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Exploring Associations between Psychopathology and Uncinate Fasciculus White Matter Microstructure in the ABCD Study

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Background

- Uncinate fasciculus (UF): white matter tract connecting prefrontal regions to temporal subcortical structures; important for emotion regulation¹
 - UF alterations occur in anxiety disorders
 - Our lab has found decreases in UF microstructural integrity in children with anxiety disorders²
- Most previous studies of UF and psychopathology focus on singular diagnoses. However, many children experience symptoms from multiple psychopathology domains.
- Adolescent Brain Cognitive Development (ABCD) study provides publicly available data from a large community sample



- Examine relationship between dimensional anxiety and UF microstructure within a large, sociodemographically diverse sample
- Explore specificity of anxiety-related findings when accounting for ADHD and depression symptoms.

Methods

- Data from baseline visit – participants age 9-10
- DTI: Fractional anisotropy (FA), a marker of white matter integrity³
 - Tabulated average FA values for white matter tracts: uncinate fasciculus, cingulate gyrus cingulum, hippocampal cingulum, inferior fronto-occipital fasciculus, superior longitudinal fasciculus, fornix, corpus callosum, global white matter
- Dimensional psychopathology: T scores on DSM-oriented subscales from Child Behavioral Checklist – Anxiety, Depression, ADHD⁴
- Covariates: age, sex, race, socioeconomic status (SES) measures (income, parental education, material hardship, area deprivation index), trauma exposure, intracranial volume
- Examine predictors of FA using linear regression models in R

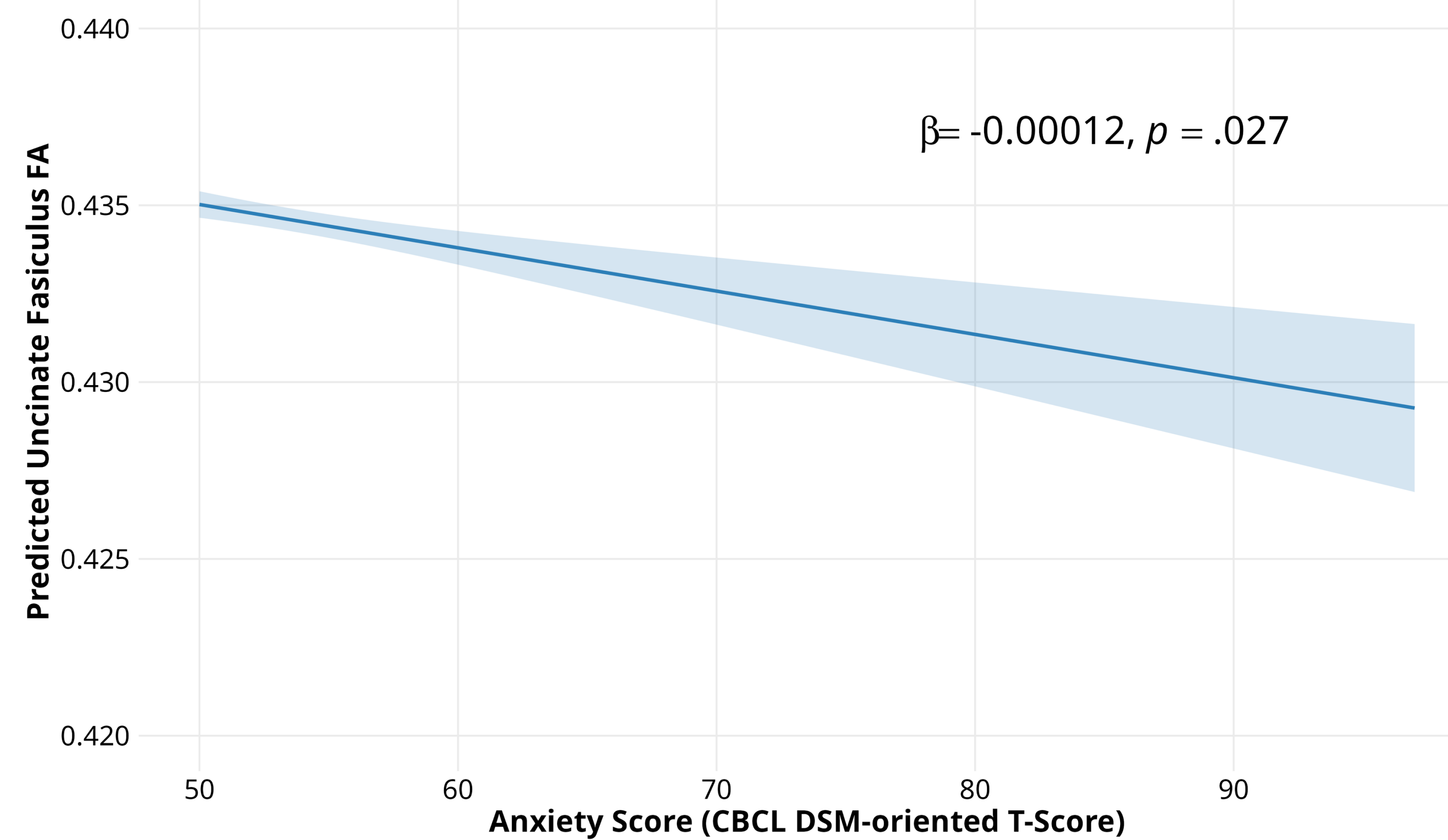
Sample Demographics (N = 8503)

Demographics described as Mean (SD) or n (%)

Age (Years)	9.97 (0.63)
Sex (Female)	4,130 (49%)
Racial Identity	
White	5,927 (70%)
Black	1,171 (14%)
Asian	170 (2.0%)
Hispanic/Latino	211 (2.5%)
Multiracial/Other	1,024 (12%)
Household Income Bracket	
<25K	1,168 (14%)
25K-50K	1,230 (14%)
50K-75K	1,161 (14%)
75K-100K	1,269 (15%)
100K-200K	2,689 (32%)
>200K	986 (12%)
Parental Education Level	
Grade School	313 (3.7%)
HS diploma/GED	690 (8.1%)
Some College	2,140 (25%)
Bachelor's Degree	2,259 (27%)
Graduate school/Professional Degree	3,101 (36%)
Material Hardship Assessment Score	0.44 (1.06)
Area Deprivation Index National Percentiles	39 (26)
History of Trauma Exposure (# yes)	3,090 (36%)
Intracranial Volume (mm ³)	1,498,105 (143,229)

Higher Anxiety Symptoms Correlated with Lower UF FA in Anxiety Model

Model: UF FA predicted by Dimensional Anxiety, Demographics (age, sex, race), Multiple SES measures, Trauma, ICV, and Interactions



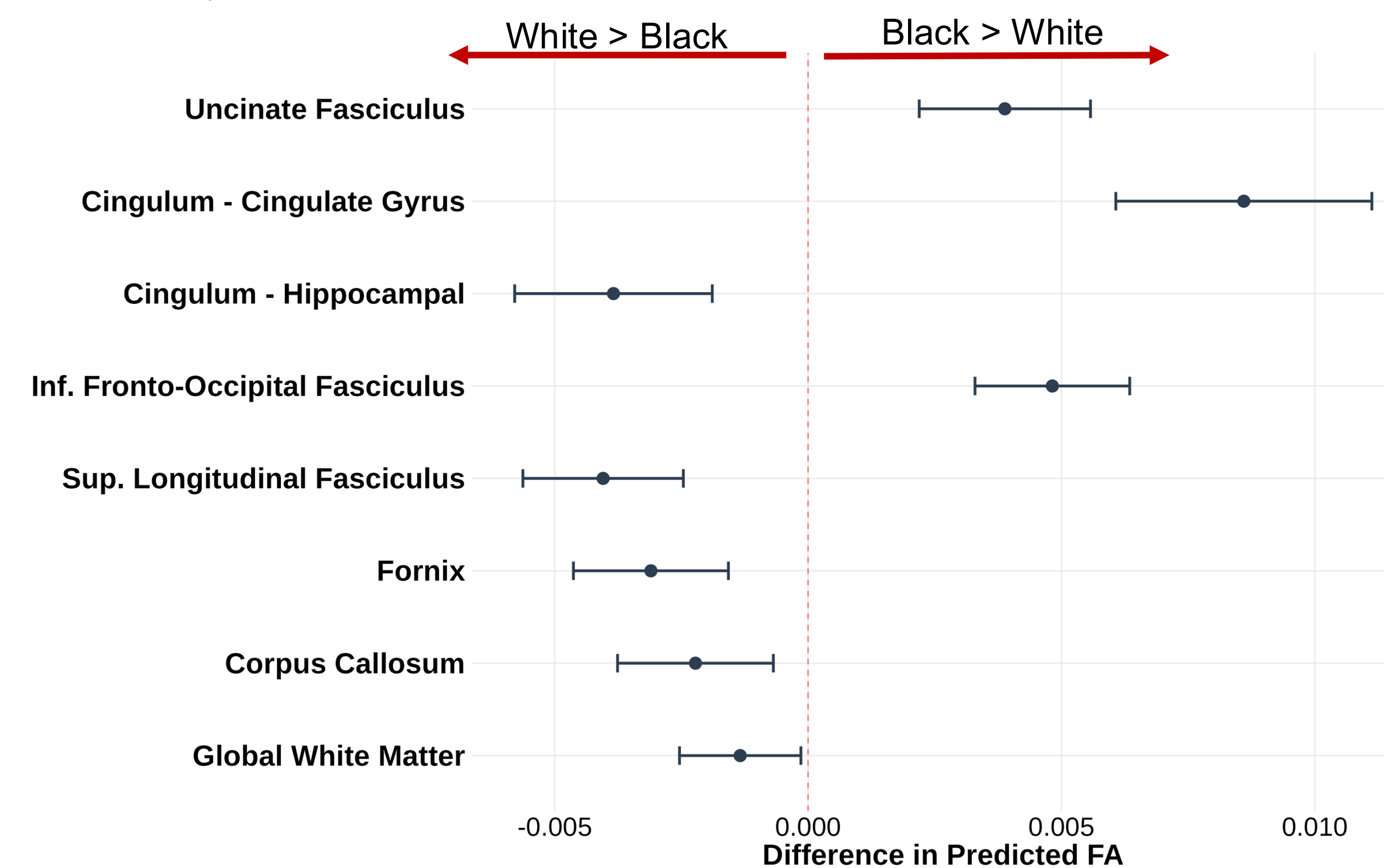
Additional Significant Predictors of UF FA

Predictor	Estimates	P-values
Age	0.003	<.001
Sex (Male reference)	0.004	<.001
Race (Black vs White)	0.004	<.001
Income	-0.001	.023
Parental Education	0.001	.042
Trauma	0.001	.010
ICV	0.000	<.001
Anxiety-Trauma interaction	0.000	.043

- Anxiety did not significantly predict FA in other white matter tracts.
- Across tracts, age, parental education, and ICV show similar effects on FA.
- Direction of race and sex effects on FA vary across tracts.

Direction of Significant Effects of Race on FA Varies by Tracts

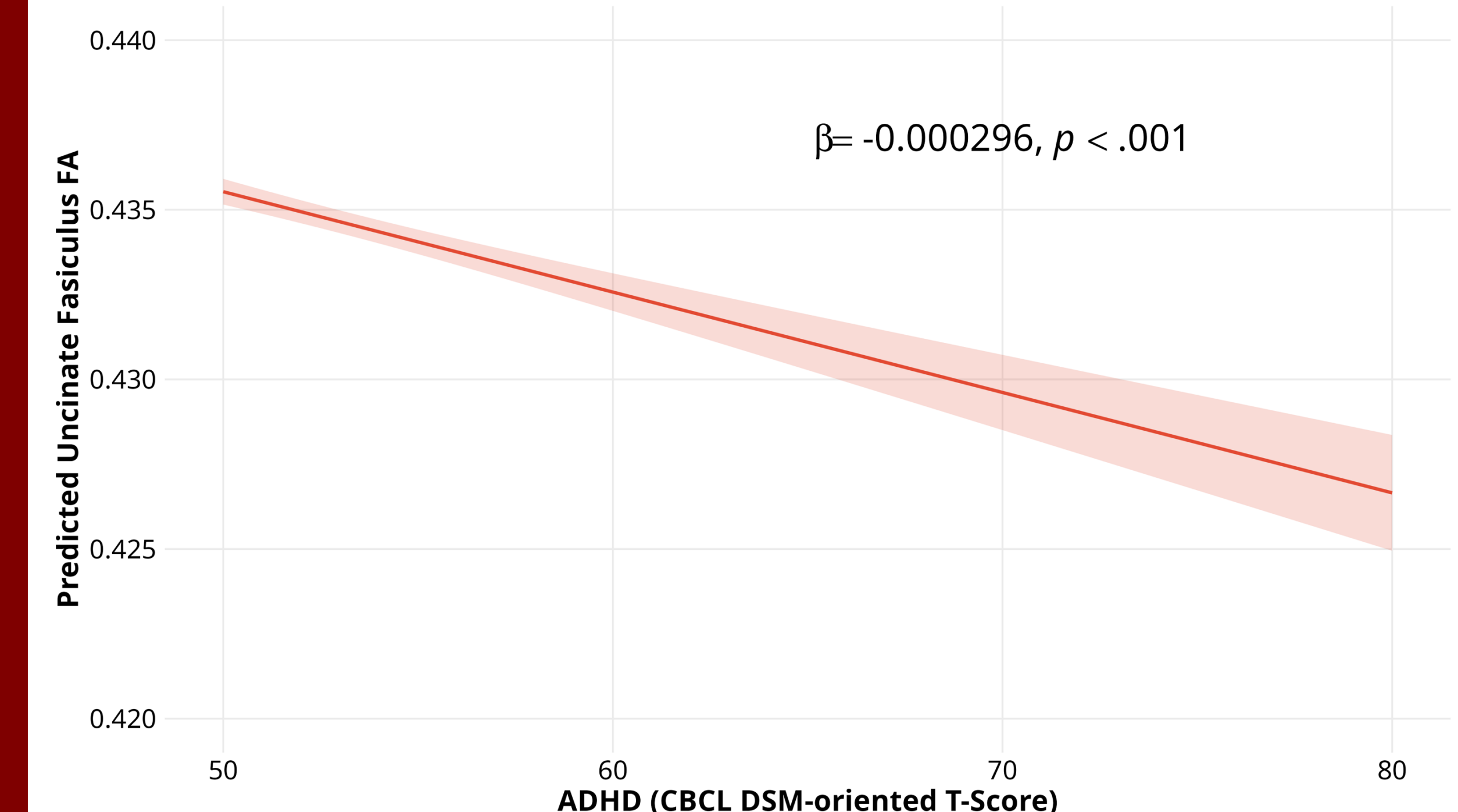
Model: FA of 8 tracts predicted by Dimensional Anxiety, Demographics (age, sex, race), Multiple SES measures, Trauma, ICV, and Interactions



- Significant effect of race (Black vs white) across all tracts ($p = .028 - <.001$)
- Effects for other races vs white are more modest, but in similar pattern.

ADHD Symptoms Specifically Correlate with UF FA in Anxiety, Depression, ADHD Model

Model: UF FA predicted by Multiple Dimensional Psychopathology (anxiety, depression, ADHD), Demographics (age, sex, race), Multiple SES measures, Trauma, ICV, and Interactions



- Higher ADHD predicted lower FA across 7 tracts ($p = .019 - <.001$).
- Anxiety and depression symptoms did not significantly predict FA in any tract in this model.
- Effects of other covariates are similar to anxiety-only model.

Conclusions

- Utilizing the large, broadly-phenotyped ABCD sample allows for a multidimensional exploration of complex relationships.
 - Higher anxiety symptoms predicted lower FA only in the UF.
 - ADHD symptoms are the strongest psychopathology predictor of FA across tracts.
- Age, sex, race, and SES consistently predict white matter microstructural integrity across multiple psychopathology.
 - Variation in direction of effects of race across tracts calls for comprehensive assessment and nuanced interpretation of relationship between race and white matter integrity.

Acknowledgments

Data used in the preparation of this poster were obtained from the [Adolescent Brain Cognitive Development™ \(ABCD\) Study](#), held in the [NIH Brain Development Cohorts Data Sharing Platform](#). This is a multisite, longitudinal study designed to recruit more than 10,000 children aged 9–10 and follow them over 10 years into early adulthood.

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