Precision scanning of brain networks in older adults

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Resting-state functional connectivity (rs-FC) measures spontaneous correlations in the activity of brain regions, thereby allowing us to study brain organization in living humans. Previous work has focused on group descriptions of rs-FC. Although this work has produced highly validated representations of the brain's functional network architecture, it occludes individual differences in network organization. Recently, "precision" methods have used rs-FC data from highly sampled subjects to create individual network maps, revealing differences between the individual and the group average in whole-brain network organization as well as idiosyncrasies of rs-FC in specific regions. These studies have focused on samples of healthy young adults, and it is currently unknown whether these individual network features extend across the lifespan. One question of particular interest is whether individual differences in brain organization underscore the large individual differences seen in healthy aging. To address this question, we used "precision"-fMRI approaches to measure brain networks in a small sample of healthy older adults (ages 65-75; final sample N=10). Each participant completed 5 separate fMRI sessions focused on collecting rs-FC data. In addition, participants completed a behavioral session to measure various aspects of cognitive and emotional functioning. These datasets are being compared to a similar precision fMRI dataset from a sample of healthy young adults (ages 18-30). Our goals are (1) to establish protocols for measuring high-quality low-motion precision data in older adults, (2) to determine the reliability (within day test-retest) and stability (across day similarity) of brain network measurements from older adult samples to guide future precision data projects, and (3) to provide a preliminary examination of the distribution of individual differences in brain organization in older adults and how this distribution contrasts with measures from young adults. Initial findings suggest that data collection is feasible and high-quality, with an average of 89% of slices retained after motion filtering, resulting in a mean of 38 minutes of usable data per subject per day. Previous work has shown that >30 minutes of high-quality data can produce reliable (r>0.9) rs-FC measurements. Data collection is ongoing. Next steps include examining the relationship between brain network measurements and cognitive performance, and a comparison to rs-FC measures from a sample of young adults. Measuring individual variability in brain function in older adults may help us understand the sources of variability in aging as well as provide clinically useful biomarkers.

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