

Using FreeSurfer to Identify Brain Quality Across Childhood and Adolescence

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Youth Emotion Study (YES)

The Youth Emotion Study (YES) is a research study at UNC Chapel Hill in partnership with the UNC Girls Health Study that explores how brain development in adolescence is affected by stressful life experiences and to clarify neural risk markers for self-injurious thoughts and behaviors (STBs).

- fMRI scanning of adolescent girls (9-16 years) while they completed cognitive control, emotion regulation/reactivity, and social processing tasks
- Collected longitudinal fMRI data for a subset of the sample, to analyze changes in neural processes through adolescence
- Future analyses will explore the effects of maltreatment on cognitive and reward processing mechanisms, examine the effects of interpersonal stress on emotion reactivity and regulation and determine how mechanistic changes in these processes may be linked to or confer risk for STBs

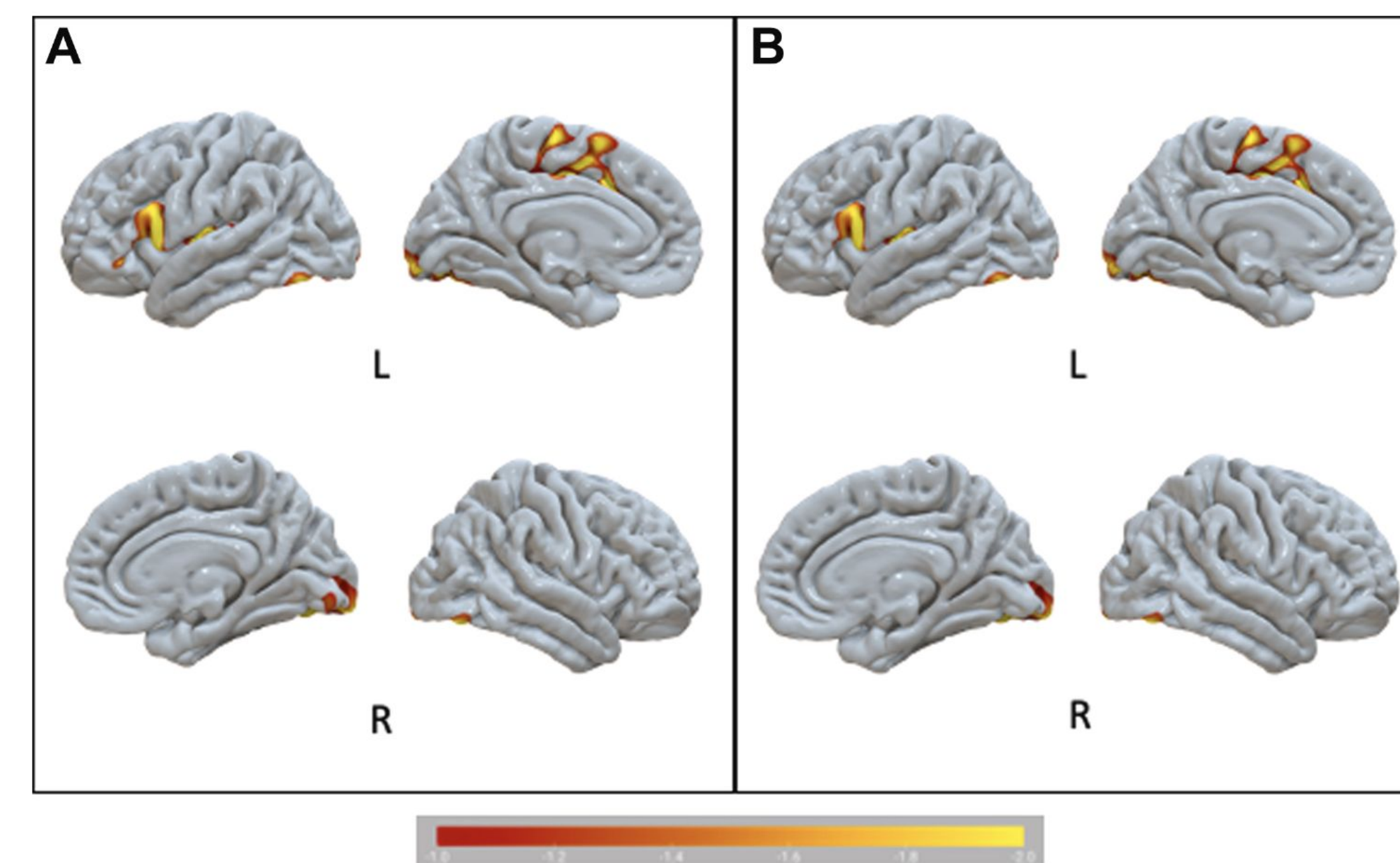


Figure 1
Associations Between Deprivation and Cortical Thickness
Note: (A) Deprivation is associated with increases in cortical thickness in the lateral occipital cortex (N = 72). (B) When additionally controlling for other adversities, deprivation is associated with increases in the insula, cingulate cortex, superior temporal, superior frontal, fusiform, and lateral occipital cortex (N = 72). L = left; R = right.

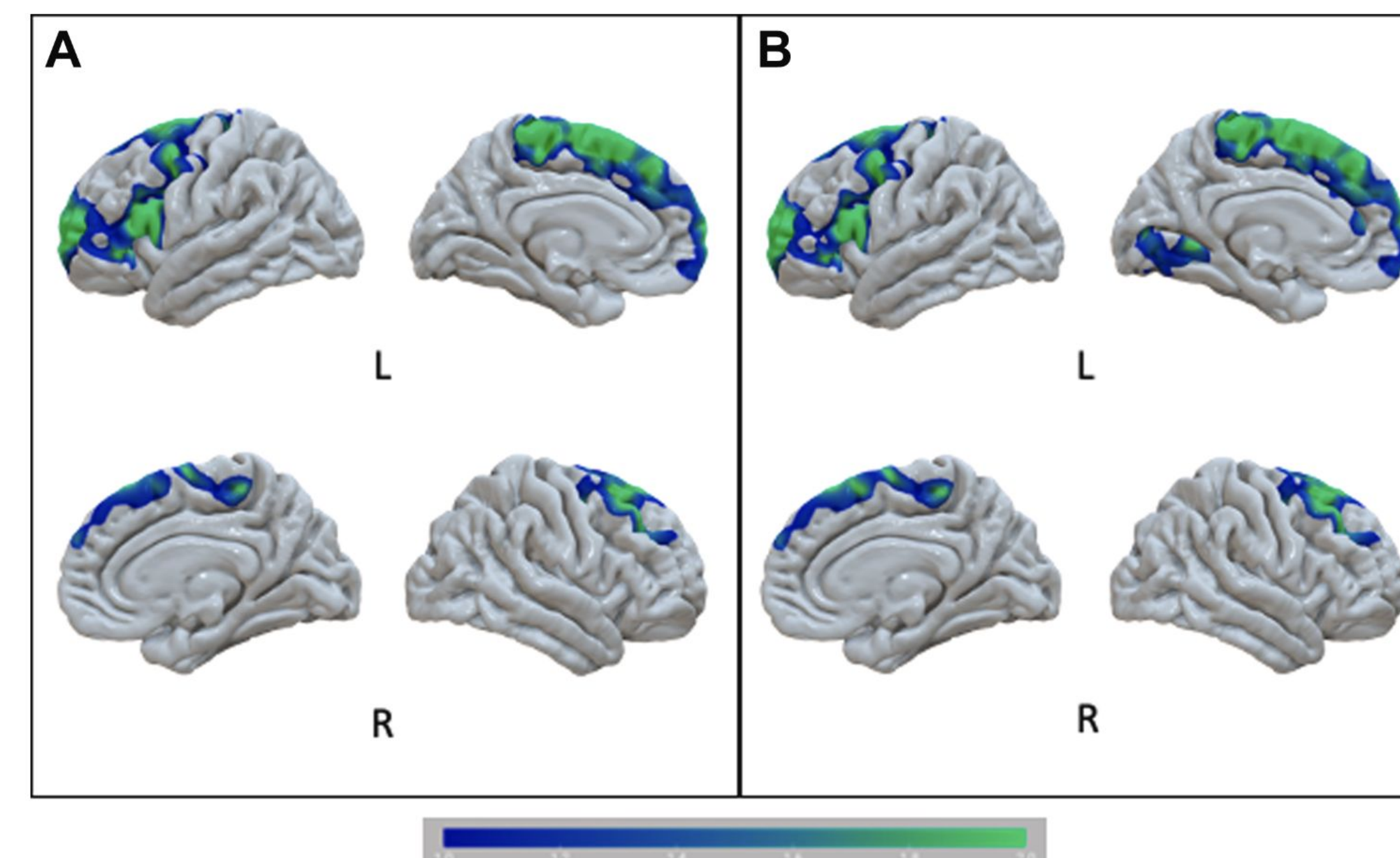
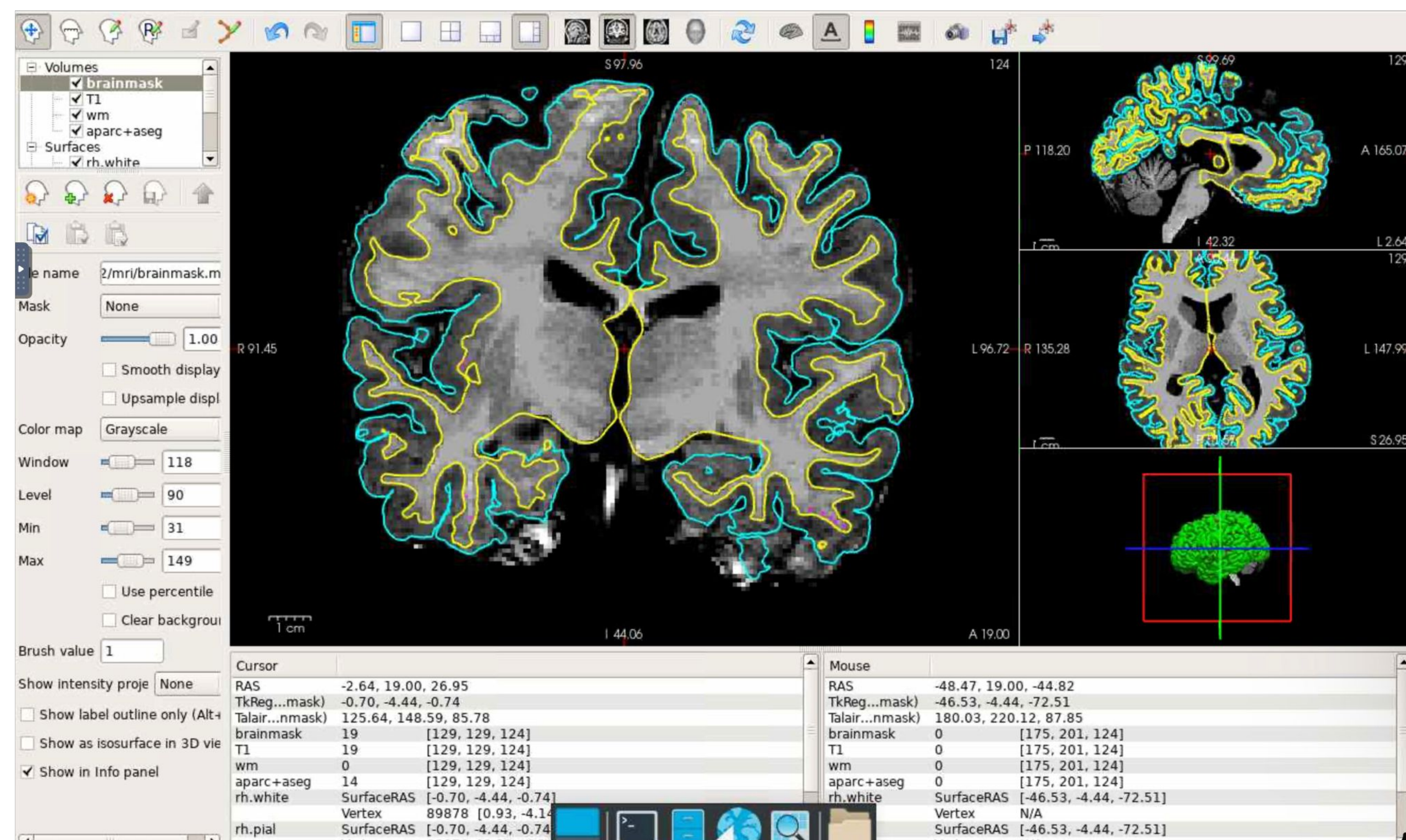


Figure 2
Associations Between Threat and Cortical Surface Area
Note: (A) Threat is associated with widespread decreases in cortical surface area, including substantial decreases across prefrontal regions (N = 72). (B) When additionally controlling for other adversities, results are largely unchanged (N = 72). L = left; R = right.

Study of Toddler to Teenager Anxiety and Resiliency (STTAR)

The Study of Toddler to Teenager Anxiety and Resiliency (STTAR) is a longitudinal follow-up to the Duke Preschool Anxiety Study conducted ten years ago at Duke Primary Care. This study is designed to discern how adolescents (ages 12-18) are influenced by their early life experiences. Our current study expands on Duke's original study and aims to understand how the original group of participants has developed over the last decade and how facets of early childhood affect a teenager's emotionality and emotion regulation.

- This study involves both parent and adolescent participation to gain a well-rounded holistic view of the child's development, mood, feelings, thoughts, and behaviors
- Data is collected using Magnetic Resonance Imaging (MRI), which is used to gain a better understanding of the relationship between cortical development and emotionality/emotion regulation



The FreeSurfer Software

FreeSurfer: neuroimaging data analysis software that quantifies functional, connectonal and structural properties of brain images taken by *Magnetic Reasoning Images (MRIs)*.

- MRIs - use strong magnetic field to produce images of the brain
 - Measure energy released when protons shift
 - Identify certain types of tissue in the brain, and therefore can depict different parts of the brain
- FreeSurfer **identifies white and gray matter** and uses a template to mark boundaries for those tissues
 - Assign "names" to subcortical and cortical areas.
- How FreeSurfer works: Acquire a T1 weighted image > register T1 into "space" using gross landmarks (skull, ventricles) and affine registration > skull is then stripped > white matter points chosen based on MNI coordinates and intensity > finally, white matter locations are used to "scoot out" until intensity falls out and goes black (CSF).

References

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- *Studies*. CIRCLE Lab. (n.d.). Retrieved April 18, 2023, from <https://circlelab.unc.edu/studies/>
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