Towards Standardized sgACC-DLPFC Denoising Strategies: Impact of preprocessing variability on sgACC-DLPFC functional connectivity

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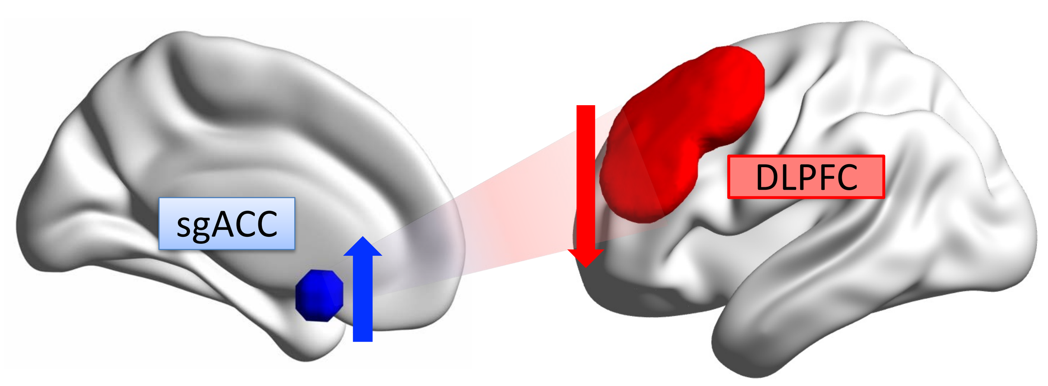
Background

- Defining a **neural marker** for **depression** has profound implications for both understanding and treating the disorder. [1]
- Functional magnetic resonance imaging (**fMRI**) is a powerful tool for identifying such biomarkers, with one promising candidate being the **weakened anticorrelated** functional connectivity (**FC**) between the subgenual anterior cingulate cortex (**sgACC**) and dorsolateral prefrontal cortex (**DLPFC**).[2]
- One major **challenge** to establishing this biomarker is its **reproducibility** in terms of **strength** and **topology** of FC.



Objective

- Given **sgACC**'s inflated susceptibility to **physiological nuisance** artifacts, the functional **heterogeneity** over the extent of the **DLPFC**, and the **lack** of biomarker **reproducibility** → the **current study** aimed to investigate the role of **fMRI denoising** strategies as a source of variability in the **strength and topology of the sgACC-DLPFC**.[3,4,5]

Methodology

- fMRI data collected from 60 subjects with treatment-resistant depression (TRD) at baseline (T0) underwent four different denoising strategies (DS).
- (DS1) fMRIPrep + IC + WM + CSF + GS, (DS2): fMRIPrep + IC + WM + CSF, (DS3) fMRIPrep + Motion +WM + CSF+ GS (DS4) fMRIPrep + Motion + WM + CSF + GS.
- FC was computed for each subject in each DS as the Pearson correlation between the sgACC seed and the DLPFC.
- Exploratory analyses assessed the relationship between denoising and FC.

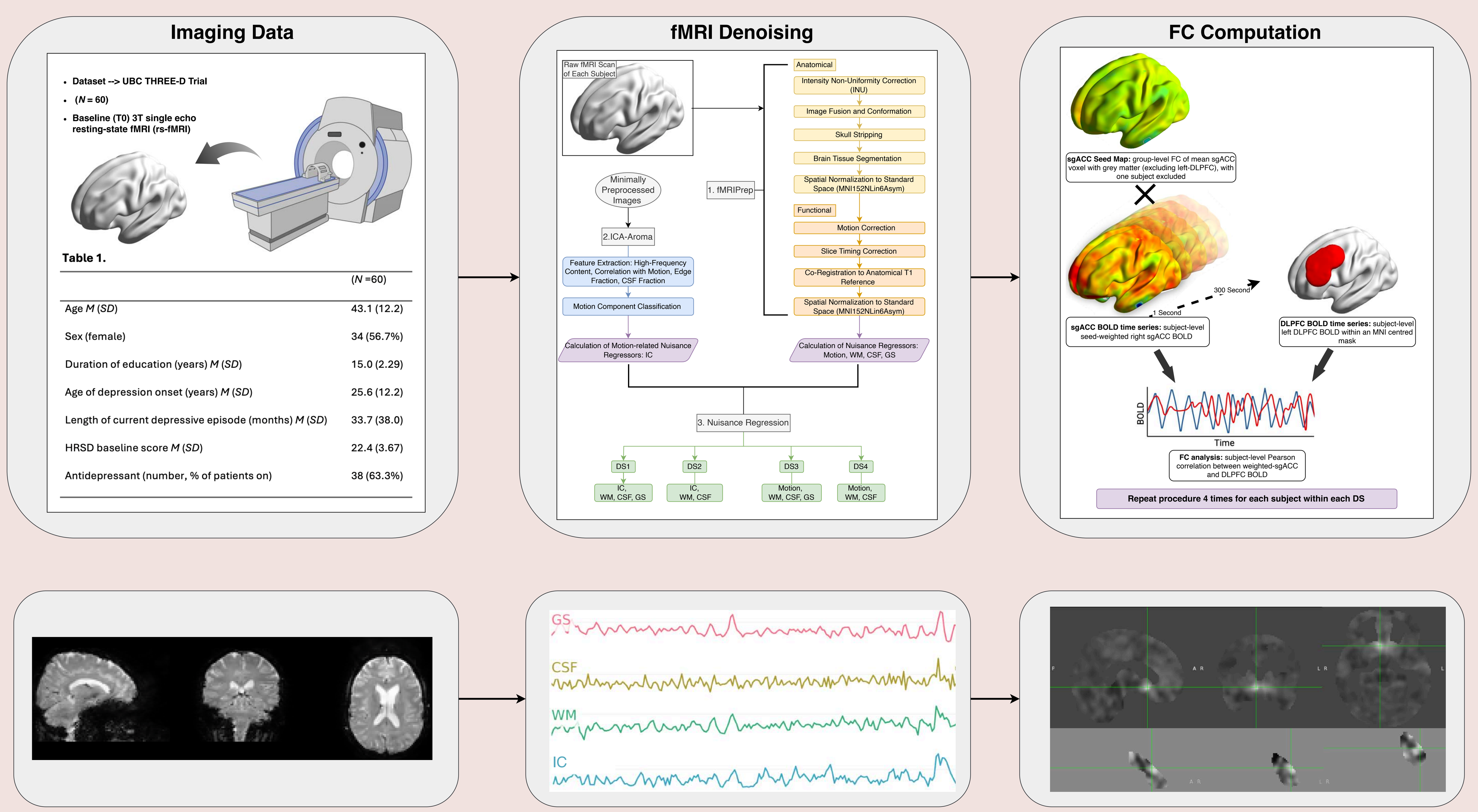
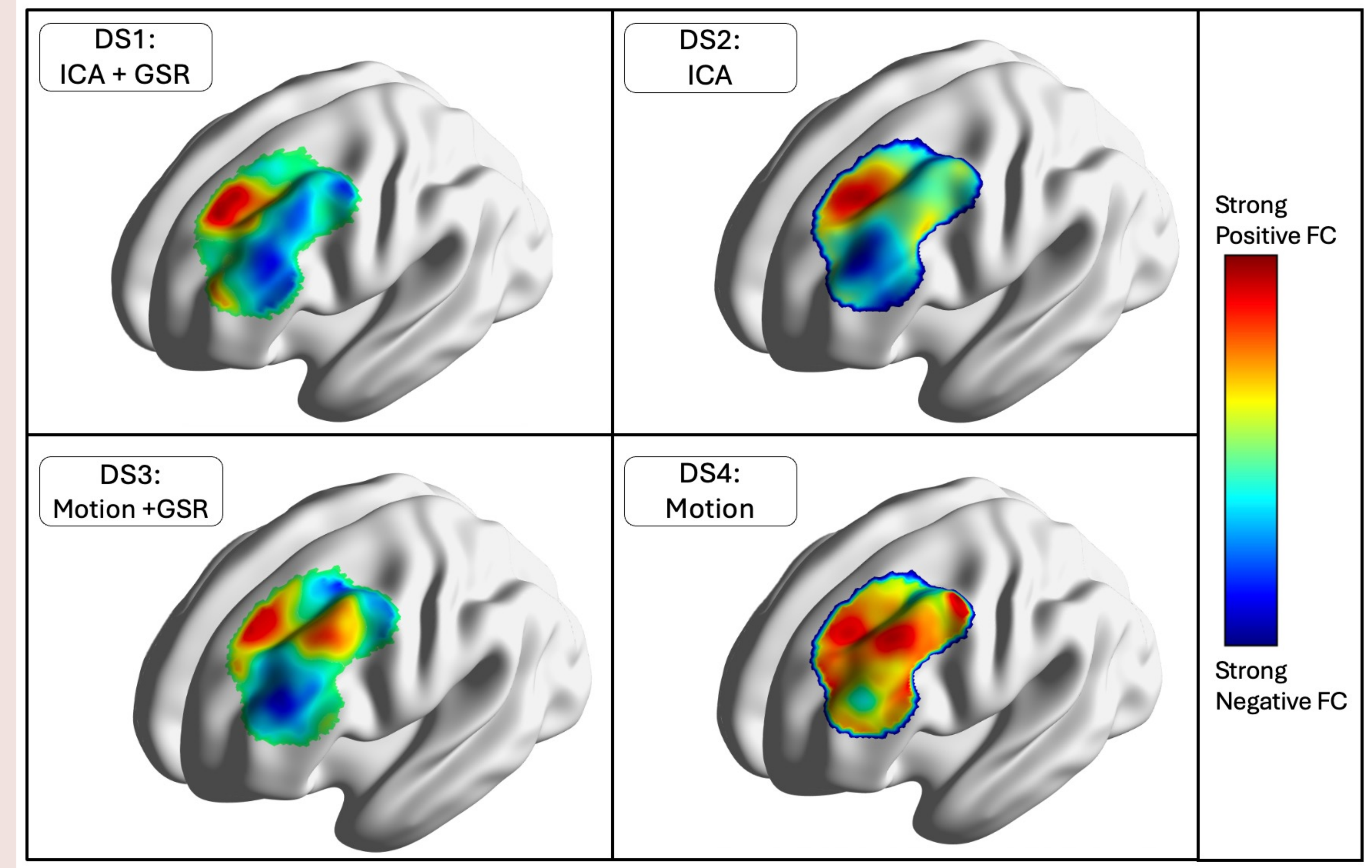


Table 1.

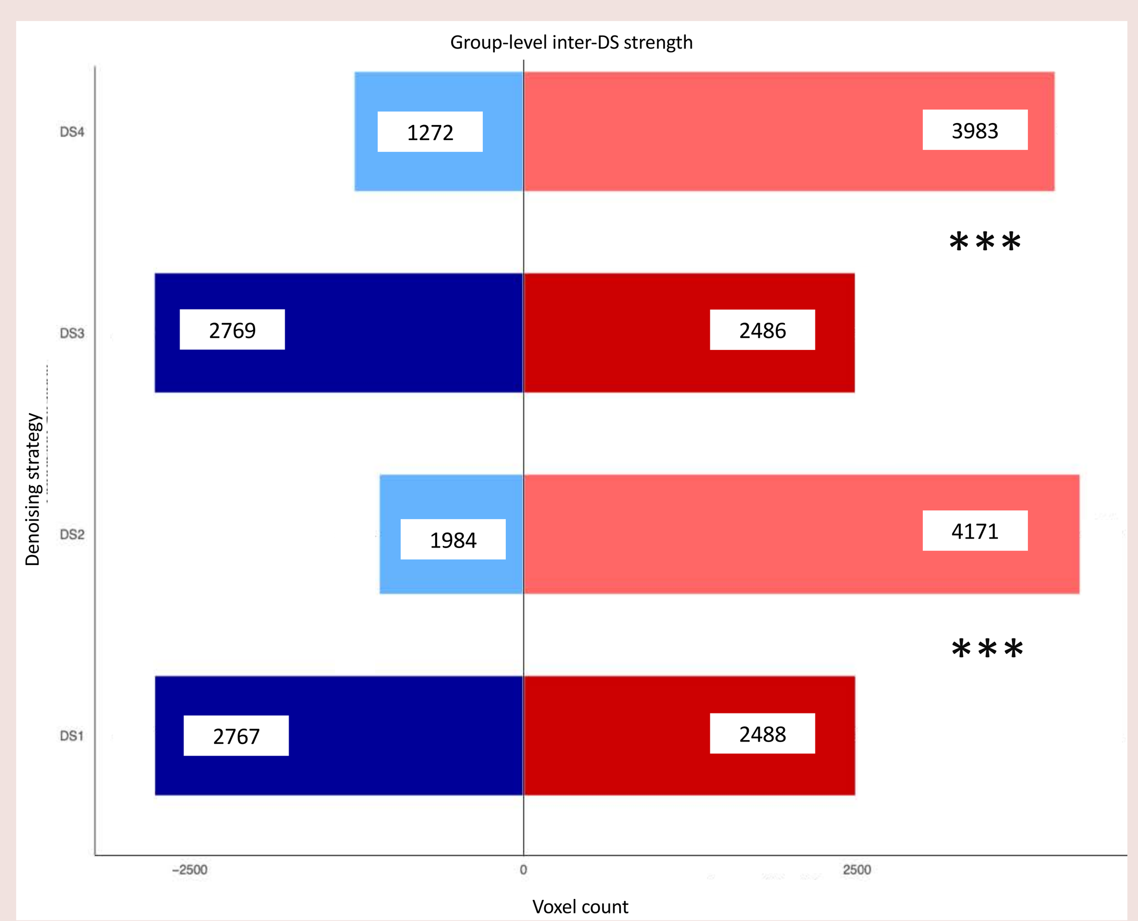
	(N =60)
Age *M* (*SD*)	43.1 (12.2)
Sex (female)	34 (56.7%)
Duration of education (years) *M* (*SD*)	15.0 (2.29)
Age of depression onset (years) *M* (*SD*)	25.6 (12.2)
Length of current depressive episode (months) *M* (*SD*)	33.7 (38.0)
HRSD baseline score *M* (*SD*)	22.4 (3.67)
Antidepressant (number, % of patients on)	38 (63.3%)

Results

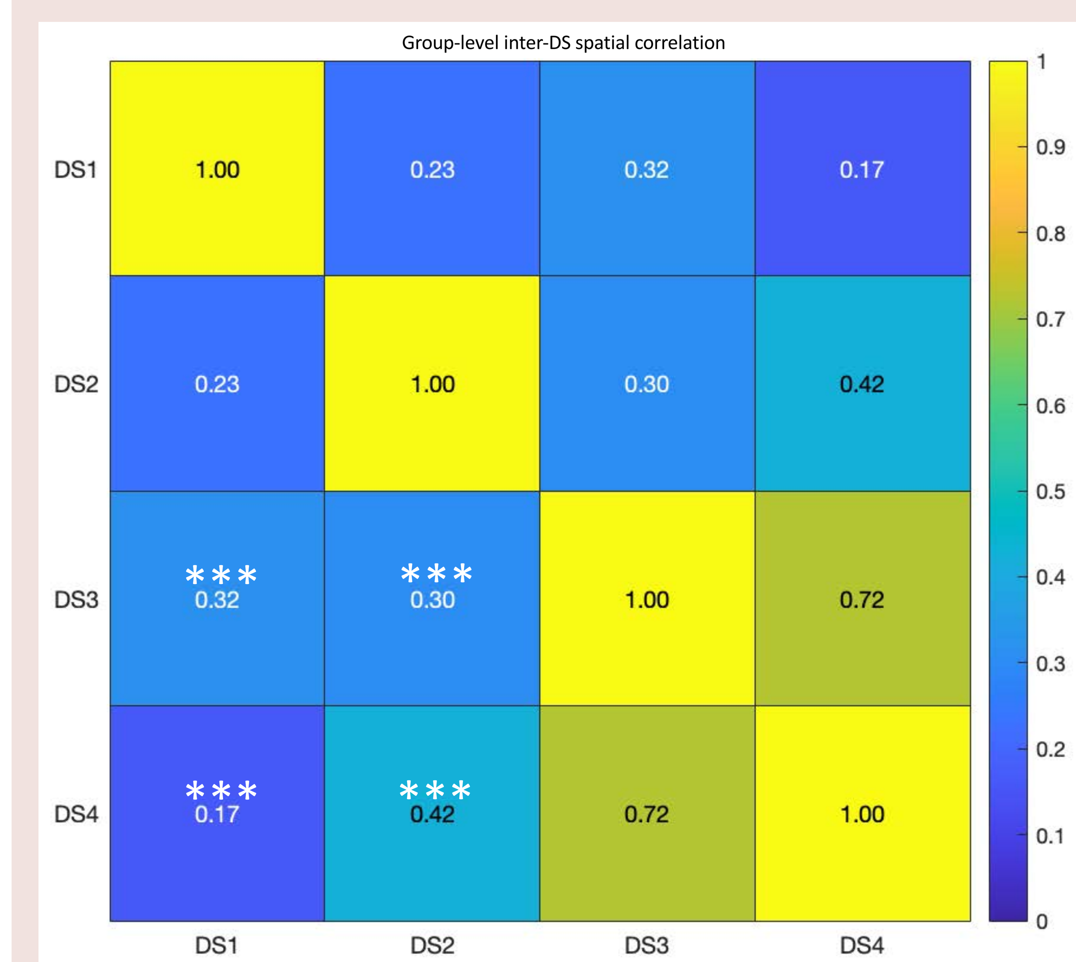


- **GSR Significantly increased anticorrelation** (negative FC) regardless of motion correction method (p < .001).
- Regardless of GSR, there was **significant topological differences** between denoising strategies that used **different motion correction methods** (p < .001).

- **Strength**



- **Topology**



Conclusion

- The present study demonstrates that denoising strategies, especially **GSR** and **ICA**, critically **influence** sgACC-DLPFC FC estimates, affecting both **strength** and **spatial topology**.
- These **findings emphasize** the **need** for **standardizing** fMRI data **denoising strategies** to advance the reproducibility and translational prospects of the sgACC-DLPFC depression biomarker.

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