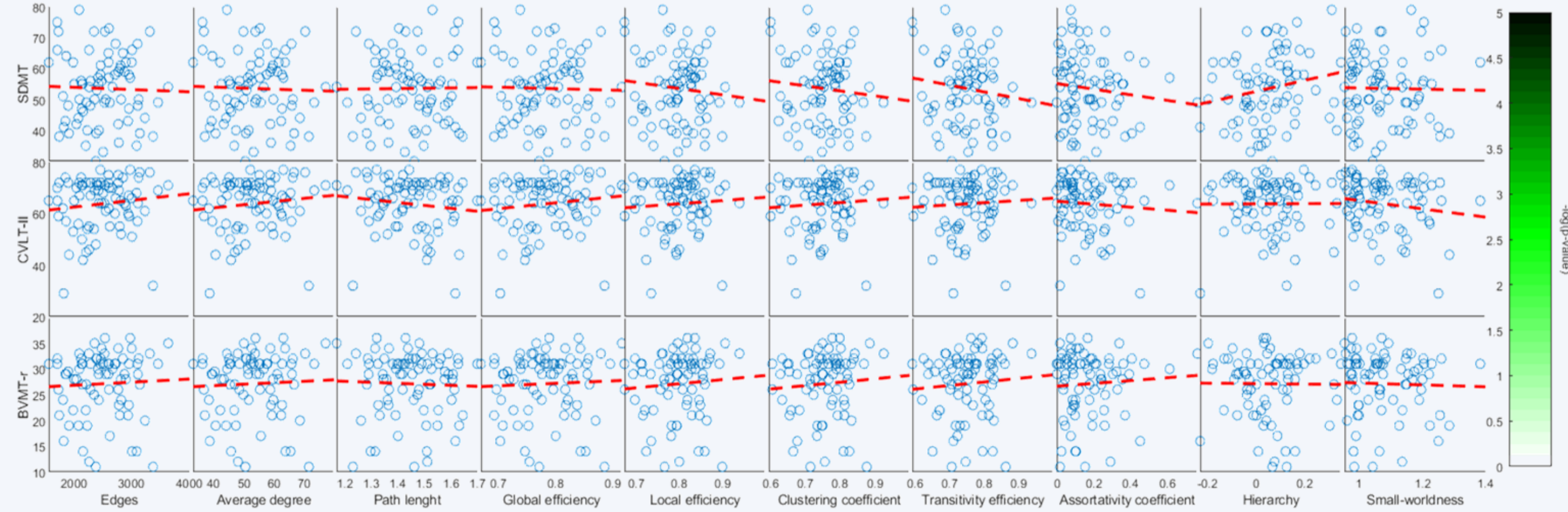# Do brain networks represent cognition in MS?

Baijot Johan, Van Laethem D., Denissen S., Costers L., Cambron M., D'Haeseleer M., D'hooghe M. B., Vanbinst A., De Mey J., Nagels G., Van Schependom J.

Functional connectivity (fMRI):

Scatterplots of the cognitive parameters versus the graph theoretical parameters from a functional network. Trendlines and correlations have been added, when a correlation was significant (p-value<0.05) the background was coloured according to the significance level and when a correlation survived multiple comparisons this was indicated with two red stars in the left top corner. The r-value of the correlation was added to the plot in red if significant.

Structural connectivity:
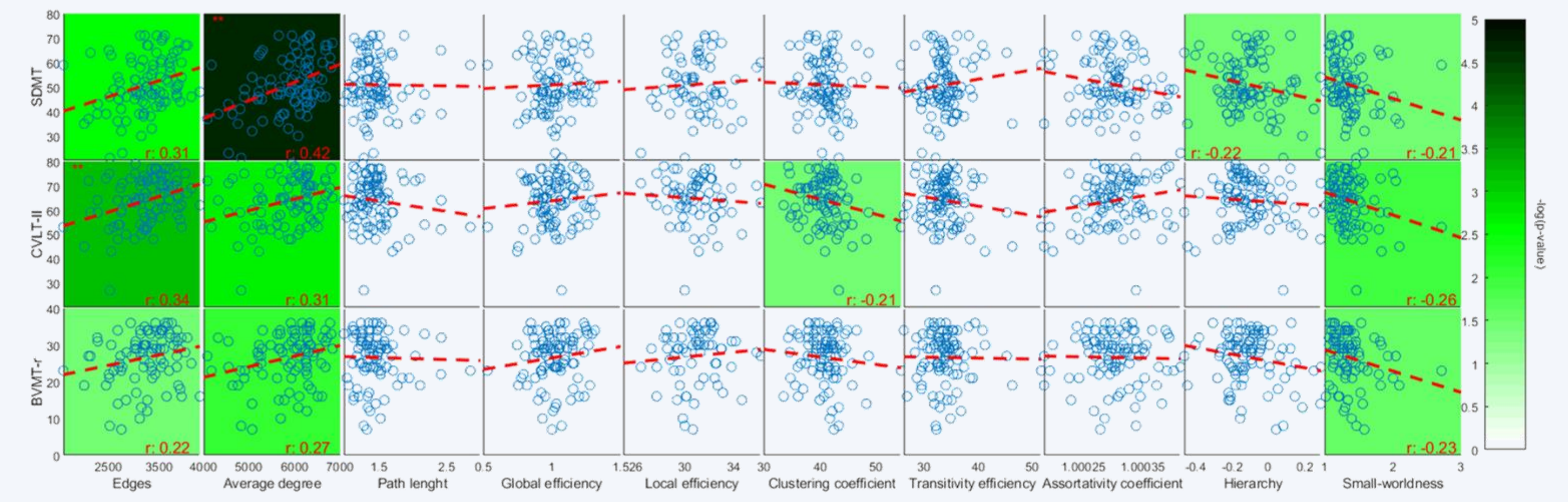
Scatterplots of the cognitive parameters versus the graph theoretical parameters from a structural network. Trendlines and correlations have been added, when a correlation was significant (p-value<0.05) the background was coloured according to the significance level and when a correlation survived multiple comparisons this was indicated with two red stars in the left top corner. The r-value of the correlation was added to the plot in red if significant.

Graph-theoretical analysis is a novel tool to understand the organisation of the brain. When applied in MS, the network parameters are altered in MS compared to healthy subjects (HS) for functional and structural imaging, and correlations with cognition are small (<0.5) or not significant. Yet the question remains whether altered graph theoretical parameters reflect real pathology-induced network reorganization of the brain's structure and functioning or if the current used network construction methodology are not suitable for the MS pathology?
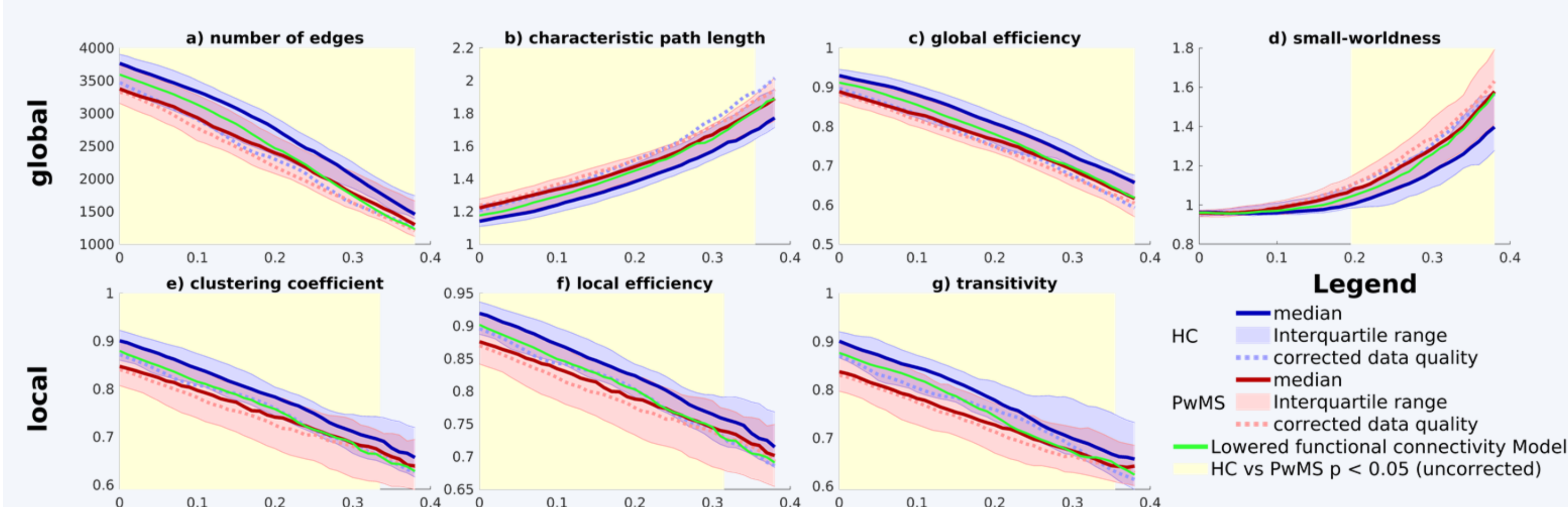
- Do not analyse fMRI in MS without correcting for data quality as data quality is likely related to disease progression and cognitive impairment

- Structural networks are not specific to cognitive deterioration, but rather reflects overall decline
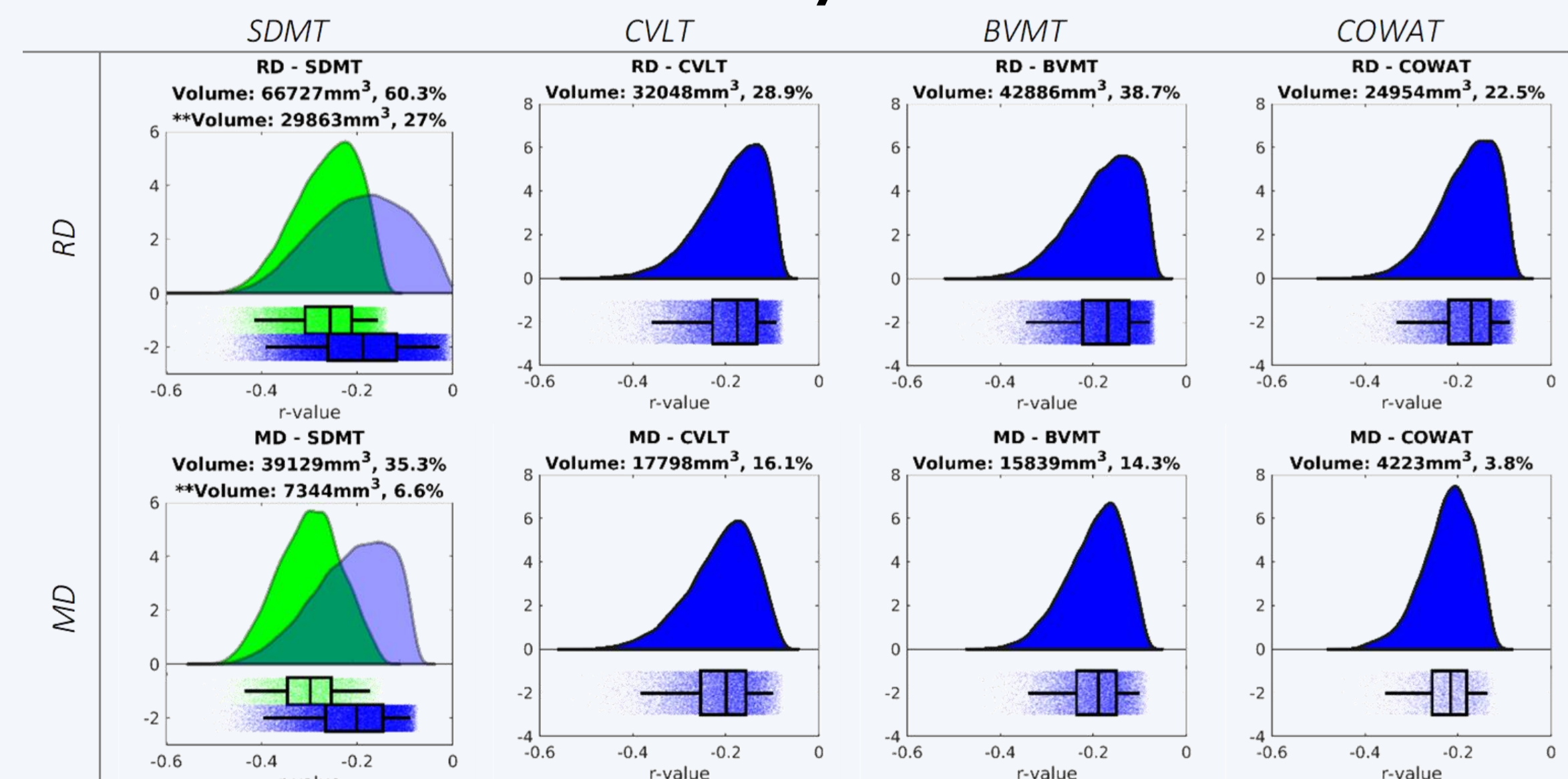

Functional connectivity (fMRI):

Data quality (CNR & tSNR) influence graph-theoretical parameters.

Network parameters in function of cut-off from binary networks of HC and PwMS. To model the general decrease of connectivity in MS 0.04 was subtracted from all edge weight of all HC and the median of obtained network parameters was used.

Structural connectivity:

Distribution of r-values from the voxel wise Pearson correlations between the diffusion tensor parameters and neuropsychological z-scores, for the significant voxels of the TFCE analysis. Results using the cut-off of 0.001 are shown in green and the corresponding volume indicated with **. In blue we also show the results of cut-off 0.05 and it's corresponding volume.

Radial diffusivity is linked to SDMT, and to demyelination through ex-vivo and simulations. So this reflect more the overall central nervous system damage caused by MS

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