Associations between reading for pleasure and cortical surface area in the ABCD Study

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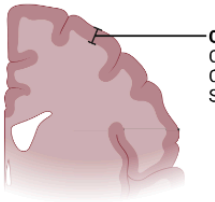
INTRODUCTION

- **Reading skill** is associated with white matter as part of a dynamic, experience-dependent system that changes over time (Roy et al.).
- Small studies have linked **pleasure reading** with reading skill (Cullinan), even after controlling for socioeconomic covariates (Schiefele et al.).
- However, to our knowledge, no large-scale studies assess the correlation between **pleasure reading** and **brain structure**.
- **This study investigates the relationship between pleasure reading and cortical morphometry in the Adolescent Brain Cognitive Development℠ Study (ABCD Study®).**

METHODS



Cortical (vertexwise) phenotypes:
Cortical thickness
Cortical surface area
Sulcal depth

Predictor of Interest: Weekly time spent reading for leisure

Fixed Effect Covariates:

Age	Race
Sex	Household Income
MRI device	Parental Education
MRI software	NIH Toolbox Reading Skill

Random Effects: Family

Data Analysis: Fast Efficient Mixed Effects Analysis (Fan, 2021)

Model 1: $phenotype \sim read_{hours} + age + sex + scanner + software + (1|family)$

Model 2: $phenotype \sim read_{hours} + age + sex + scanner + software + race + income + (1|family)$

Model 3: $phenotype \sim read\ hours + age + sex + scanner + software + race + income + education + read_{skill} + (1|family)$

CONCLUSIONS

- **Reading for pleasure** was associated with cortical surface area in the **right lateral temporal cortex**
  - associated with **language comprehension** and visual processing
- Association held after adjusting for race and income
- Adjusting for reading skill attenuated relationship (but not completely)
- Next steps:
  - Voxelwise analysis of diffusion MRI?
  - Incorporation of multiple timepoints?

SAMPLE

- ABCD Study® data release 4.0, baseline cohort
- Total *N* = 6,861 adolescents, age 9-11
- Exclusion criteria:
  - lack of English proficiency
  - severe sensory, neurological, medical or intellectual limitations
  - inability to complete MRI scan at baseline.

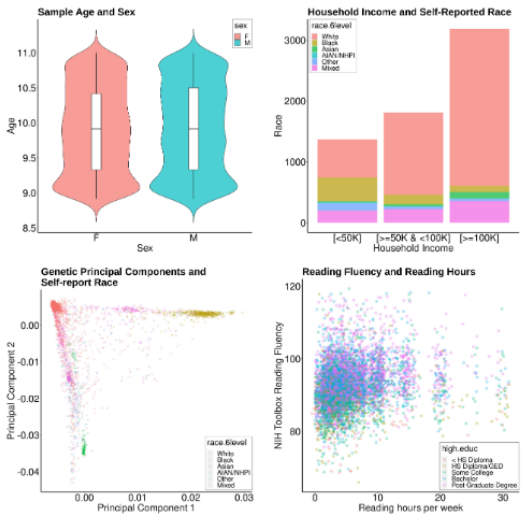


Figure 1. Demographic information in the sample used for analysis.

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RESULTS

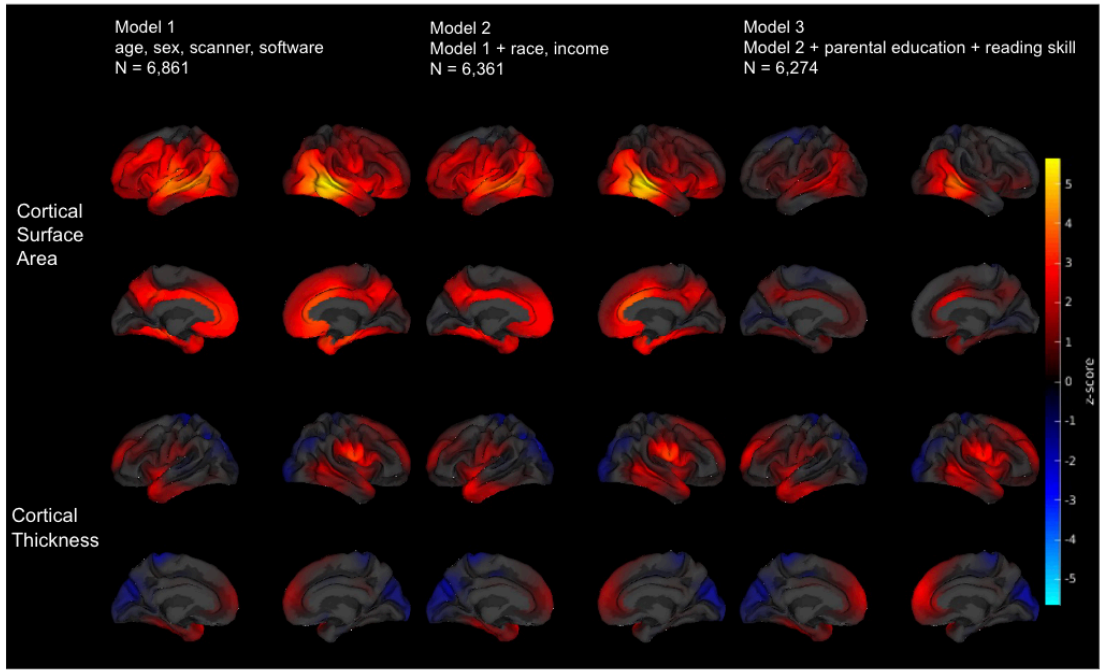

Figure 2. Results of linear mixed effects models of time spent reading for leisure on cortical morphometry.

- In reduced models of cortical surface area, pleasure reading was significantly associated with cortical surface area in the **right lateral temporal cortex** (maximum z-statistic 5.65).
- **After adding race and parental income** as fixed covariates, **this relationship remained significant** at the vertex-wise level (maximum z-statistic 5.48).
- **Adding reading skill led to a decrease in observed associations** (maximum z-statistic = 4.15), though visual inspection of cortical plots revealed a pattern of association in the same region of the right lateral temporal cortex.
- Models for cortical thickness did not achieve vertex-wide significance (all z-statistics < 4.0).

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FEMA on GitHub

FEMA on bioRxiv