

# Amygdala sub-regional functional connectivity predicts anxiety in children with reading disorder

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## Abstract

Pediatric reading disorder (RD) is associated with an increased risk of anxiety symptoms, yet understudied are the neurobiological factors that might underlie anxiety in children with RD. Given the role of the amygdala in anxiety, we assessed resting state functional connectivity of amygdalar subregions in children with RD to identify functional correlates of anxiety and reading impairment. We collected resting state functional MRI data from 22 children with RD and 21 typically developing (TD) children, ages 7 to 13 years. We assessed group differences in resting state functional connectivity (RSFC) from amygdalar subregions. Associations of amygdalar RSFC and volume with reading impairment, reading fluency scores, and anxiety symptoms were explored. Relative to TD children, those with RD showed increased RSFC from amygdalar nuclei to medial prefrontal cortex. Across all subjects, RSFC from right centromedial amygdala to left medial prefrontal cortex positively predicted both reading impairment and self-reported anxiety, and anxiety mediated the relationship between RSFC and reading impairment. These findings are consistent with amygdalar functional abnormalities in pediatric anxiety disorders, suggesting a common neurobiological mechanism underlying anxiety and reading impairment in children. Thus, aberrant patterns of RSFC from amygdalar subregions may serve as potential targets for the treatment of anxiety symptoms that typically co-occur with RD. Our dimensional approach to studying anxiety in RD revealed how amygdalar connectivity underlies anxiety and reading impairment across a continuum from normal to abnormal.

## RESEARCH HIGHLIGHTS

- Relative to typically developing children, those with reading disorder showed increased resting state functional connectivity from amygdalar nuclei to medial prefrontal cortex.
- Connectivity from right centromedial amygdala to left medial prefrontal cortex predicted reading impairment and anxiety, and anxiety mediated the relationship between connectivity and reading impairment.
- These findings are consistent with amygdalar functional abnormalities in pediatric anxiety disorders, suggesting a common

neurobiological mechanism underlying anxiety and reading impairment in children.

- Our dimensional approach to studying anxiety in reading disorder revealed how amygdalar connectivity underlies anxiety and reading impairment across a continuum from normal to abnormal.

## 1 | INTRODUCTION

Reading disorder (RD) is characterized by persistent difficulties in reading that are unexpected given a child's developmental level (American Psychiatric Association, 2013). RD is the most common learning disorder, affecting 5–17% of children, and children with

\*These authors contributed equally to this work