Using normative model to analyze the changes of white matter microstructural properties in autism spectrum disorder

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Background
Cumulative evidence supports white matter impairment in autism spectrum disorder (ASD). Whether the development of white matter tracts in ASD deviated from the norm are still unclear. Using a longitudinal follow-up design and normative model analysis, this study investigated the developmental changes in microstructural properties of white matter tract in ASD and clinical correlates of the change rate of white matter diffusion indices.

Aims & Objectives
This study aims to (1) exam whether structural connectivity of ASD deviated from the norm and (2) investigate whether the change of structural connectivity of ASD deviated from the norm.

Methods
This study recruited 75 individuals with ASD (aged 15.3±4.2 years) at baseline and followed the imaging 4.7±1.9 years later. We used Siemens 3T MRI diffusion spectrum imaging to measure structural connectivity. To measure the magnitude of deviation from the norm, we calculated z-scores of fractional anisotropy (FA), axial diffusivity (AD), radial diffusivity (RD), mean diffusivity (MD), and generalized FA (GFA) for each of 76 tracts based on a norm established in 680 typically-developing individuals.

Results
We found that callosal fibers connecting the temporal poles, hippocampus, and amygdala showed higher AD, RD, and MD in ASD at both Time 1 and Time 2. Several tracts showed greater increases in FA z-scores at follow-up (Time 2), including the right superior longitudinal fasciculus, precentral thalamic radiation, frontal aslant tract, right corticospinal tracts, left arcuate fasciculus, callosal fibers connecting genu, and bilateral thalamic radiation.

Discussion & Conclusion
Findings suggested that the callosal fibers connecting hippocampus, temporal poles, or amygdala were most significantly altered at both time points and did not show significant changes between the two time points. Consistent with previous findings, tracts with increased FA z-scores from Time 1 to Time 2 included SLF, thalamic radiation, left arcuate fasciculus, right frontal aslant tract and corticospinal tract, supporting delayed maturation of these tracts in ASD.