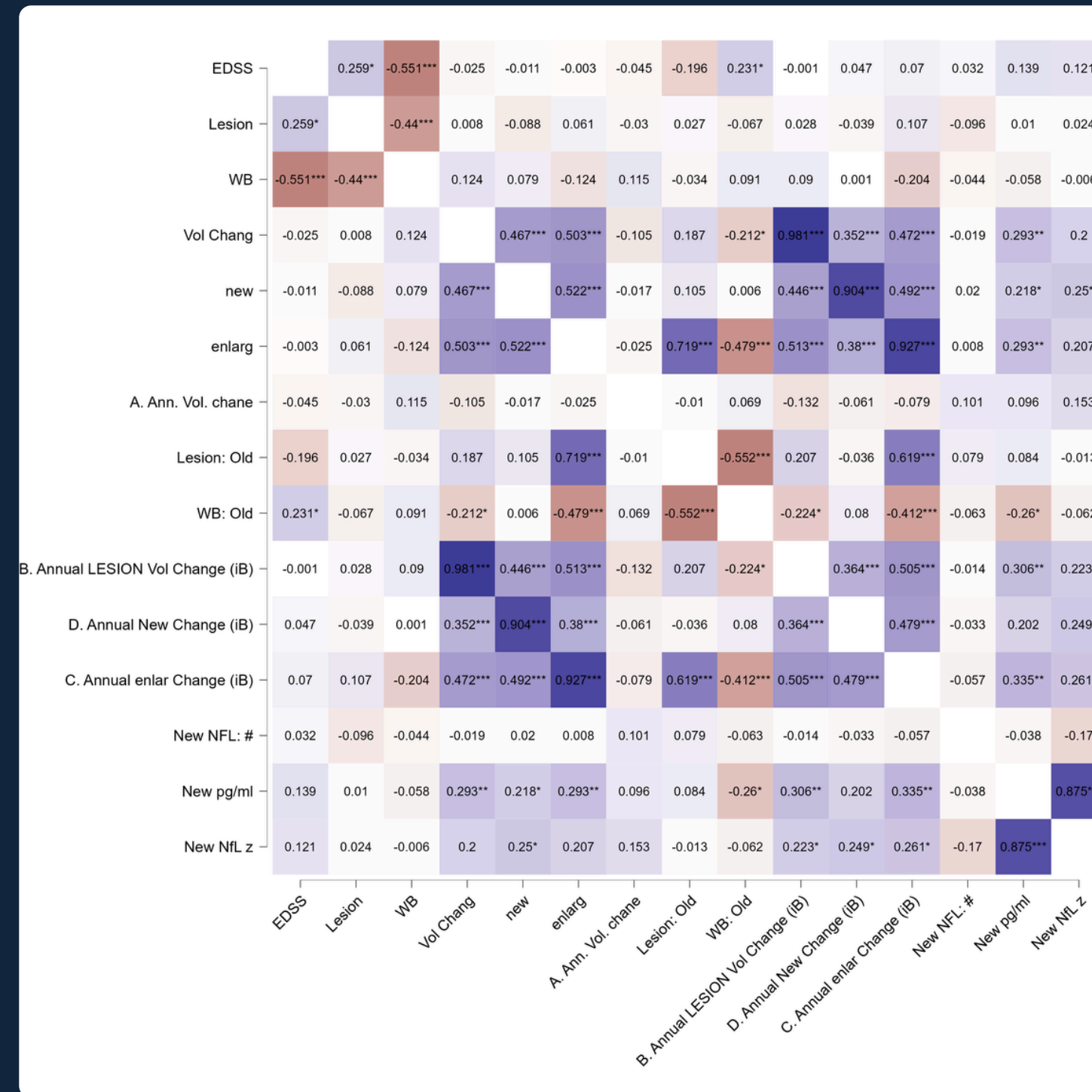


# Data Cleaning



# Data Cleaning

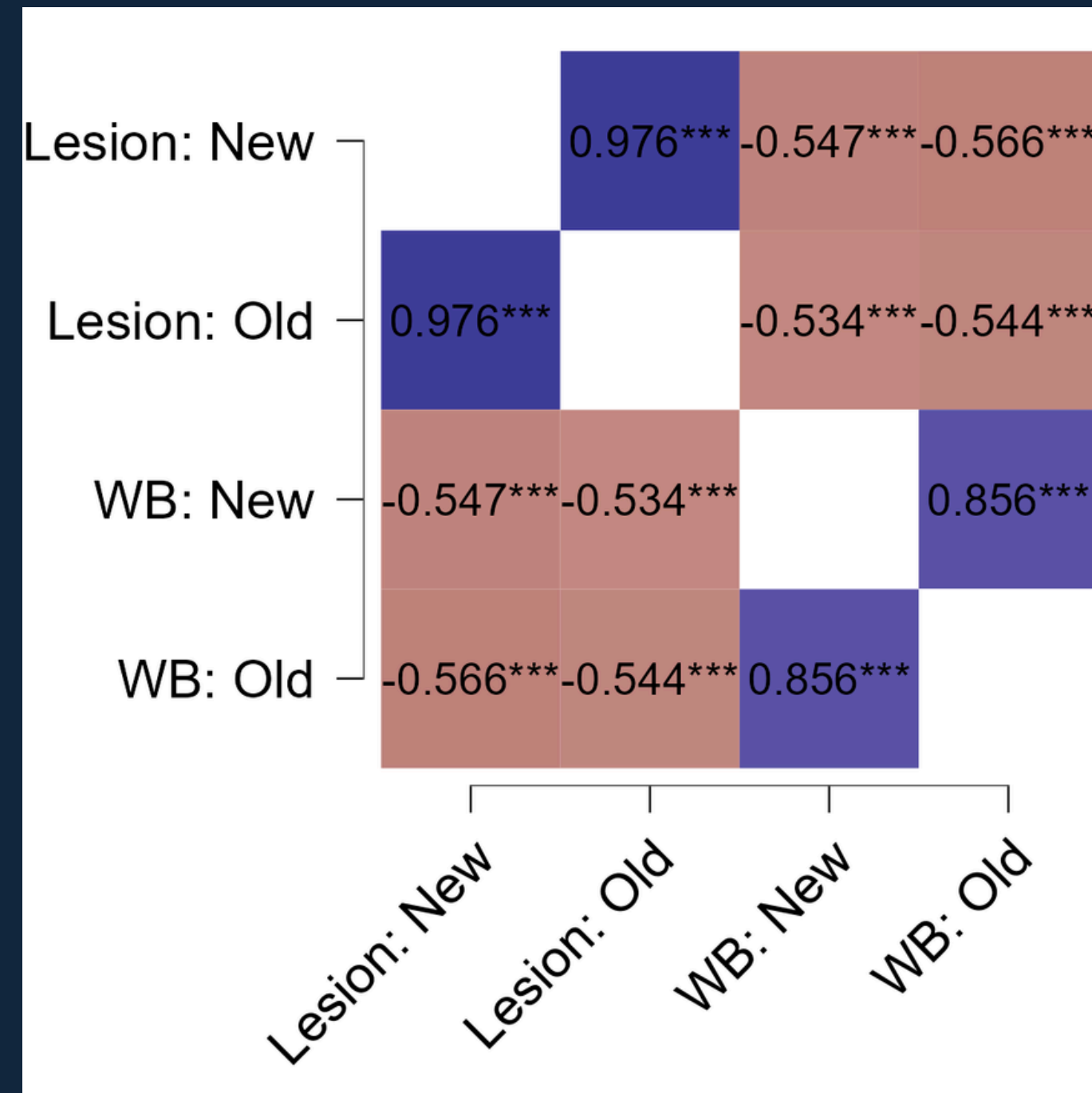
## Spearman correlations



Removing features with high collinearity, or with too few samples ( $N < 500$ )

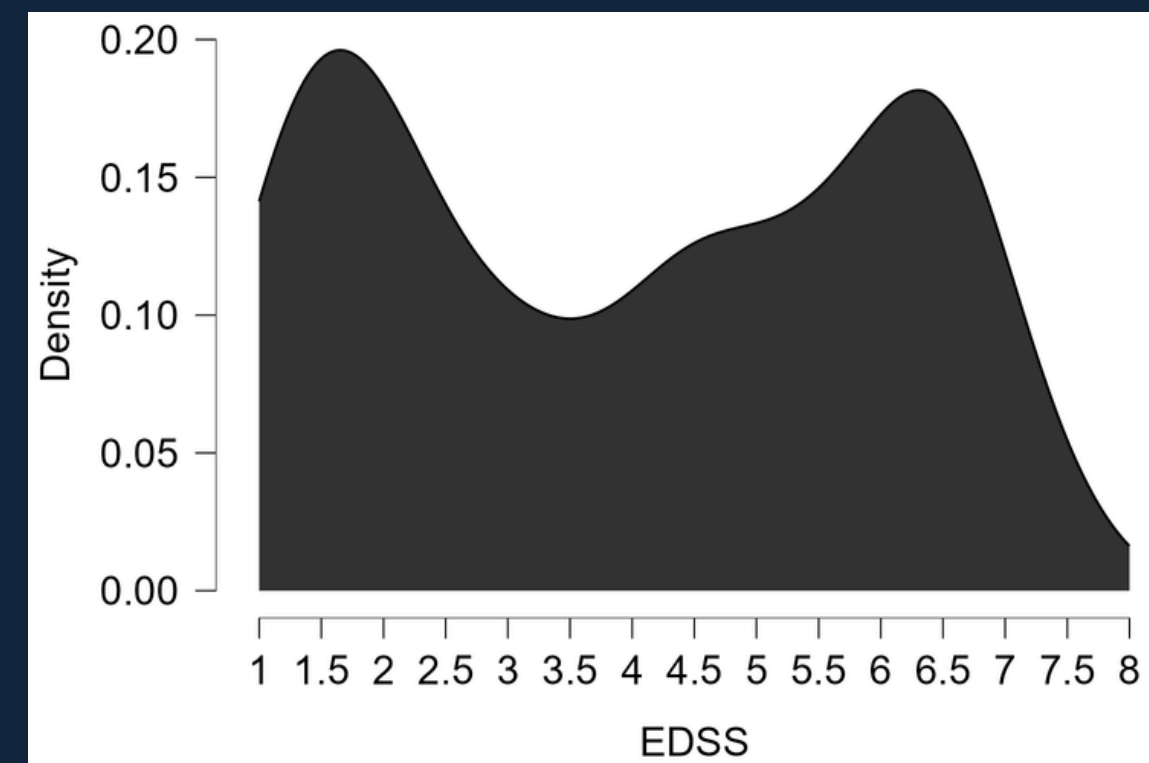
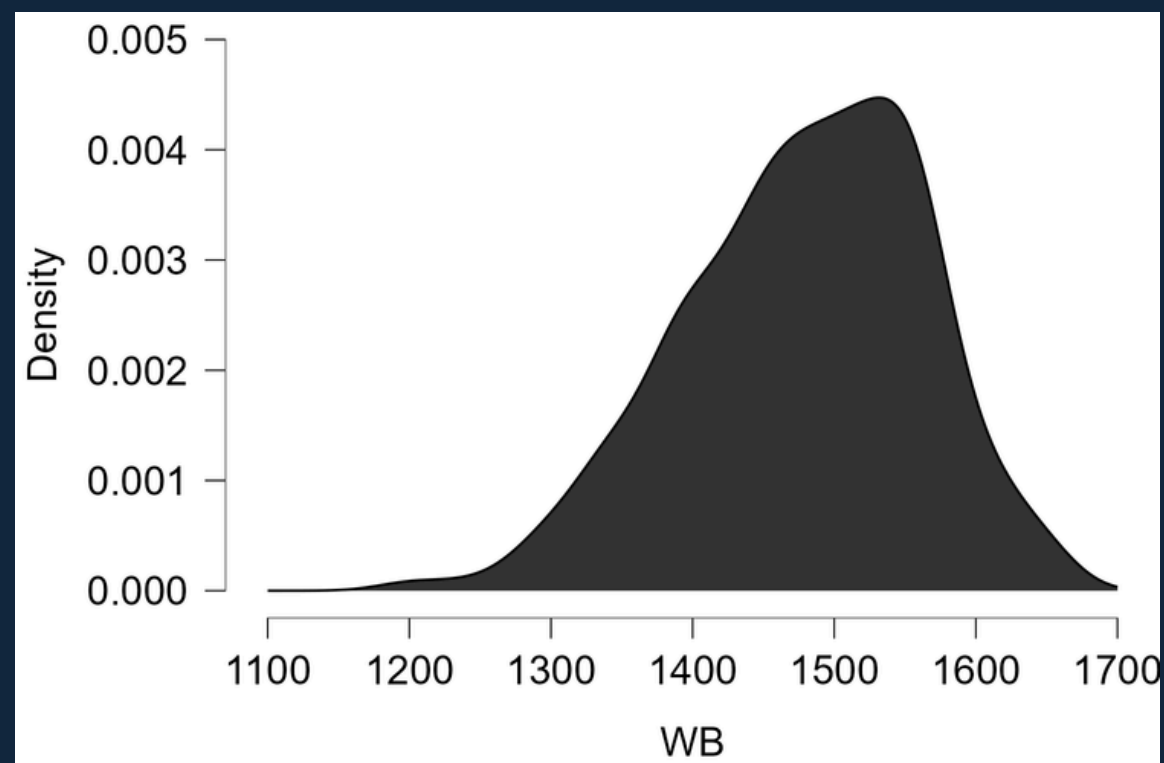
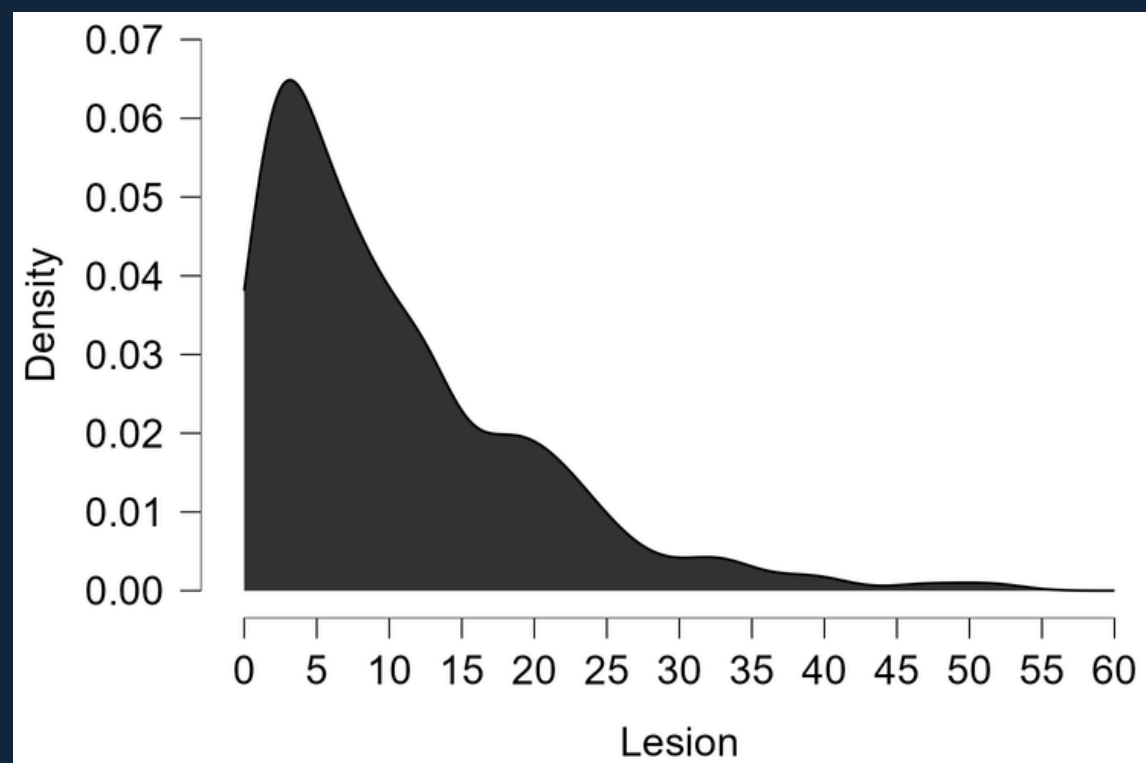
# Data Cleaning

Spearman correlations



Due to high collinearity, we keep only the current/new measurements

# Data Distributions

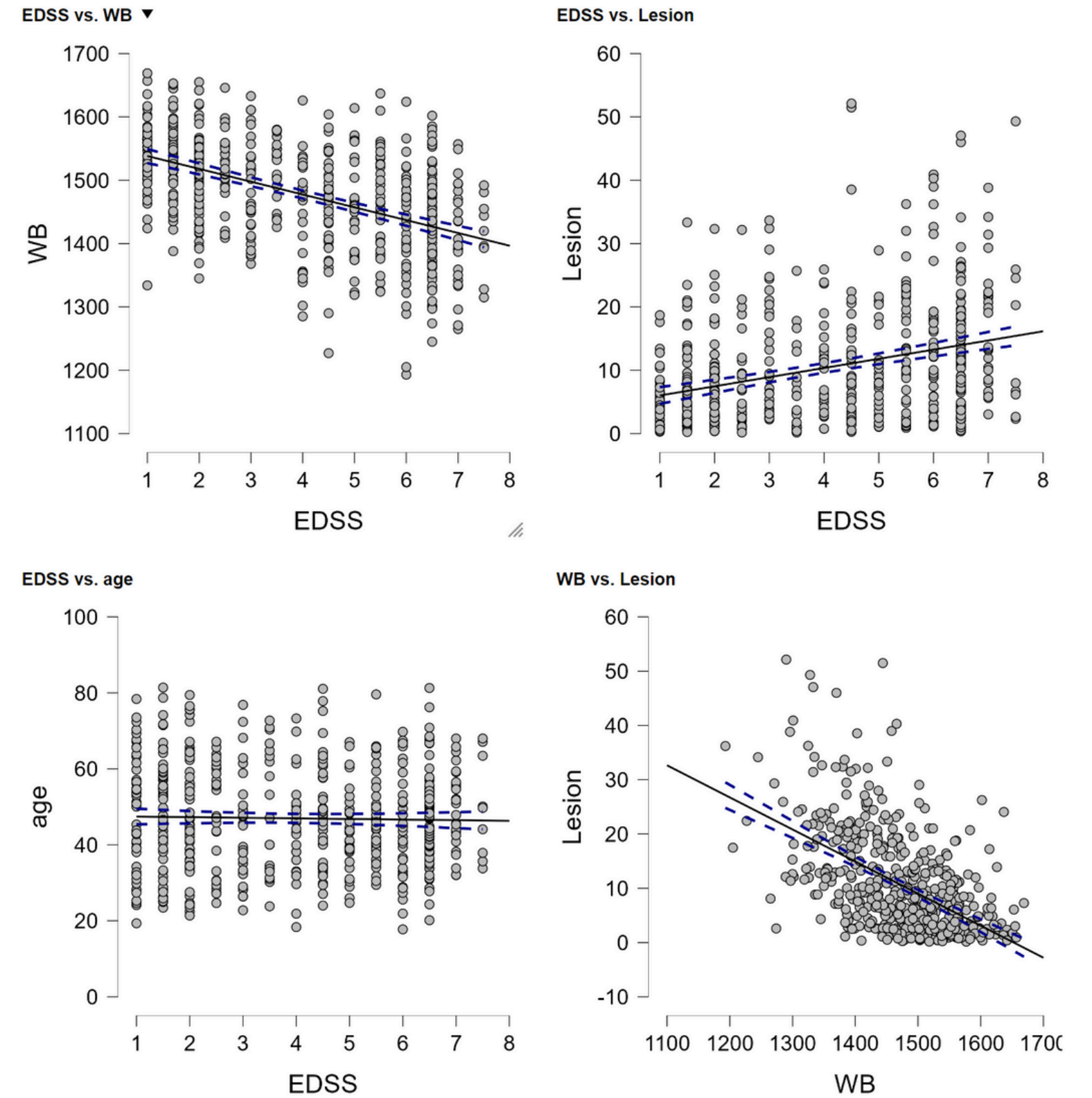
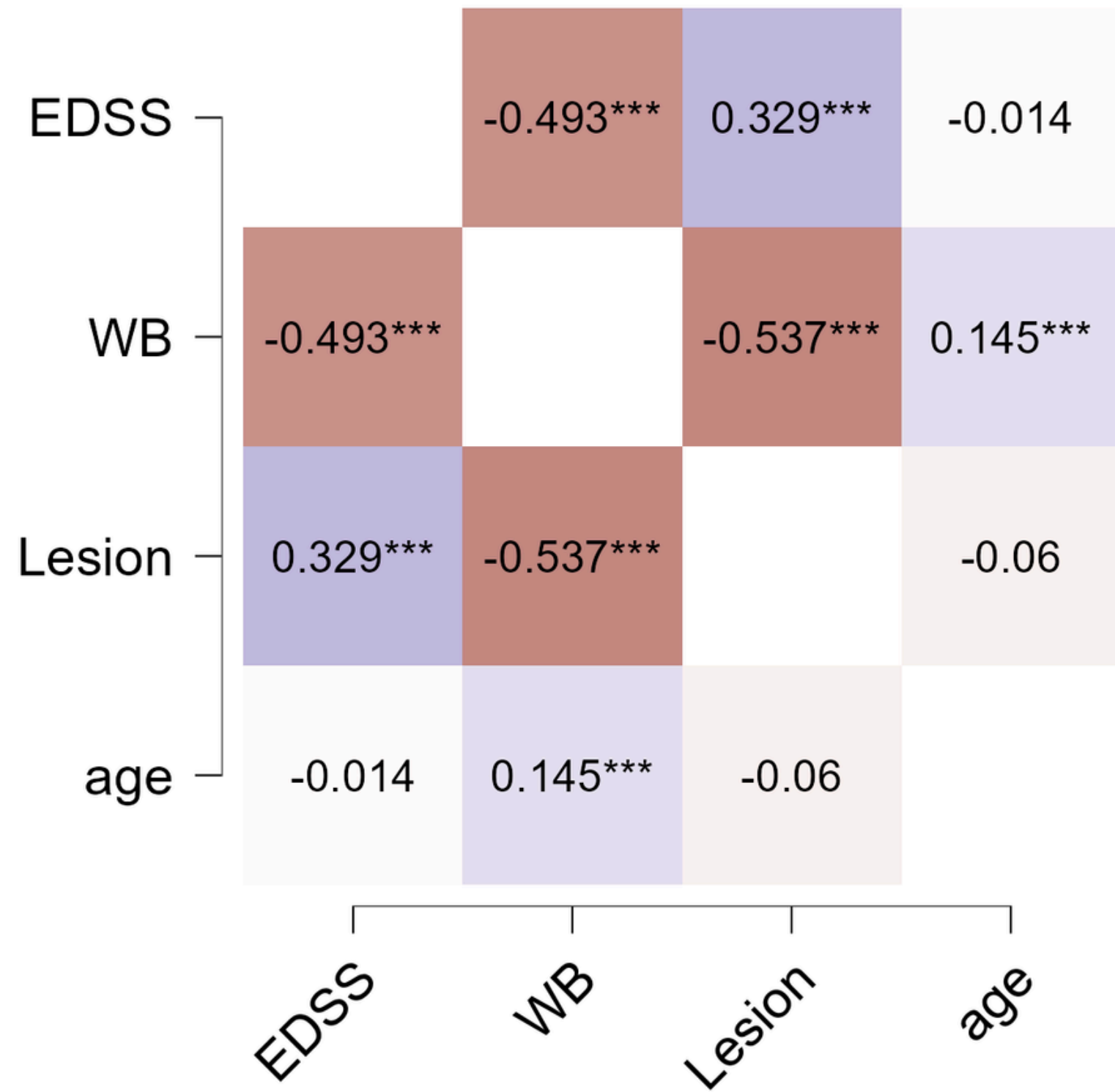


EDSS

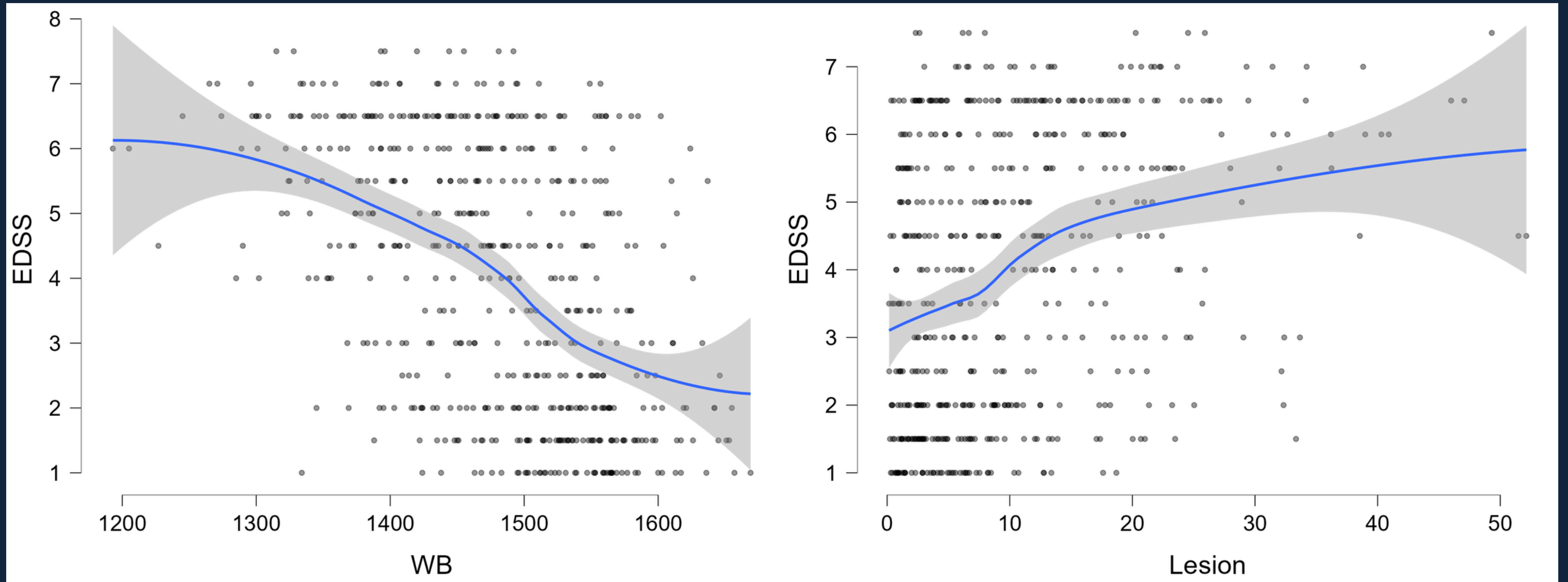




## EDSS – Correlations

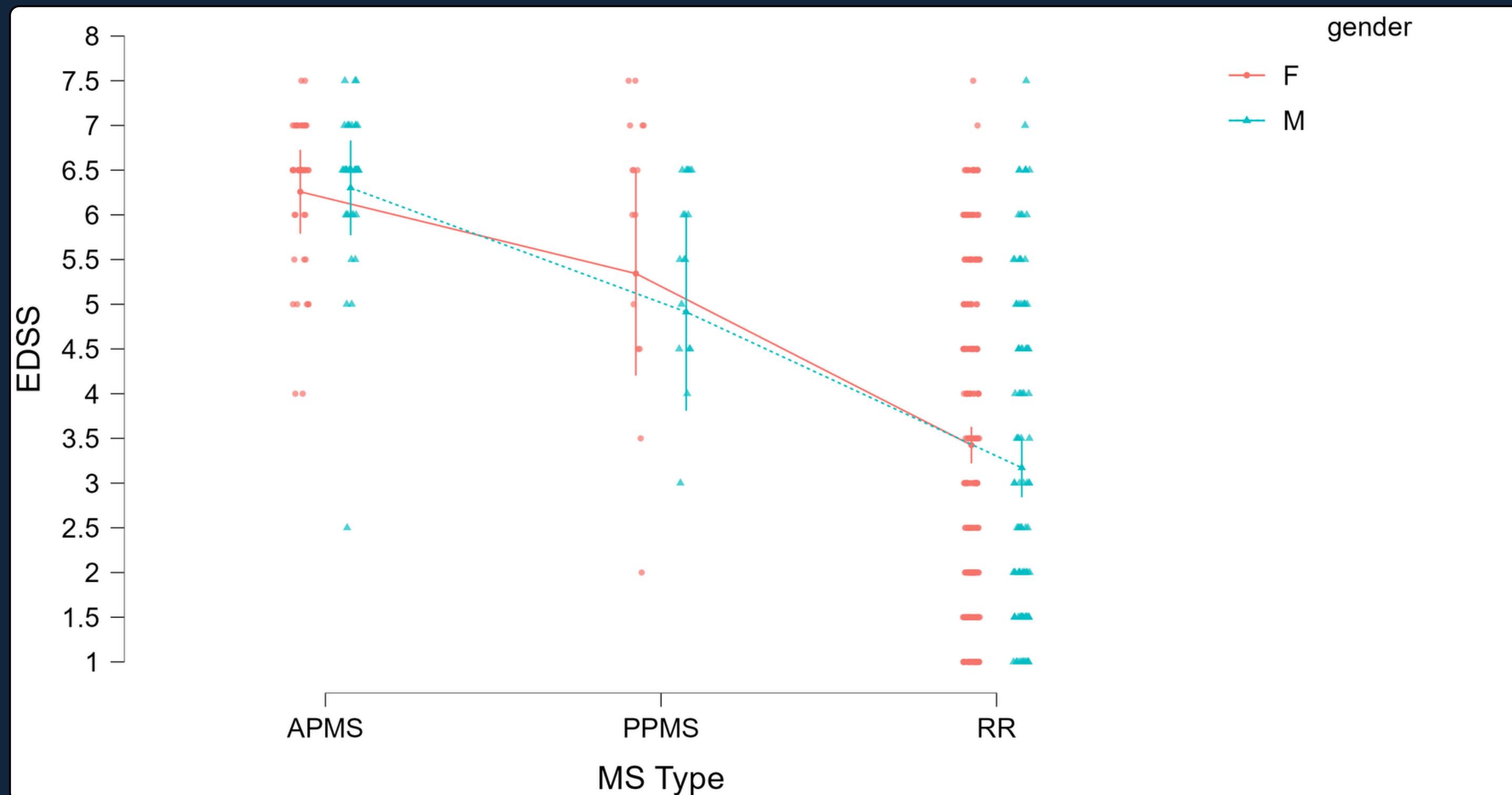


## EDSS - Scatterplots



# Predicting EDSS by MS Type and Gender

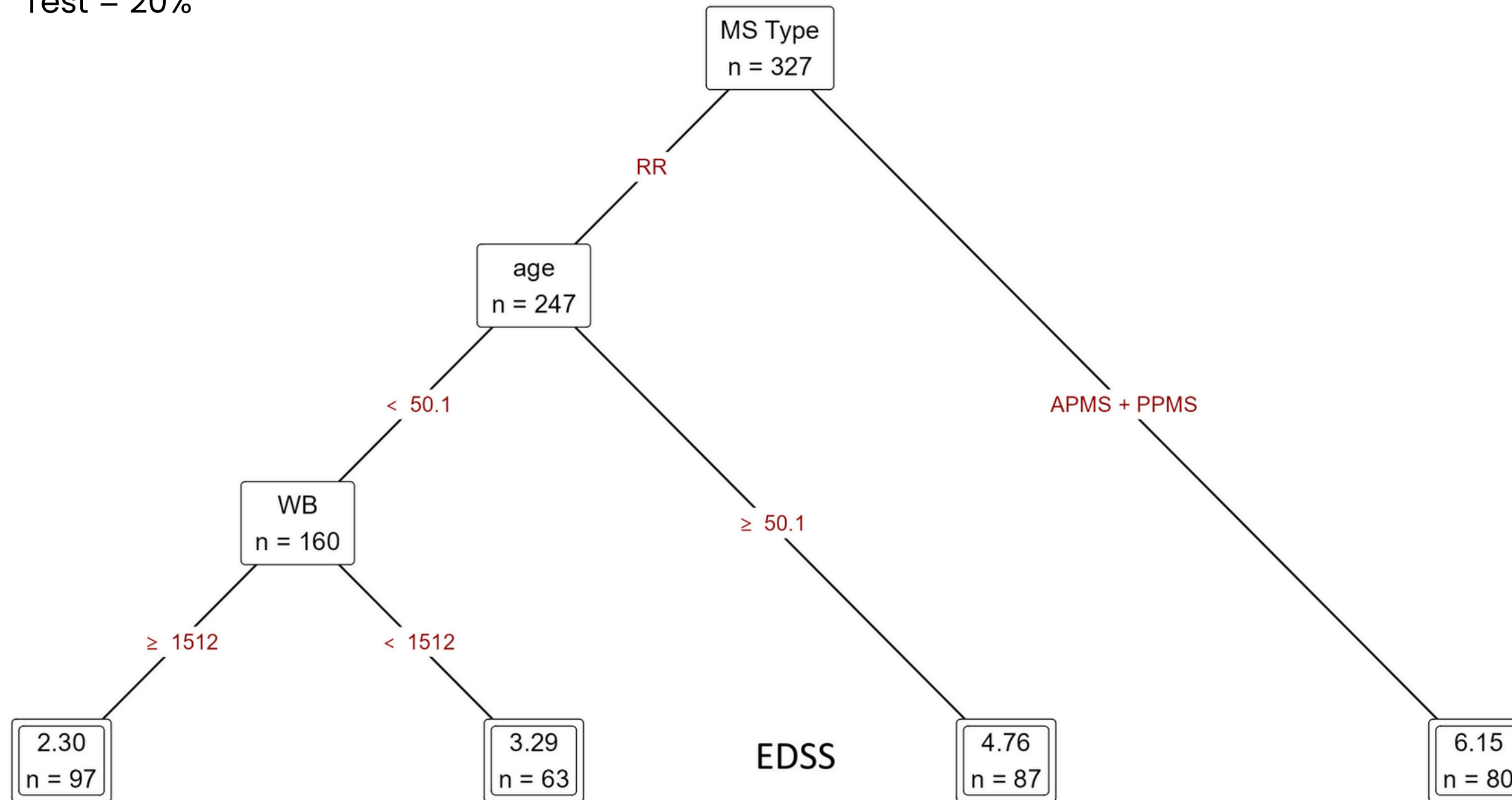
Generalized Linear Mixed Model (CI=95%)



## EDSS Prediction (CI=100%)

Train = 80%

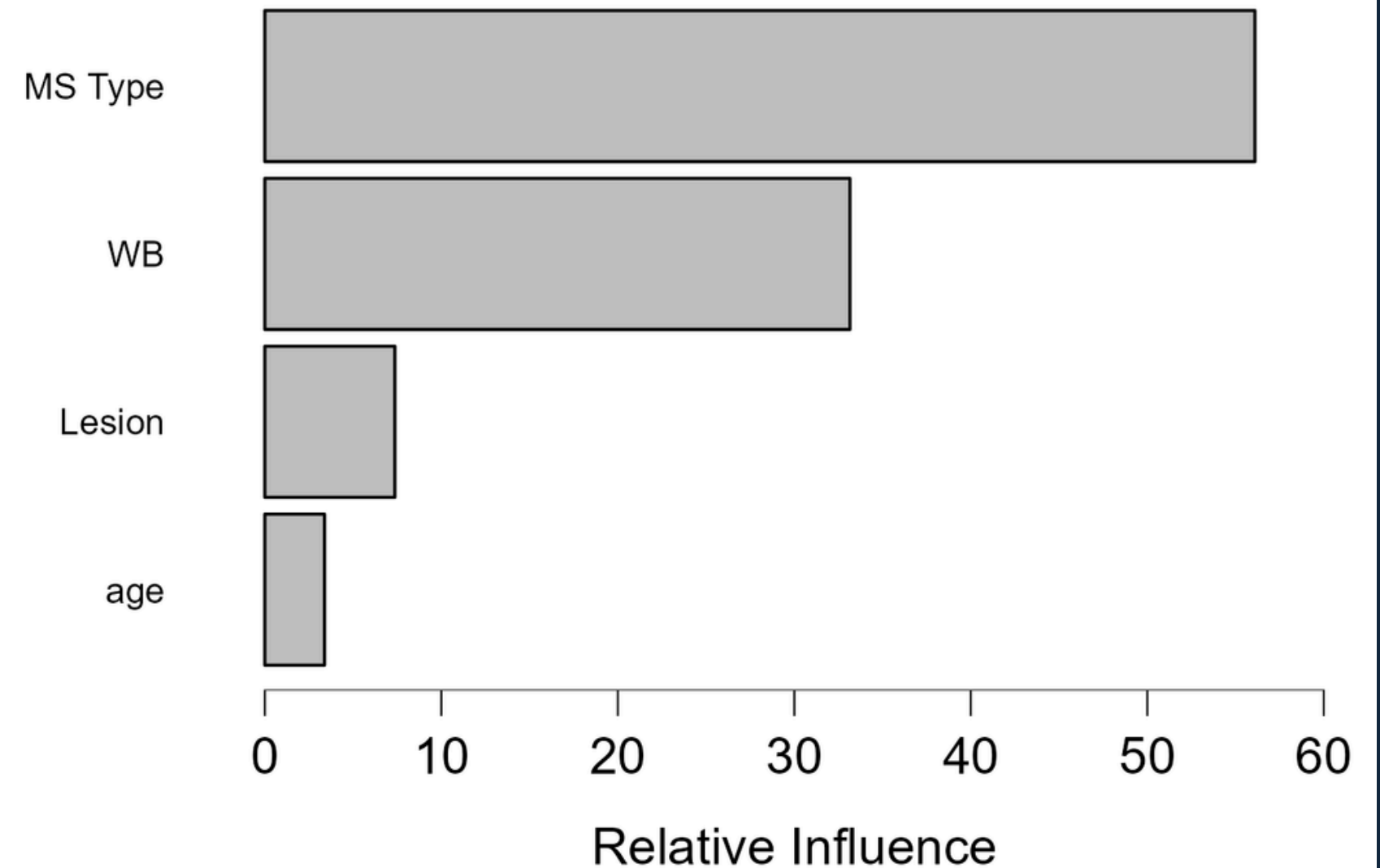
Test = 20%



## Model Evaluation

### Model Performance Metrics ▼

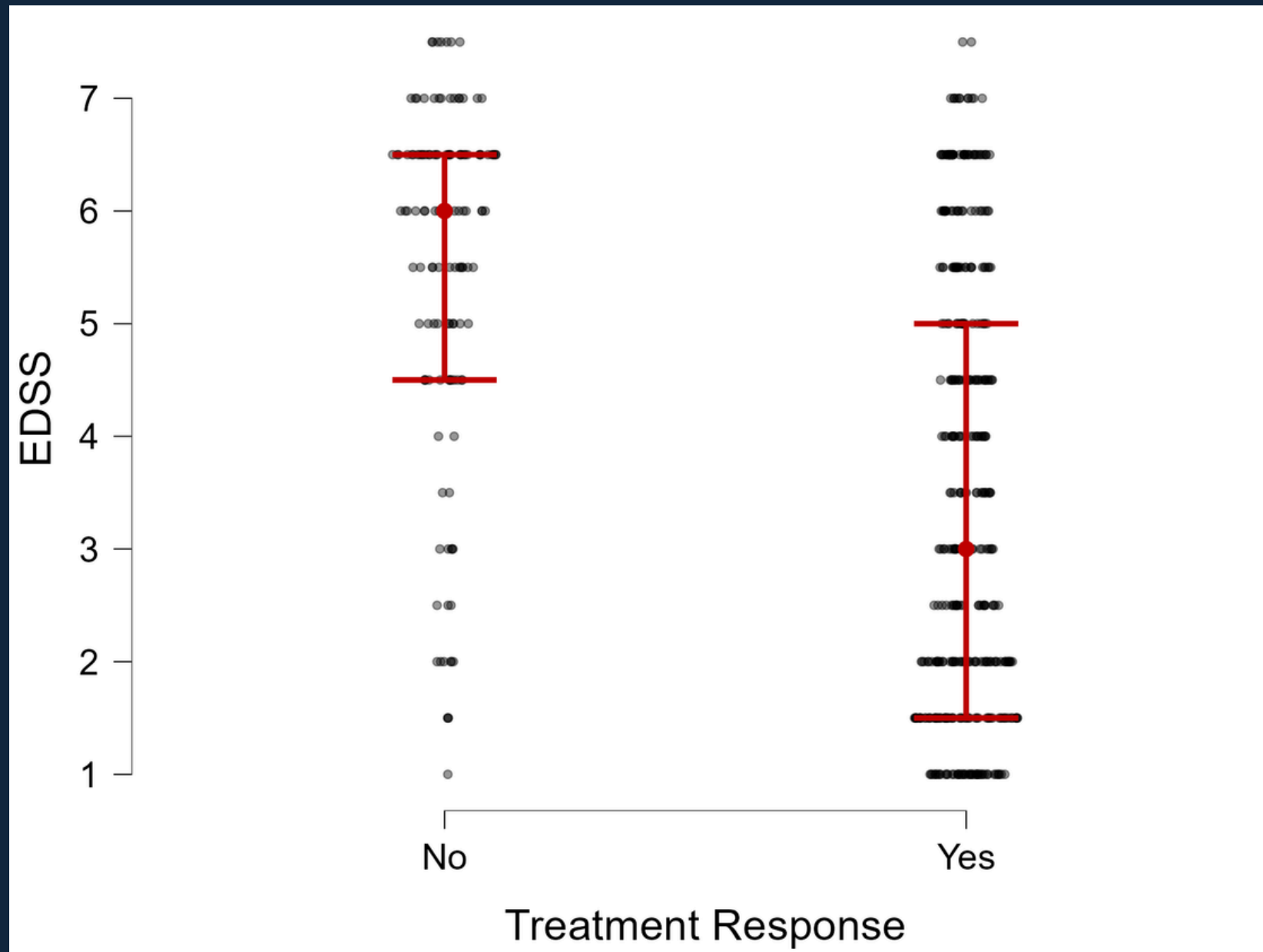
	Value
MSE	1.985
RMSE	1.409
MAE / MAD	1.133
MAPE	45.35%
R <sup>2</sup>	0.581



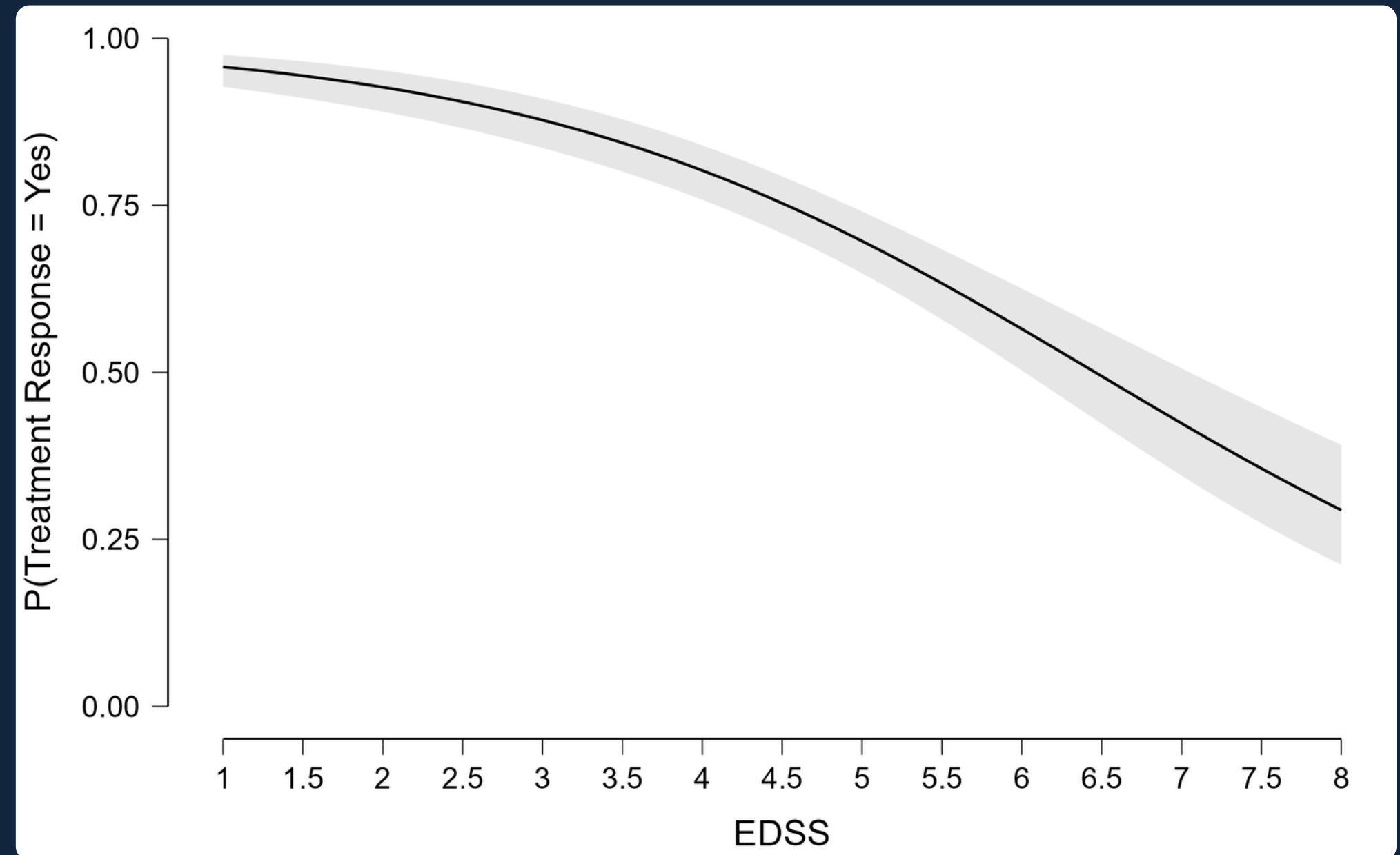
Model predictions error is around  $\pm 1.4$  (RMSE)

## EDSS and Response to Treatments

Mann-Whitney :  $p < 0.001$

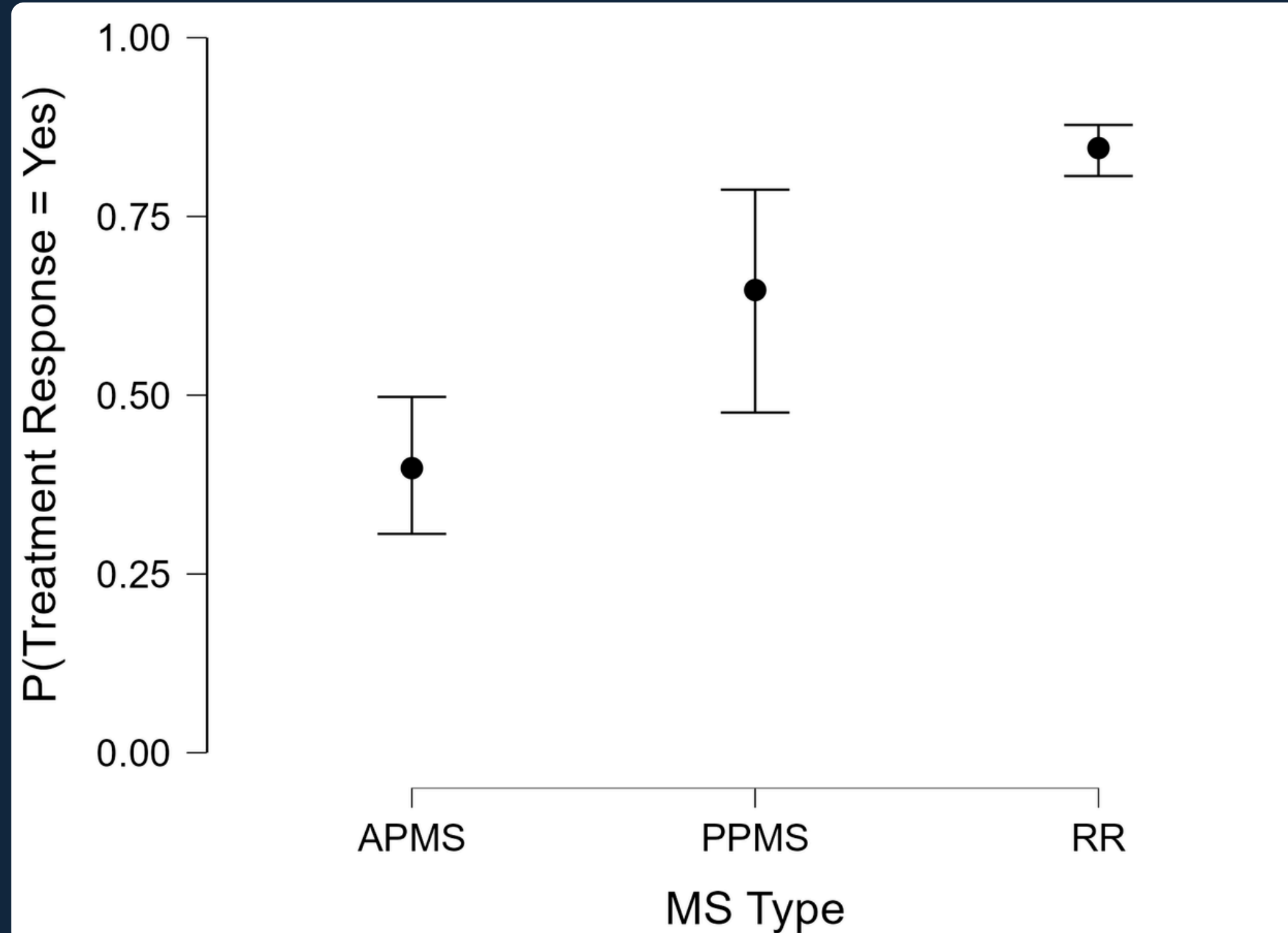


Logistic Regression (CI=95%)

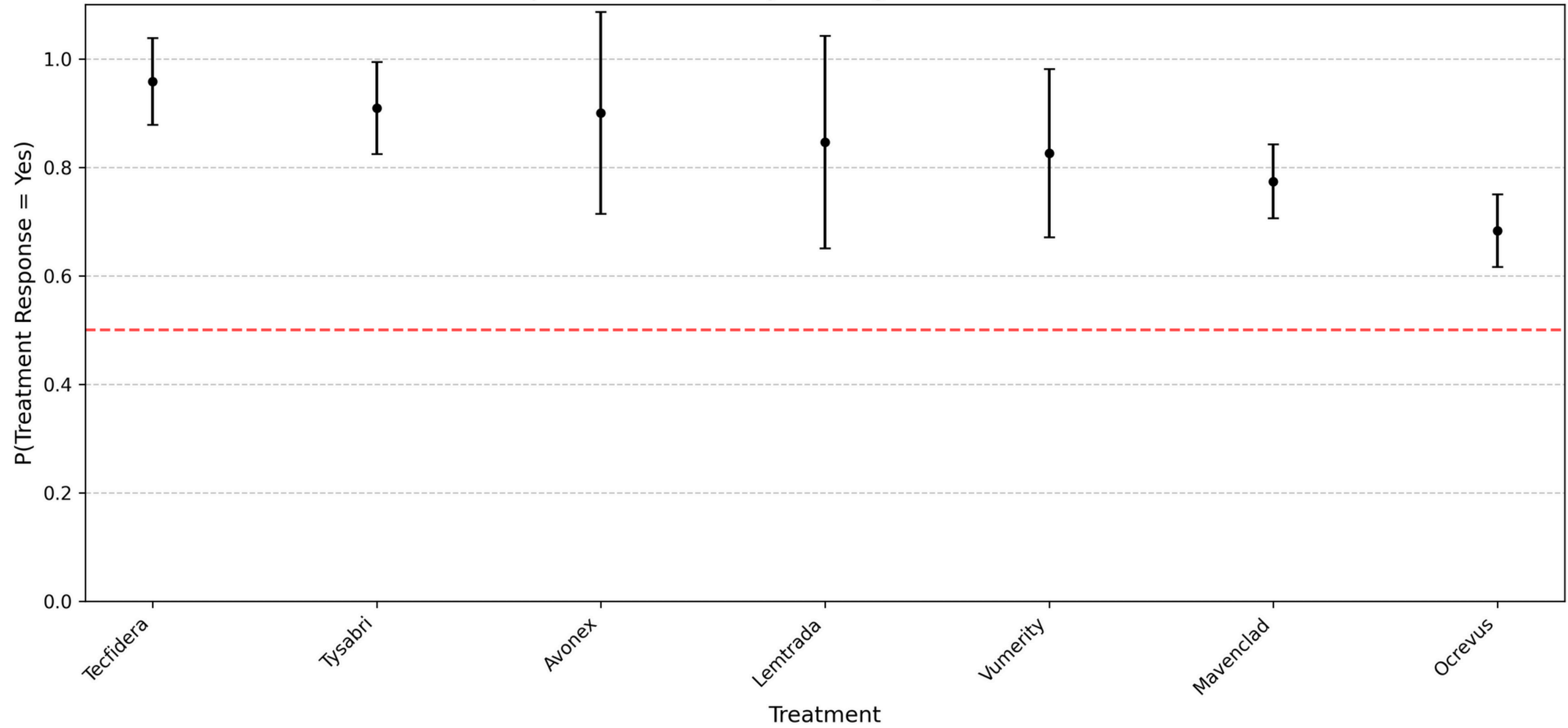


## Response to Treatments by MS Type

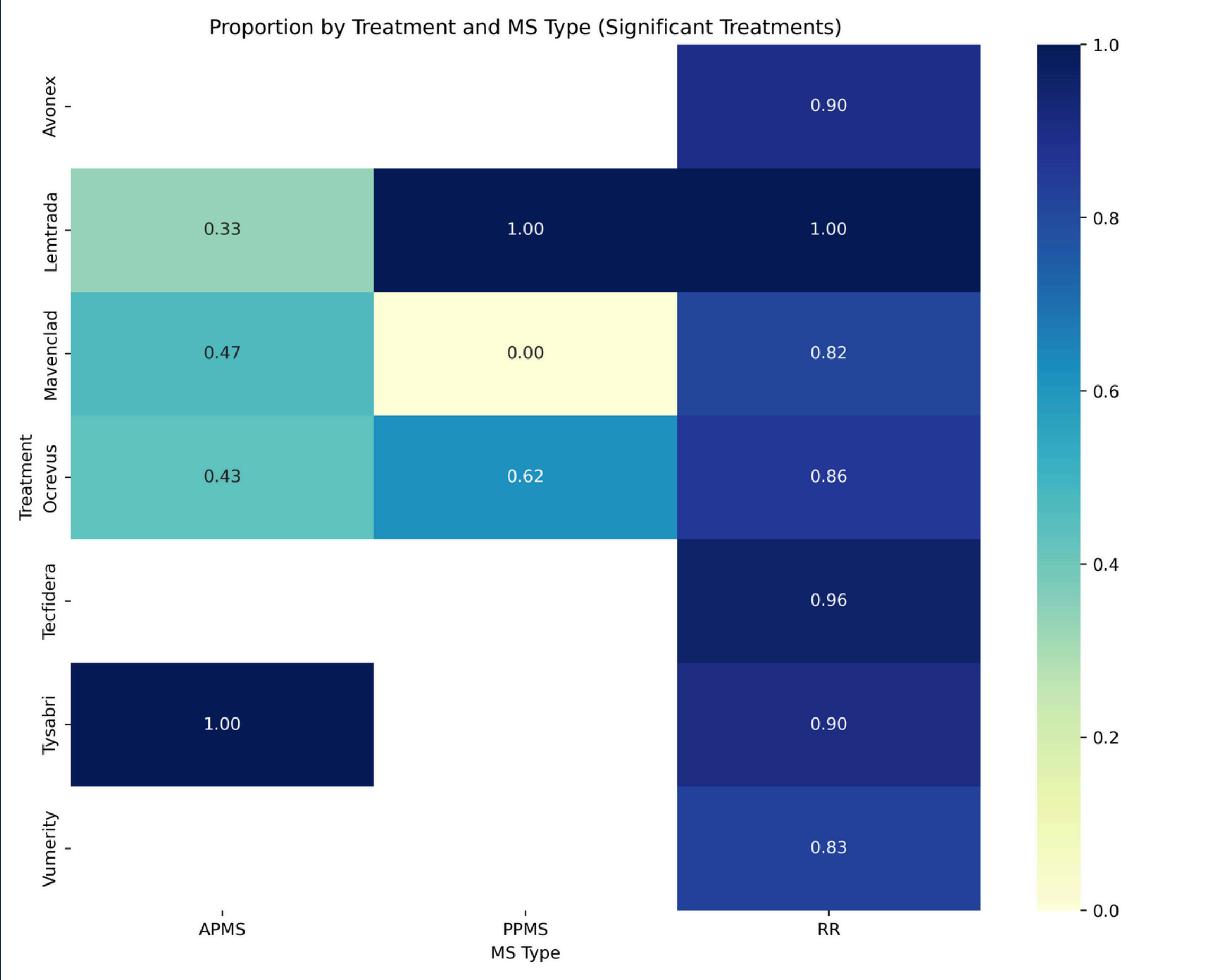
Logistic Regression (CI=95%)



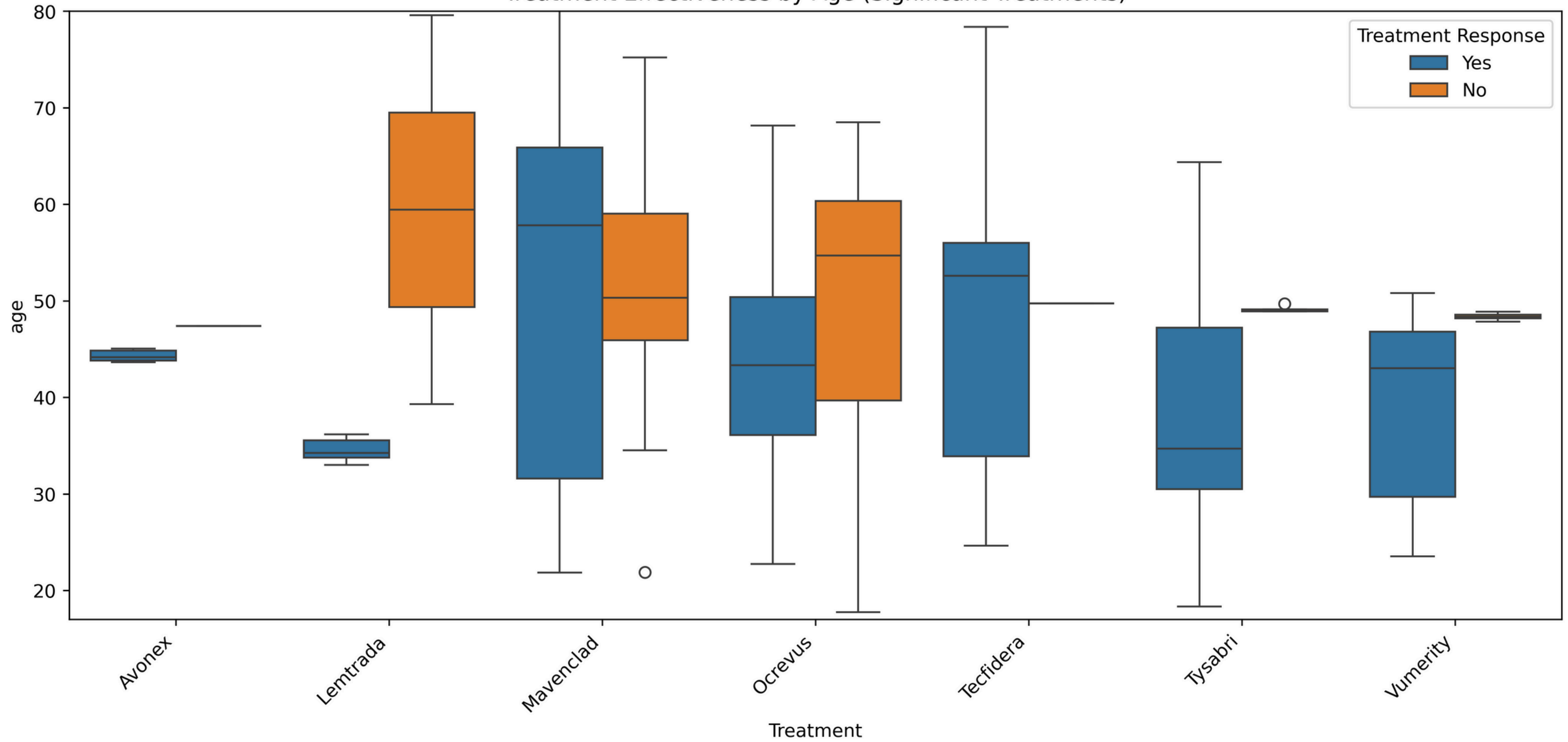
Response Probability for Significant Treatments



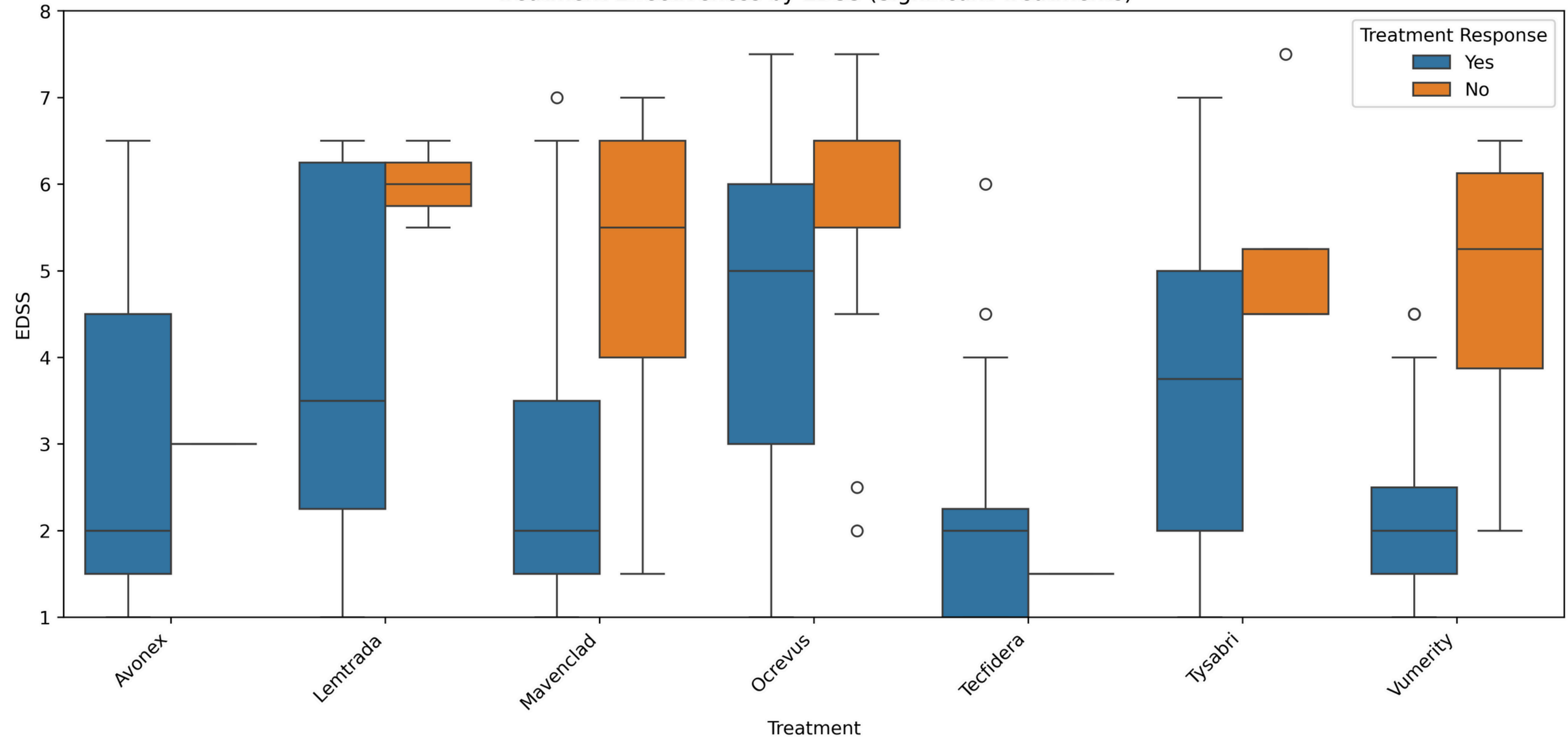


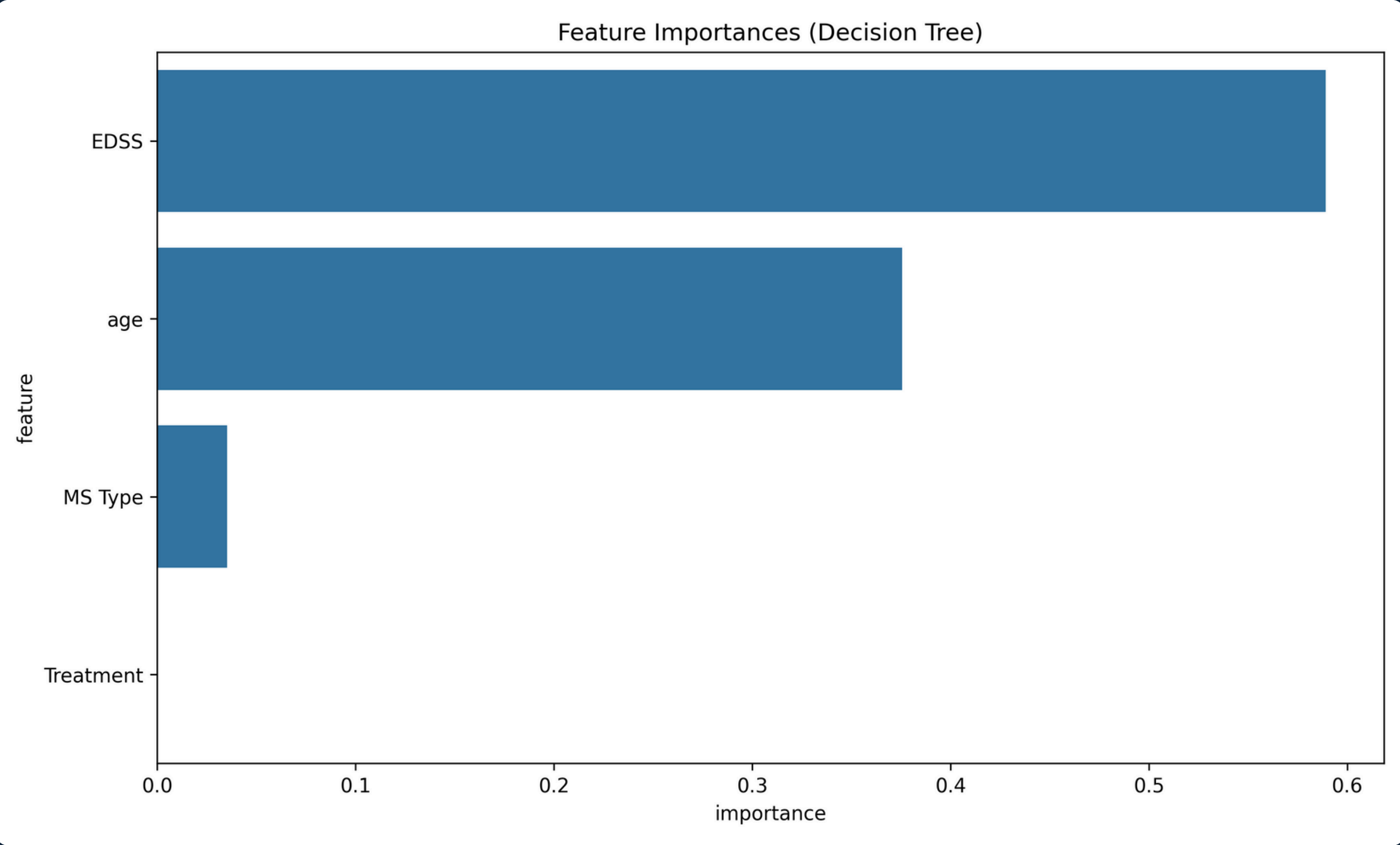


Treatment Effectiveness by Age (Significant Treatments)



Treatment Effectiveness by EDSS (Significant Treatments)





## Best Treatment Effectivness Combinations

Treatment	Patients	MS-Type	Proportion	Age	EDSS	p-value
Avonex	10	RR	90.00%	43.8 to 45.4	1.6 to 4.5	0.0215
Lemtrada	13	RR	84.62%	30.8 to 45.9	3.0 to 5.5	0.0225
Mavenclad	146	RR	77.40%	50.2 to 55.6	3.0 to 3.7	<0.001
Ocrevus	186	RR	68.28%	44.1 to 47.6	4.8 to 5.3	<0.001
Tecfidera	24	RR	95.83%	40.6 to 52.7	1.5 to 2.6	<0.001
Tysabri	44	RR	90.91%	36.0 to 43.2	3.0 to 4.1	<0.001
Vumerity	23	RR	82.61%	37.1 to 45.0	2.0 to 3.4	0.0026

## Model Evaluation

Cross-validation with 6 folds

Decision Tree Classification Report:

	precision	recall	f1-score	support
No	0.41	0.31	0.35	104
Yes	0.80	0.87	0.83	342
accuracy			0.74	446
macro avg	0.61	0.59	0.59	446
weighted avg	0.71	0.74	0.72	446

- Poor results for predicting No Response to Treatments due to small sample size.