Concordance Among Indices of Intrinsic Brain Function: Inter-Individual Variation and Temporal Dynamics Perspective

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**Background**: Intrinsic brain activity is posited to play a central role in human brain function. Various resting-state fMRI (R-fMRI) measures have been developed to characterize intrinsic brain activity. While each of these measures has gained a growing presence in the literature, questions remain regarding the common and unique aspects these indices capture.

**Methods**: The present work provided a comprehensive examination of inter-individual variation and intra-individual temporal variation for commonly used measures, including fractional amplitude of low frequency fluctuations, regional homogeneity, voxel-mirrored homotopic connectivity, network centrality and global signal correlation. Multiband fast-sampling R-fMRI data (TR = 0.645s, 10 minutes/900 volumes) of 173 neurotypical individuals with quality pass datasets (8 ~ 86 years old; mean age: 44.5; 117 females) were selected from the publicly available Enhanced Nathan Kline Institute - Rockland Sample (http://fcon_1000.projects.nitrc.org). Dynamic R-fMRI indices were generated using sliding time-window analysis (hamming windows, length of 100 TRs, overlapping of 3 TRs).

**Results**: Regardless of whether examining intra-individual or inter-individual variation, we found that these definitionally distinct R-fMRI indices tend to exhibit a relatively high degree of covariation. When taken as a measure of intrinsic brain function, inter-individual differences in concordance for R-fMRI indices appeared to be stable, and negatively related to age (i.e., functional concordance among indices decreases with age). To understand the functional significance of concordance, we noted that higher concordance was generally associated with higher strengths of R-fMRI indices, regardless of whether looking through the lens of inter-individual (i.e., high vs. low concordance participants) or intra-individual (i.e., high vs. low concordance states identified via temporal dynamic analyses) differences. Finally, temporal dynamics analyses also revealed that high concordance states are characterized by increased within- and between-network functional connectivity, suggesting more general variations in network integration and segregation.

**Conclusions**: The current study draws attention to questions regarding how to select an R-fMRI index for usage in a given study, as well as how to compare findings across studies that examine inter-individual or group differences using different indices. Additionally, our work suggests global neural signals exist in the brain, and their spontaneous variations over time result in fluctuations in the connectedness of brain regions.