Title: Predicting response to reading intervention based on structural and functional brain connectivity

Research Questions: Reading disability (RD, sometimes called dyslexia) affects approximately 10% of otherwise typically developing children. Past studies of adults and children have demonstrated changes in the structure and function of the brain following reading intervention. However, there is significant variability in the degree to which children with reading disability respond to reading intervention. The present study aimed to examine how growth in reading skills following reading intervention is predicted by pre-intervention brain connectivity, as measured with resting-state functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI), which assessed functional and structural connectivity respectively. Resting-state fMRI examines patterns of spatially coordinated spontaneous neural activity to reveal coherent brain networks. DTI measures diffusion of water molecules in white matter to examine the microstructure of white matter tracts. Individual differences in children's reading ability have previously been associated with differences in both these types of connectivity patterns. However, it remains unclear how both these measures may relate to potential for growth in behavioural reading skills.

Methods: Participants were children enrolled in grades 4-6 in Southwest Ontario, Canada, identified with reading disabilities and participating in a school-based Empower Reading remediation program. The Empower program is a 110-hour small-group intervention for struggling readers that has been shown to result in significant and generalizable gains in decoding, word recognition, reading accuracy, reading rate, and reading comprehension in

children with reading disability. Prior to beginning the Empower program, all children first completed behavioural measures of reading and cognitive abilities. Children also participated in a 3 Tesla MRI scan, during which we acquired a six-minute resting-state fMRI scan, a DTI scan, and an anatomical scan used to align functional and structural measures to each individual's brain anatomy. A second set of behavioural and MRI data was collected for each participant following completion of the Empower program.

Analysis and Results: Preliminary analyses clearly show improvements in behavioural reading ability for participants post-intervention, although there is variability in the degree to which each participant's reading improved. In our ongoing analyses, we are examining how pre-intervention connectivity within the brain's functional reading network and within white matter tracts of the brain are related to individual differences in the magnitude of these behavioural changes.

Implications: Finding relationships between connectivity and improvements in reading ability will enhance understanding of the neural basis supporting reading and of the variability in response to intervention. Elucidating the association between behavioural measures and neuroimaging measures may lead to the development of more targeted methods of identification and intervention.