No association between cortical gyrification or intrinsic curvature and attention-deficit/hyperactivity disorder in adolescents and young adults


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Magnetic resonance imaging (MRI) studies have highlighted subcortical, cortical and structural connectivity abnormalities associated with attention-deficit/hyperactivity disorder (ADHD). Gyrification investigations of the cortex have been inconsistent and largely negative, potentially due to a lack of sensitivity of the previously used morphological parameters. The innovative approach of applying intrinsic curvature analysis, which is predictive of gyrification pattern, to the cortical surface, applied herein allowed us greater sensitivity to determine whether the structural connectivity abnormalities thus far identified at a centimeter scale also occur at a millimeter scale within the cortical surface. This could help identify neurodevelopmental processes that contribute to ADHD.

Structural MRI datasets from the NeuroIMAGE project were used [n=306 ADHD, n=164 controls and n=148 healthy siblings of individuals with ADHD (age in years, mean(sd); 17.2 (3.4), 16.8 (3.2) and 17.7 (3.8), respectively)]. Reconstructions of the cortical surfaces were computed with FreeSurfer. Intrinsic curvature (taken as a marker of millimetre-scale surface connectivity) and local gyrification index were calculated for each point on the surface (vertex) with Caret and FreeSurfer, respectively. Intrinsic curvature skew and mean local gyrification index were extracted per region; frontal, parietal, temporal, occipital, cingulate and insula. A generalized additive model was used to compare the trajectory of these measures between groups over age, with sex, scanner site, total surface area of hemisphere and familiarity accounted for.

After correcting for sex, scanner site, and total surface area no group differences were found in the developmental trajectory of intrinsic curvature or local gyrification index. Despite the increased sensitivity of intrinsic curvature, compared to gyrification measures, to subtle morphological abnormalities of the cortical surface, we found no millimeter-scale connectivity abnormalities associated with ADHD.