Neural Correlates of Reading Comprehension Pre- and Post-Intervention in Struggling Readers

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INTRODUCTION

Background:
- Numerous studies have found altered brain activity in struggling readers relative to typical readers (Deurenberg et al., 2014).
- Fewer studies have examined sentence comprehension and the interaction of reading with cognitive control processing.

Objectives:
- To assess the interaction of reading and cognitive control in the brain in a reading intervention study, before and after intervention.

Approach:
- Multi-site (Austin, Braustin, and Houston, Texas) 4th grade in-school reading intervention with children age 8-11, identified as either at risk or higher achieving.
- Multimodal imaging approach (task and resting state fMRI, structural MRI, DTI).
- Struggling readers compared to Bernstein de-identified (BID) at baseline conditions. The intervention was implemented by the UT Austin Meadows Center for Preventing Educational Risks.
- Sentence comprehension (Neylor et al., 2008) and stop signal (cognitive control, Aron et al., 2004) tasks were used to study pre- and post-4th grade effects.

METHODS

Sentence Comprehension Task
- 20 Struggling Readers, 11 females (9±.79 years), 2.8 A U.
- 16 Post-Intervention Struggling Readers, 9 females (9±.85 years), 2.8 A U.
- 10 Typical Readers (9±.58 years), 2.8 A U.
- 100% task accuracy.
- All Struggling and Typical Readers (n=56).

Stop Signal (Inhibition) Task
- 20 Struggling Readers, 11 females (9±.81 years), 2.8 A U.
- 16 Post-Intervention Struggling Readers, 9 females (9±.82 years), 2.8 A U.
- 10 Typical Readers (9±.58 years), 2.8 A U.
- 90% “go” accuracy, 10% stop accuracy, and 30s or longer stop signal response time (SSRT) (Congor et al., 2012).
- All Struggling and Typical Readers (n=40).

STOP SIGNAL TASK BRAIN REGIONS

Box plots show group differences in neuroimaging activations during the Stop Signal Task. Significant group differences were found in extrastriate cortex (MNI: x=15; y=41; z=10), sensorimotor cortex (MNI: x=15; y=27; z=10) and prefrontal cortex (MNI: x=36; y=12; z=32). Sensitivity analysis indicated that these differences were not due to age or IQ differences. These results highlight the importance of cognitive control during reading and comprehension and suggest potential targets for intervention strategies to improve reading and cognitive control in struggling readers.