Structural Brain Features Associated with Autism in Children: A VBM Study

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Introduction

ADOS & ADI-R
- Autism Spectrum Disorder (ASD) identified with Autism Diagnostic Observation Schedule (ADOS)
- Autism identified with the Autism Diagnostic Interview – Revised (ADI-R)
- Both cover communication & language, social interaction, and play

VBM Analysis
- Statistical parametric mapping identifies brain anatomy differences across two groups
- Scans aligned with template, removing large anatomical differences
- Segmented & smoothed, each voxel represents the average of surrounding area
- Then each voxel's image is compared across all the brain images

Wechsler Abbreviated Scale of Intelligence FIQ
- Most common test for IQ in children
- Combined score of Vocabulary, Similarities, Block Design, & Matrix Reasoning
- Scores calculated using average of same age typical performance

Grey Matter Volume
- Typically increases across child development
- Peaks during puberty, then decreases

Methods

Participants

26 total ages 7-12Y/L: 10 Typical (M=11.0) & 16 Autism/ASD (M=10.37)
- All participants fully verbal
- Inclusion criteria for Autism/ASD: meet designation from ADOS or ADI-R
- Inclusion criteria for typical: no history of any genetic, neurological, psychiatric, or developmental disorders & no first degree relatives with an ASD diagnosis

Source
- Scans taken by UCLA & procured through the ABIDE I database

Processing
- Anatomical MRI scans processed through CAT 12 & SPM tools in Matlab
- Grey matter, white matter, and cerebrospinal fluid data segmented
- Grey matter segments were smoothed and compared
- Identified structural differences in scans
- Comparisons were made across ASD/Autism scans and typical scans & the structural differences and FIQ scores interaction

Results

Test Scores:
- Typical Average FIQ score M = 109.8 > Average FIQ ASD/Autism M = 103.375
- The overall FIQ score range within "Average" (90-109): 90-132

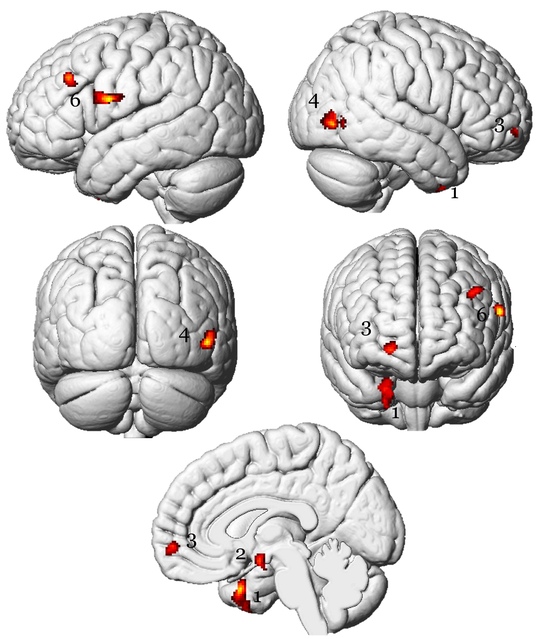
Independent Samples T-Test

Independent Samples T-Test

	t	df	p
FIQ	-1.220	24.00	0.234

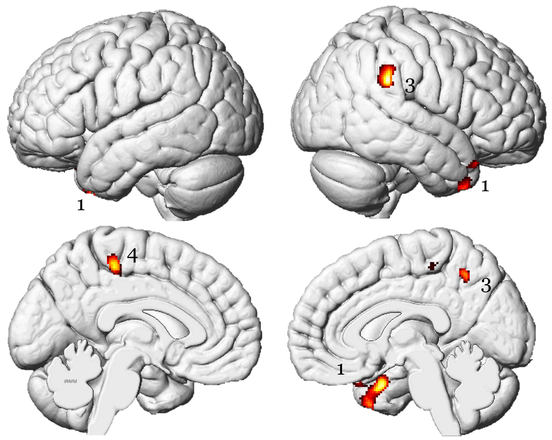
Significance Minimums:
- Clusters>=125 voxels
- Pvalue = 0.005

Typical



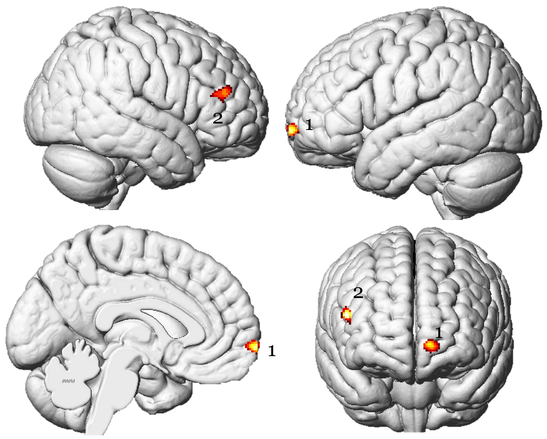
Most Notable Clusters Located In:
1. Superior Temporal Gyrus
2. Limbic Lobe
3. Superior Frontal Gyrus
4. Inferior Frontal Gyrus
5. Lentiform Nucleus
6. Precentral Gyrus
7. Middle Frontal Gyrus

Interaction



Most Notable Clusters Located In:
1. Limbic Lobe
2. Inferior Parietal Lobule
3. Precuneus
4. Paracentral Lobule

Autism



Most Notable Clusters Located In:
1. Superior Frontal Gyrus
2. Middle Frontal Gyrus

Significance

- This correlation between IQ scores and the GMV in the frontal regions might show that the maturation of these areas are crucial for the Autism group.
- The frontal areas that correlate with intelligence were more inferior for the Typical group and more superior for the Autism/ASD group. This can indicate developmental differences in frontal networks that are important for the IQ measure.
- The interaction shows differential relations with the intelligence scores, between the Autism and Typical groups.
- The typical group had two clusters showing GMV and IQ correlations whereas GMV correlated with IQ only in two clusters for the Autism group. This imply a more focal network for intelligence in the Autism group.

Application

- In combination with further study, could give a clearer understanding of the developmental & structural differences in children with Autism
- Could point to more comprehensive understanding of the neurological differences within the Autism Spectrum
- These understandings could potentially refine accommodation methods and education to better serve individuals with Autism/ASD
- Potential for more further study into association of FIQ levels and structural differences in children with ASD/Autism

References

Dapretto, Mirella, Bookheimer, S., Rudie, J., (2018) University of California: Los Angeles. Ahmanson-Lovelace Brain Mapping Centers, Center for Cognitive Neuroscience, Department of Psychiatry & Biobehavioral Science, Interdeparmental Neuroscience Program, David Geffen School of Medicine. Retrieved from: http://fcon_1000.projects.nitrc.org/indi/abide/abide_I.html

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