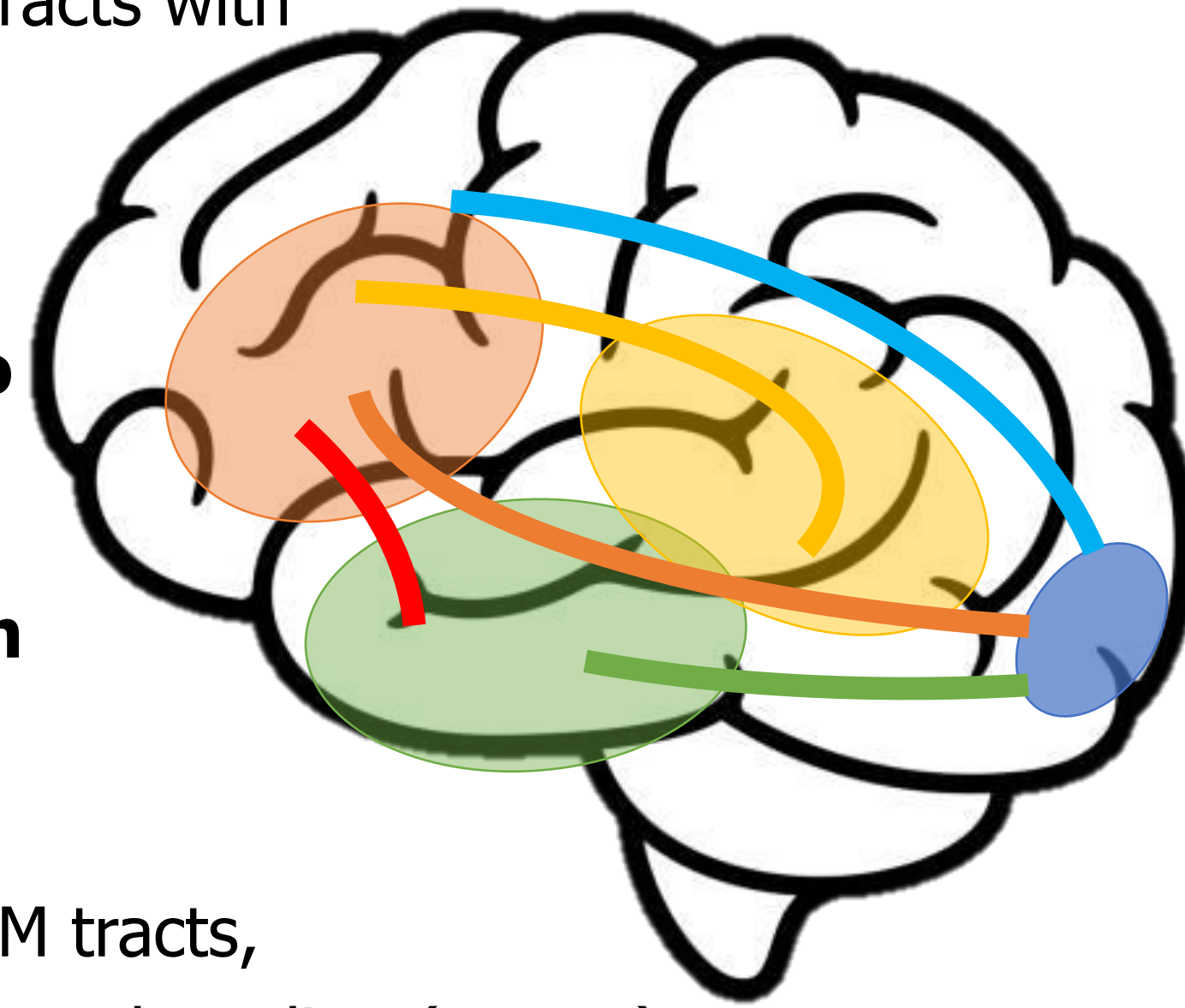# The left inferior longitudinal fasciculus is related to passage comprehension in middle childhood

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FOR EXCELLENCE IN DEVELOPMENTAL DISABILITIES

INTRODUCTION

- White matter (**WM**) "integrity" of tracts in the reading network may capture individual variability in reading scores separate from that of functional and behavioral data.
- Several studies have highlighted individual WM tracts with promising results, including the left superior longitudinal (**SLF**), inferior longitudinal (**ILF**), arcuate (**AF**), uncinate (**UF**), and inferior frontooccipital fasciculi (**IFOF**) [1-3].
- SES has been linked to WM metrics related to reading [4-6], but further interrogation of the SES-WM link across tracts is needed.
- However, results are variable across studies, possibly due to testing correlation values of individual tracts with disparate reading scores
- **We tested whether integrity, or fractional anisotropy (FA), of each of the 5 tracts above was related to reading outcomes, and whether these findings varied by SES, after controlling for FA of other tracts, in a sample of middle-aged children**
- Hypotheses:
  - Controlling for other reading-related WM tracts,
    1. FA of the left ILF will be related to word reading (**LWID**)
    2. FA of the left SLF will be related to decoding
    3. FA of the left ILF and SLF will be related to passage comprehension (**PC**)
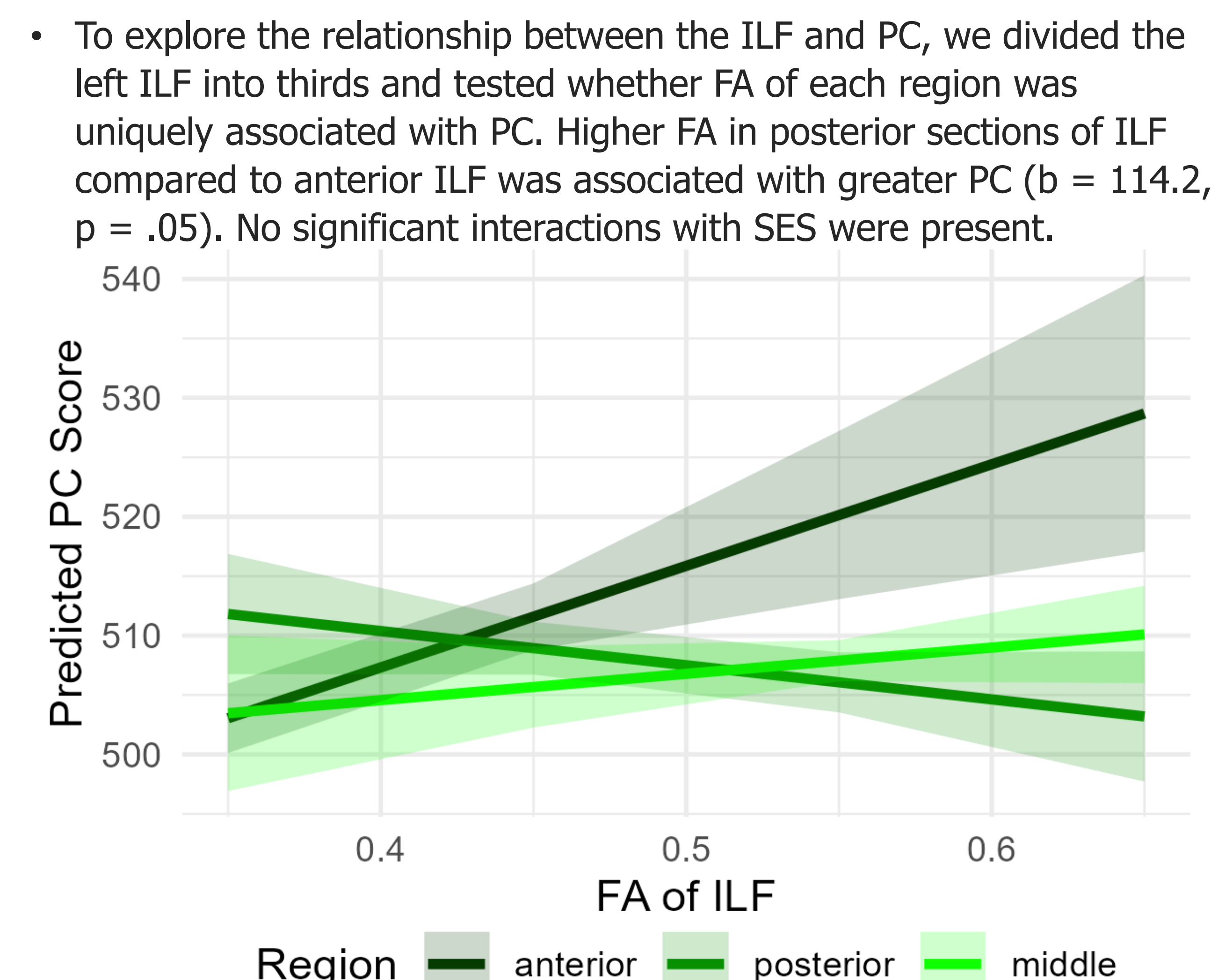   4. These findings will vary by SES
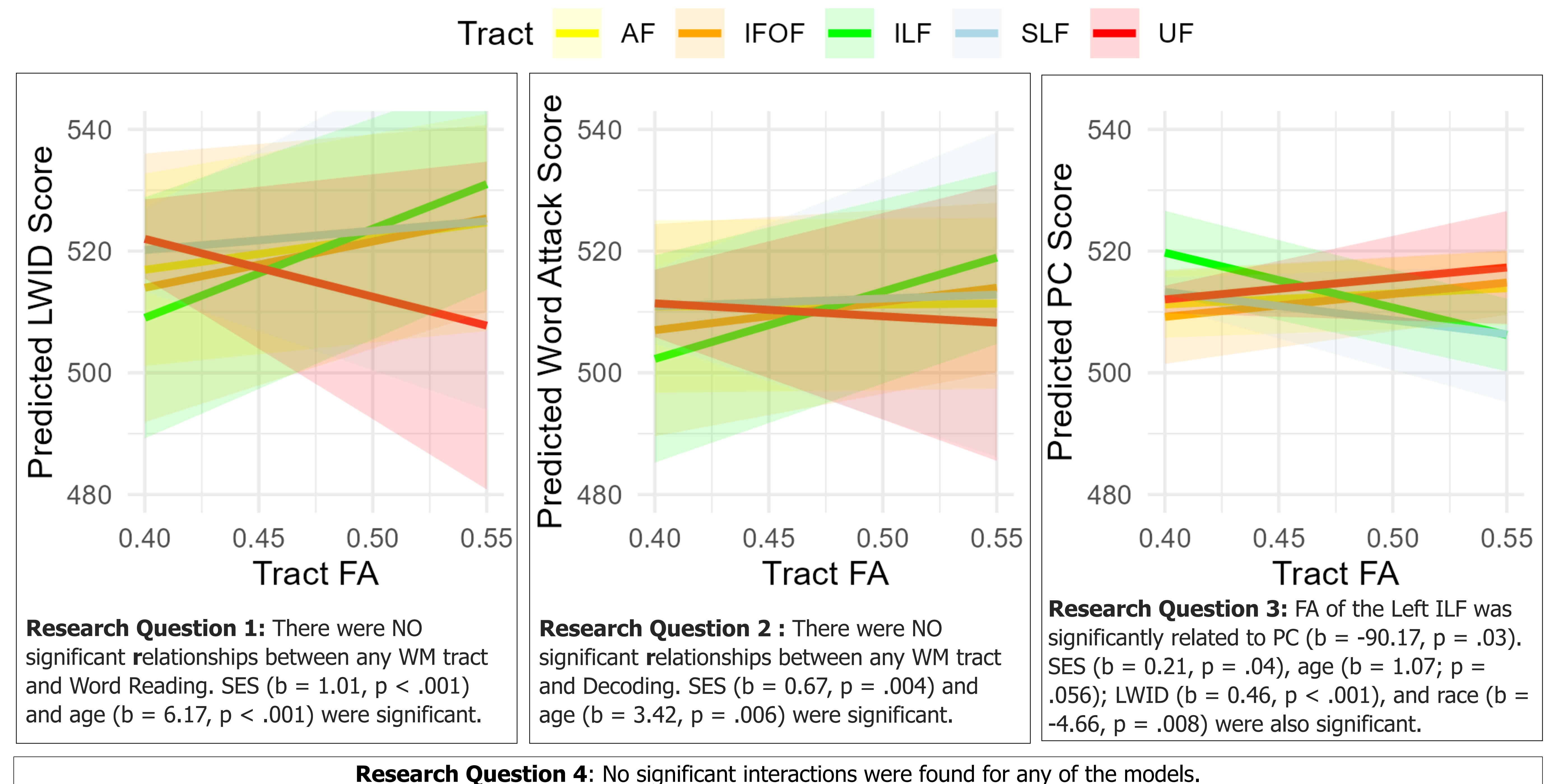
METHODS

- <u>Participants</u>: **172 children** (age M = 11.65, SD = 1.4). All participants were native English speakers with typical IQs (WASI FSIQ > 85; 58% female).
- <u>Behavioral measures</u>: The **Woodcock Johnson** measures of **Letter Word ID** (real word reading), **Word Attack** (nonword reading), and **Passage Comprehension** were used as measures of reading ability. SES was measured by Hollingshead Couple Score.
- <u>MRI</u>: DWI (HARDI) images acquired on a 3T MRI scanner with 32-channel headcoil. Data were processed using QSIPrep (ver0.16.1) and the embedded pyAFQ (ver1.3.2). Visual QA was completed.
- <u>Analyses</u>: Analyses were completed in R.
  - 3 GLMs were run to determine whether any of the 5 reading-related WM tracts were related to the outcomes of word reading, decoding, and PC.
  - For models addressing questions 1 & 2, we controlled for SES, age, gender, race and ethnicity. For model 3, the PC model, we controlled Letter Word ID and Word Attack.
  - To examine potential interactions with SES, models 1-3 were re-run with interaction terms between SES and any significant tracts.

RESULTS

Tract: AF, IFOF, ILF, SLF, UF

Research Question 1: There were NO significant relationships between any WM tract and Word Reading. SES (b = 1.01, p < .001) and age (b = 6.17, p < .001) were significant.

Research Question 2 : There were NO significant relationships between any WM tract and Decoding. SES (b = 0.67, p = .004) and age (b = 3.42, p = .006) were significant.

Research Question 3: FA of the Left ILF was significantly related to PC (b = -90.17, p = .03). SES (b = 0.21, p = .04), age (b = 1.07; p = .056); LWID (b = 0.46, p < .001), and race (b = -4.66, p = .008) were also significant.

Research Question 4: No significant interactions were found for any of the models.

EXPLORATORY RESULTS

- To explore the relationship between the ILF and PC, we divided the left ILF into thirds and tested whether FA of each region was uniquely associated with PC. Higher FA in posterior sections of ILF compared to anterior ILF was associated with greater PC (b = 114.2, p = .05). No significant interactions with SES were present.

Region: anterior, posterior, middle

CONCLUSION

- Results indicated only FA of the left ILF was significant related to PC after controlling for FA of other reading-related WM tracts, such that lower FA was related to higher PC
- An exploratory analysis indicated this relationship changed based on region of the ILF (higher FA in anterior regions of the ILF is related to greater PC)
- No significant interactions with SES were observed.
- Next steps include testing relationships with the vOF tract and using LMERs to account for within-subject differences, which will allow us to determine whether it is global FA or individual tract FA that is important for reading cognition
  - Preliminary LMER suggests within-subject tract differences in FA do not predict outcomes → suggest a global FA effect

FUNDING