Better Memory with Literacy Acquisition Later in Life

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Statistical analysis plan

Primary outcome:

The episodic memory will be measured using the Free and Cued Selective Reminding test (FCSRT). This test has 3 steps. First, the participant learns 16 figures, 4 each, with the help of semantic cues. After learning the first 16 figures, the participant recalls them three times, with distraction activity between each attempt (counting 20 to 1 backwards). The sum of each immediate free recall is called sum of attempts. It ranges from 0 (the participant does not recall any of the 16 figures in three attempts) to 48 (the participant recalls all the figures). We used this score as a measurement of episodic memory for the primary outcome.
The total raw score on the free recall sum-of-attempts trial from the FCST at the 6 months of follow up will be subtracted by the same score at baseline, in the intervention and control groups. The mean difference in each group will be compared using a paired T-test.

Secondary outcome:

The intrinsic connectivity between the hippocampus and the prefrontal cortex will be measured using resting state functional MRI. The participants will undergo one MRI scan at baseline and one MRI scan at the 6 months follow up. The BOLD signal (blood oxygen level dependent) will be extracted as follows. First, a reference volume and its skull-stripped version will be generated using a custom methodology of fMRIPrep. Head-motion parameters with respect to the BOLD reference (transformation matrices, and six corresponding rotation and translation parameters) will be estimated. The estimated fieldmap will be then aligned with rigid-registration to the target EPI (echo-planar imaging) reference run. The field coefficients will be mapped on to the reference EPI using the transform. BOLD runs will be slice-time corrected to 1.44s (0.5 of slice acquisition range 0s-2.88s). The BOLD reference will be then co-registered to the T1 reference. Coregistration will be configured with six degrees of freedom. The three global signals will be extracted within the cerebral spinal fluid and the white matter, and the whole-brain masks. Additionally, a set of physiological regressors will be extracted to allow for component-based noise correction. Principal components will be estimated after high-pass filtering the preprocessed BOLD time-series. The confound time series derived from head motion estimates and global signals will be expanded with the inclusion of temporal derivatives and quadratic terms for each. The BOLD time-series will be resampled into standard space, generating a preprocessed BOLD run in a standard space. Age will be included as a covariate in this analysis.
A seed will be placed in each hippocampus (right and left) and the intrinsic functional connectivity, meaning the BOLD activity between each hippocampus and the prefrontal cortex will be calculated at baseline and at the 6 months of follow up. The intrinsic functional connectivity at 6 months will be subtracted from the baseline. The mean difference in each group will be compared using a paired T-test.