

Assessing Multi-Year Reproducibility and Temporal Structure in Resting-State fMRI

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Resting state functional MRI (rsfMRI) permits study of brain functional networks without requiring participants to perform tasks. Robust changes in resting state networks have been observed in psychiatric and neurologic disorders, and rsfMRI outcome measures are candidate biomarkers for monitoring clinical trials, including trials of extended therapeutic interventions for rehabilitation of patients with chronic conditions (1).

We recently assessed the reproducibility and characterized the temporal structure of rsfMRI outcome measures derived using independent component analysis (2) from a longitudinal dataset reporting on a healthy adult volunteer scanned weekly over 3.5 years (3). While reproducibility was high, analysis of weekly outcome measures, including connectivity between networks (4), showed that many had significant linear trend, annual periodicity, and persistence. High reproducibility supports the candidacy of rsfMRI outcome measures as biomarkers; however, the presence of significant temporal structure should be taken into account when such measures are tracked during therapeutic interventions in chronic conditions.

Our report was essentially a case study, which other P41 centers can extend. As a case study, population heterogeneity in reproducibility and temporal variation could not be studied. For example, we found seasonal variability that could be modeled using daily temperature in Baltimore. Parallel observations in other centers would contribute to a better understanding of factors underlying variability in connectivity measures. We propose a multi-center cooperative study of longitudinal rsfMRI, modeled after the fBIRN collaboration (5), to establish multi-year reproducibility and temporal structure in rsfMRI data; this data will have important implications for rsfMRI in clinical populations. Additionally, centers will benefit from better understanding the variability and drift of their equipment.

References.

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