



Center for Diversity in
Public Health Leadership Training
at Kennedy Krieger Institute

An Assessment of Cortical Thicknesses and Surface Areas Between Groups with Autism & Intellectual Disability

UC DAVIS
HEALTH

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INSTITUTE

¹ Maternal Child Health Careers/ Research Initiatives for Student Enhancement-Undergraduate Program at Kennedy Krieger Institute,
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UC Davis MIND Institute

INTRODUCTION

Previous research has studied differences in cortical thickness & surface areas in autism and in intellectual disability (ID) separately but not jointly. This study explores differences in cortical thickness and surface areas in autistic individuals with intellectual disability (ASD-ID) and autistic individuals with normative IQ (ASD-N) and typically developing controls (TD).

- Are there regions associated with both autism and intellectual disability?
- Is there a difference in cortical surface areas/thickness between groups with Autism + Intellectual Disability (ASD-ID), Autism without ID (ASD-N), and groups with Typical Development (TD)?

The following are regions of interest (ROI) were selected based on a literature review of both autism and intellectual disability research:

- postcentral gyri and sulci
- temporal inferior gyri
- superior parietal gyri
- right precentral gyrus
- right parietal inferior supramarginal gyrus
- occipital temporal lateral fusiform gyrus

OBJECTIVE

Assess cross-sectional data to identify group differences in cortical surface area and thickness.

PARTICIPANTS

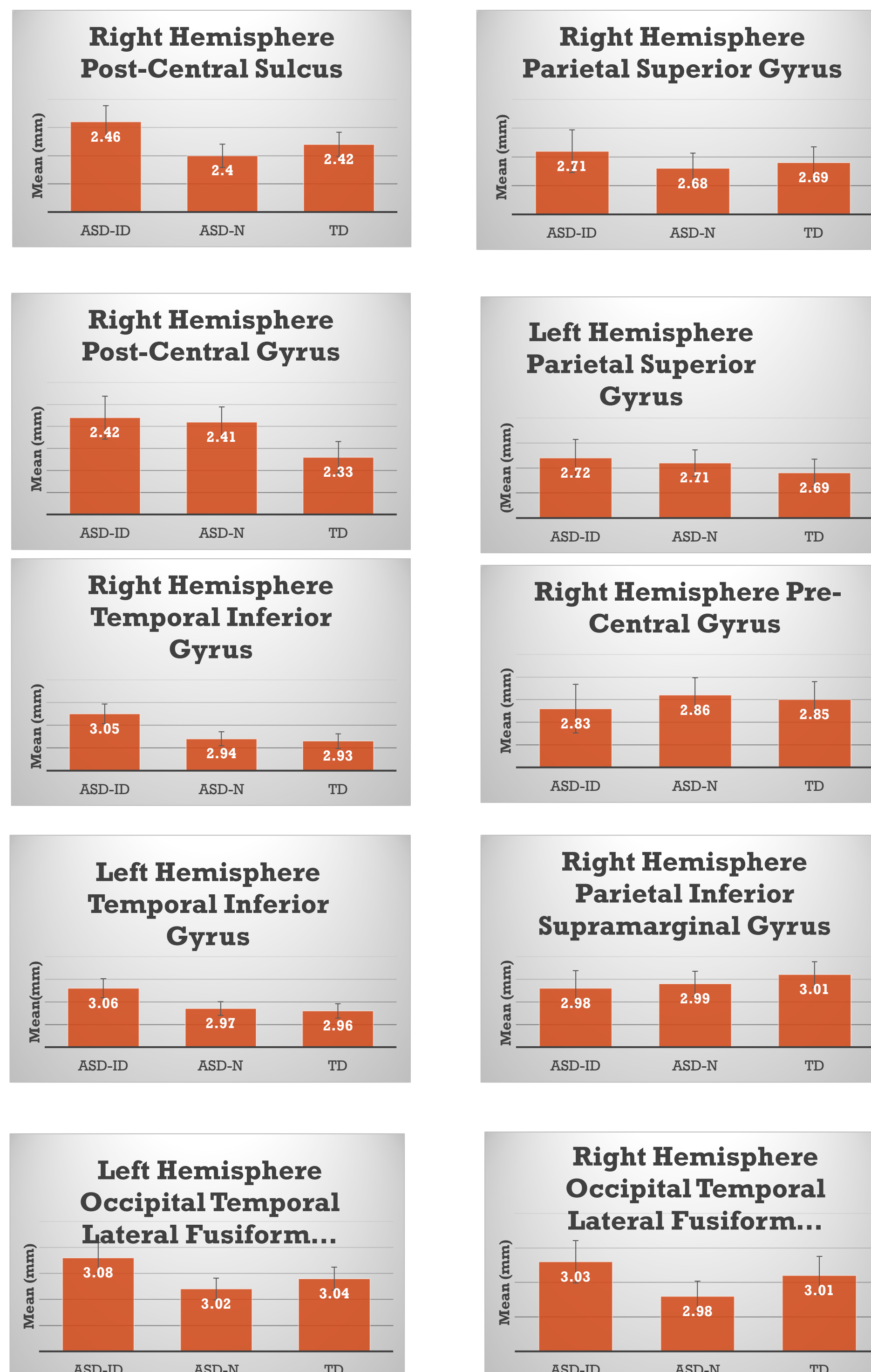
	Males			Total	Females			Total
	ASD-ID	ASD-N	TD		ASD-ID	ASD-N	TD	
COUNT	23	36	26	85	7	21	26	54
Mean Age	64.38	64.46	64.96	64.6	68.34	63.75	65.24	65.78
Full IQ Score	44.05	102.3	113.2		36.02	104.9	116.1	
Child Behavior Checklist Total Score	58.56	57	42.76		69.75	55.11	41.43	
ADOS Severity	8.35	6.7	1		7.86	5.52	1	

METHODS

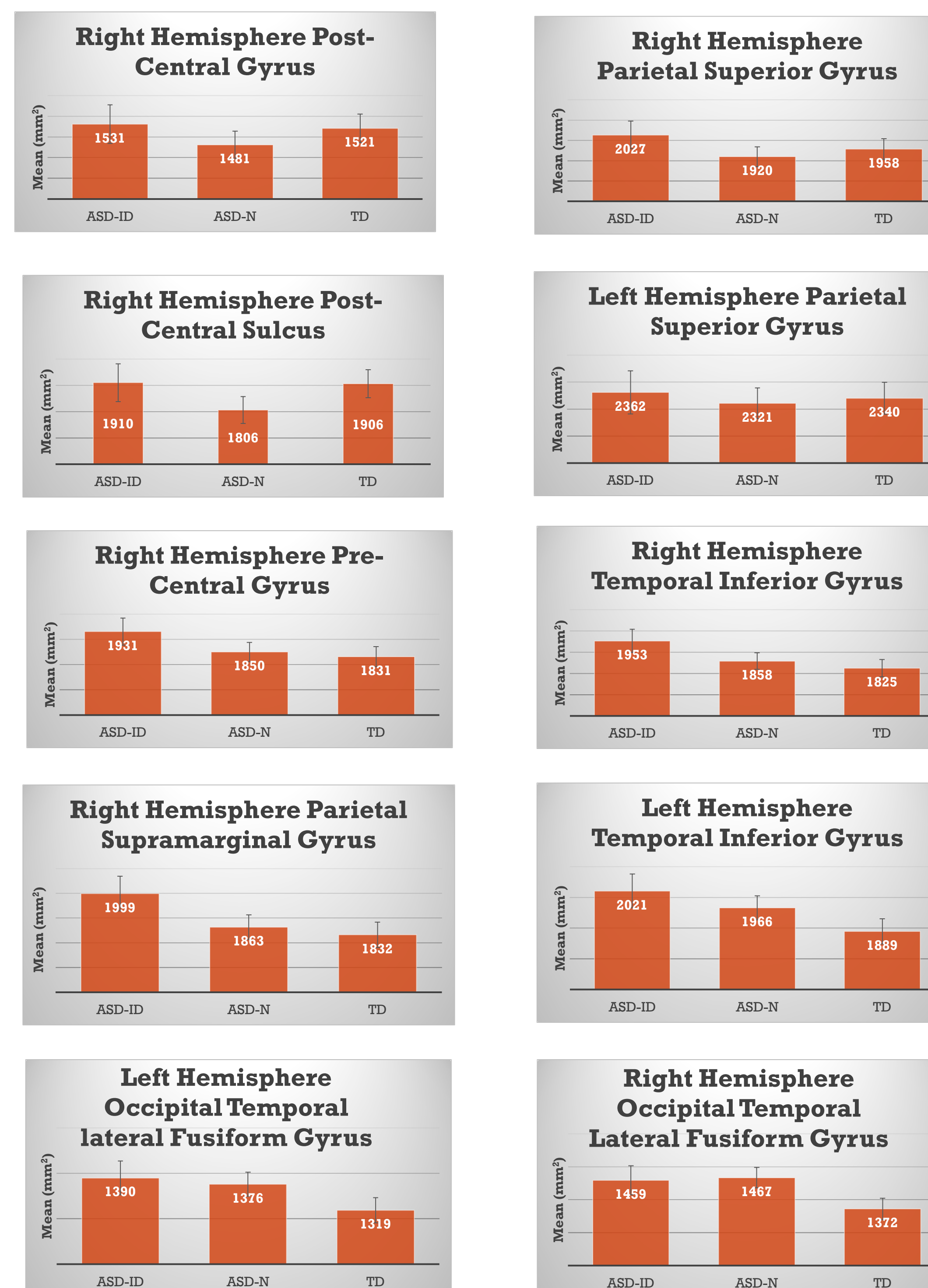
- MRI with FreeSurfer software for brain region data collection
- Multiple linear regression was performed regressing each ROI on group (ASD-ID, ASD-N, TD), age, and sex. Paired comparisons were performed using Tukey's correction for multiple comparisons.

RESULTS

Cortical Thicknesses



Cortical Surface Areas



Figures depict mean cortical thicknesses (left) and surface areas (right) of each group: ASD-ID, ASD-N, and TD. Error bars represent standard error.

DISCUSSION

- Group differences in cortical thickness and surface area were not statistically significant to the $p = .05$ level.
- However, broad patterns were observed:
 - For 8 of the 10 ROIs, the numerically thickest cortex was in the ASD-ID group.
 - For 9 of 10 ROIs, the numerically greatest surface area was in the ASD-ID group.

STRENGTHS & LIMITATIONS

Strengths:

- one of the first studies to assess brain differences in autism as a function of intellectual disability

Limitations

- modest sample size
- analysis was restricted to these regions of interest so we cannot say whether other ROIs might exhibit differences

Future directions

- multivariate analyses to identify broader more general patterns across ROIs
- look at other ROIs

ACKNOWLEDGEMENTS

I would like to thank the families who participated in the APP study, to my mentors, Dr. Joshua Lee and Dr. Christine Nordahl, for their guidance and mentorship throughout this study, to KKI Group for the wonderful opportunity to participate in the RISE-UP Program, and to my RISE-UP Cohort at UC Davis for your overall support and making my experience wholesome.

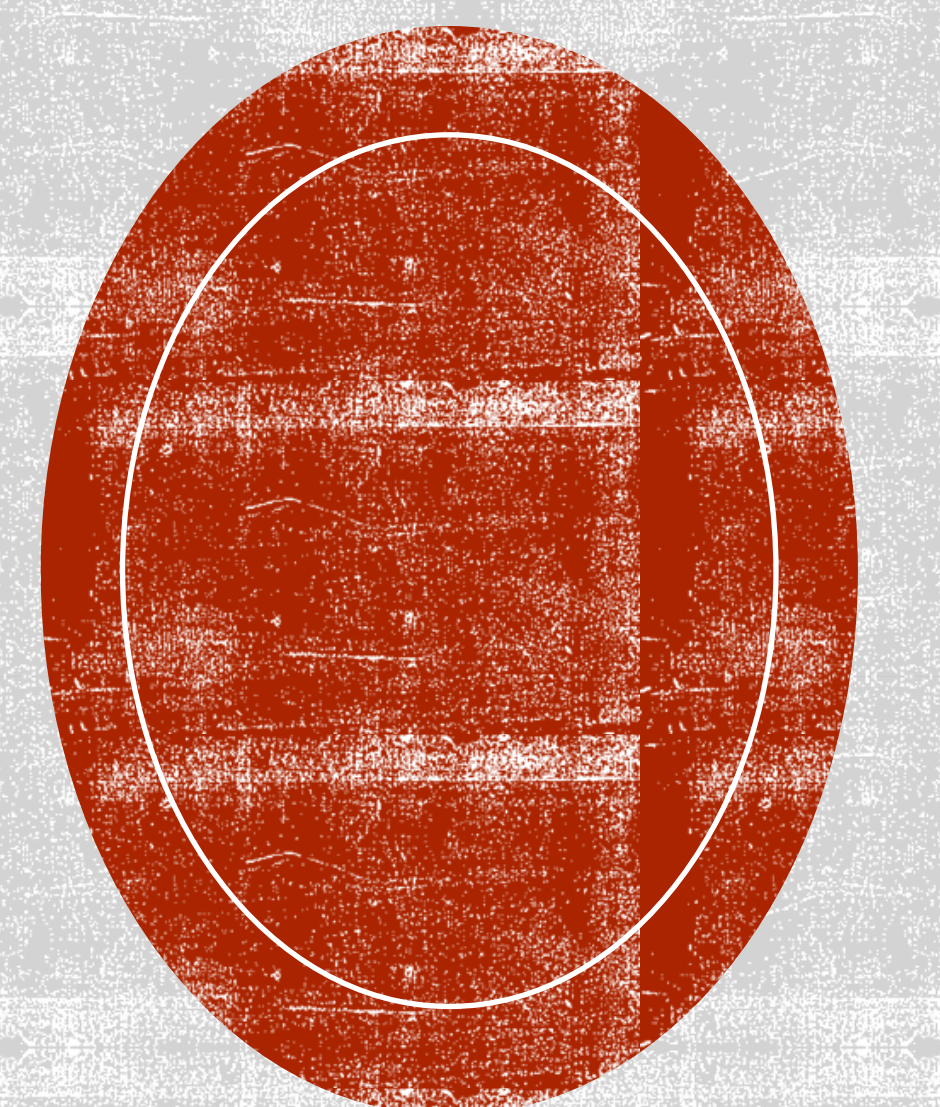
REFERENCES



Kennedy Krieger Institute

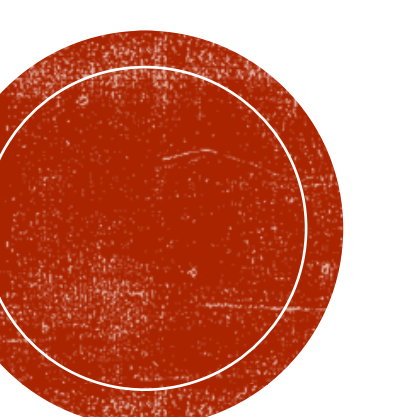
AN ASSESSMENT OF CORTICAL THICKNESSES AND SURFACE AREAS BETWEEN GROUPS WITH AUTISM & INTELLECTUAL DISABILITY

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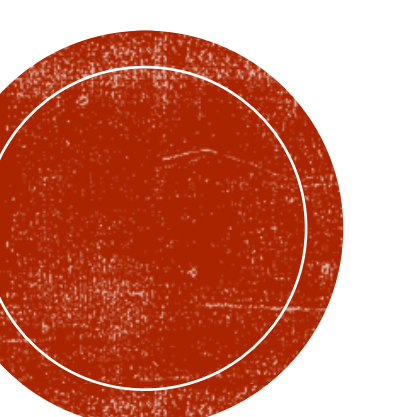
RELEVANCE

- **Autism Spectrum Disorder (ASD):** – developmental condition associated with impairments to social function and repetitive behaviors
- **35.2% individuals with autism present with severe intellectual disabilities yet little research has looked at how brains of autistic individuals with and without intellectual disability differ.**



IMPORTANT TERMS

- Autism --ASD
- Intellectual Disability – ID ; IQ scores <70
- Autistic individuals with intellectual disability --ASD-ID
- Autistic individuals with normative IQ -- ASD-N
- Typically developing controls -- TD.
- Brain Regions of Interest -- ROIs



AN ASSESSMENT OF CORTICAL THICKNESSES AND SURFACE AREAS BETWEEN GROUPS WITH AUTISM & INTELLECTUAL DISABILITY

- **Is there a difference in cortical surface areas/thickness between groups with Autism + Intellectual Disability (ASD-ID), Autism without ID (ASD-N), and groups with Typical Development (TD)?**
- **Assess cross-sectional data from the Autism Phenome Project study to identify group differences between ASD-ID, ASD-N and TD**



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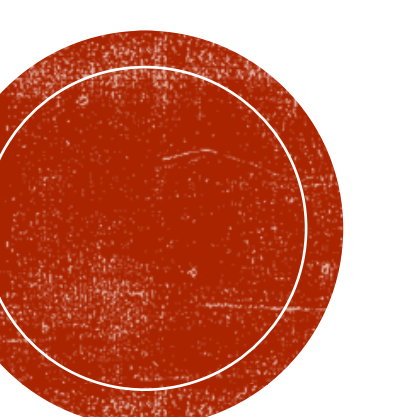
Regions of Interest:

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METHODS

- Data was collected as part of the Autism Phenome Project (APP) family studies
 - Structural MRI images were acquired in early childhood
 - Mean Age: ~5.5 years
 - ASD-ID (30)
 - ASD-N (57)
 - TD (52)



METHODS

- Assessed cortical thickness/surface area using FreeSurfer pipeline

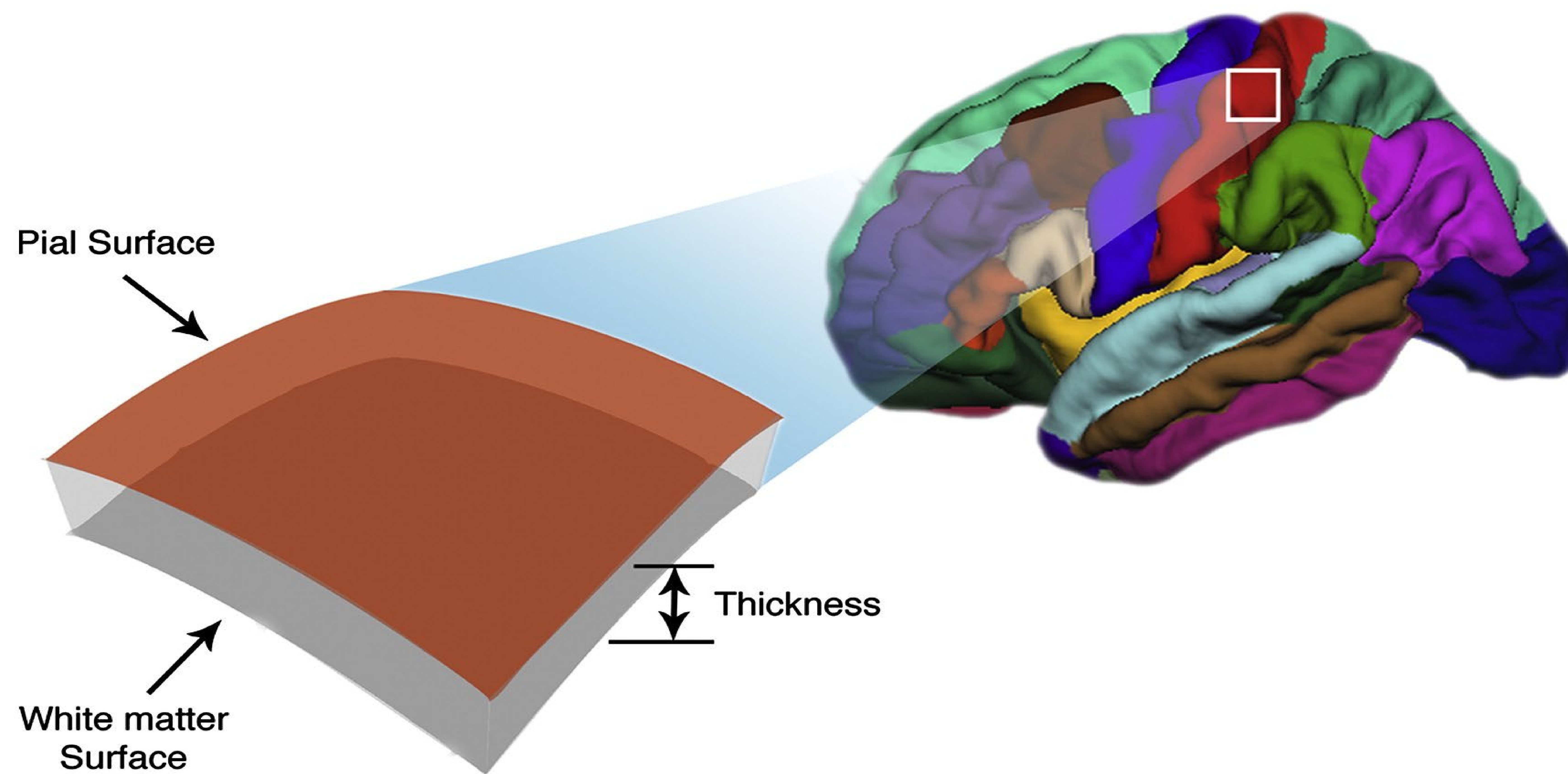
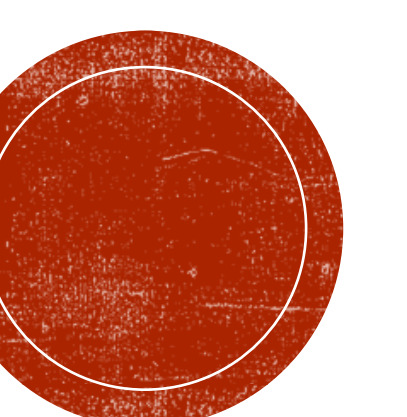
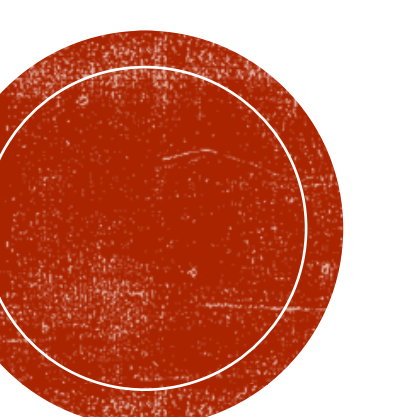


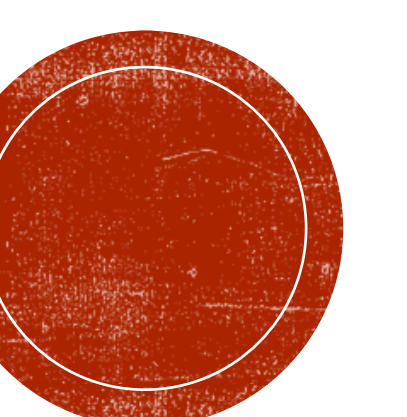
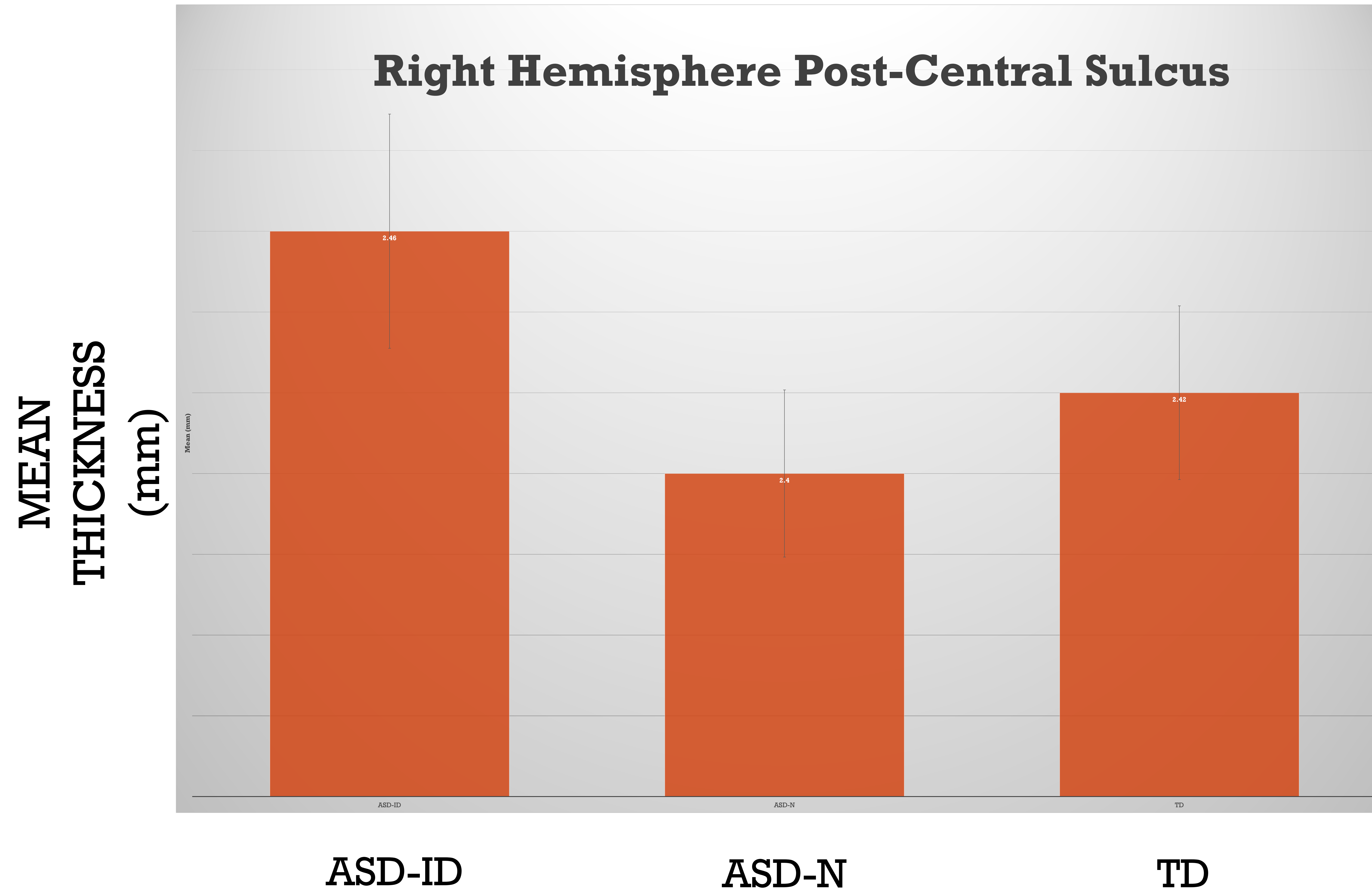
Figure from Wieranga, Langen, Oranje, and Dusron (2014) in *NeuroImage*



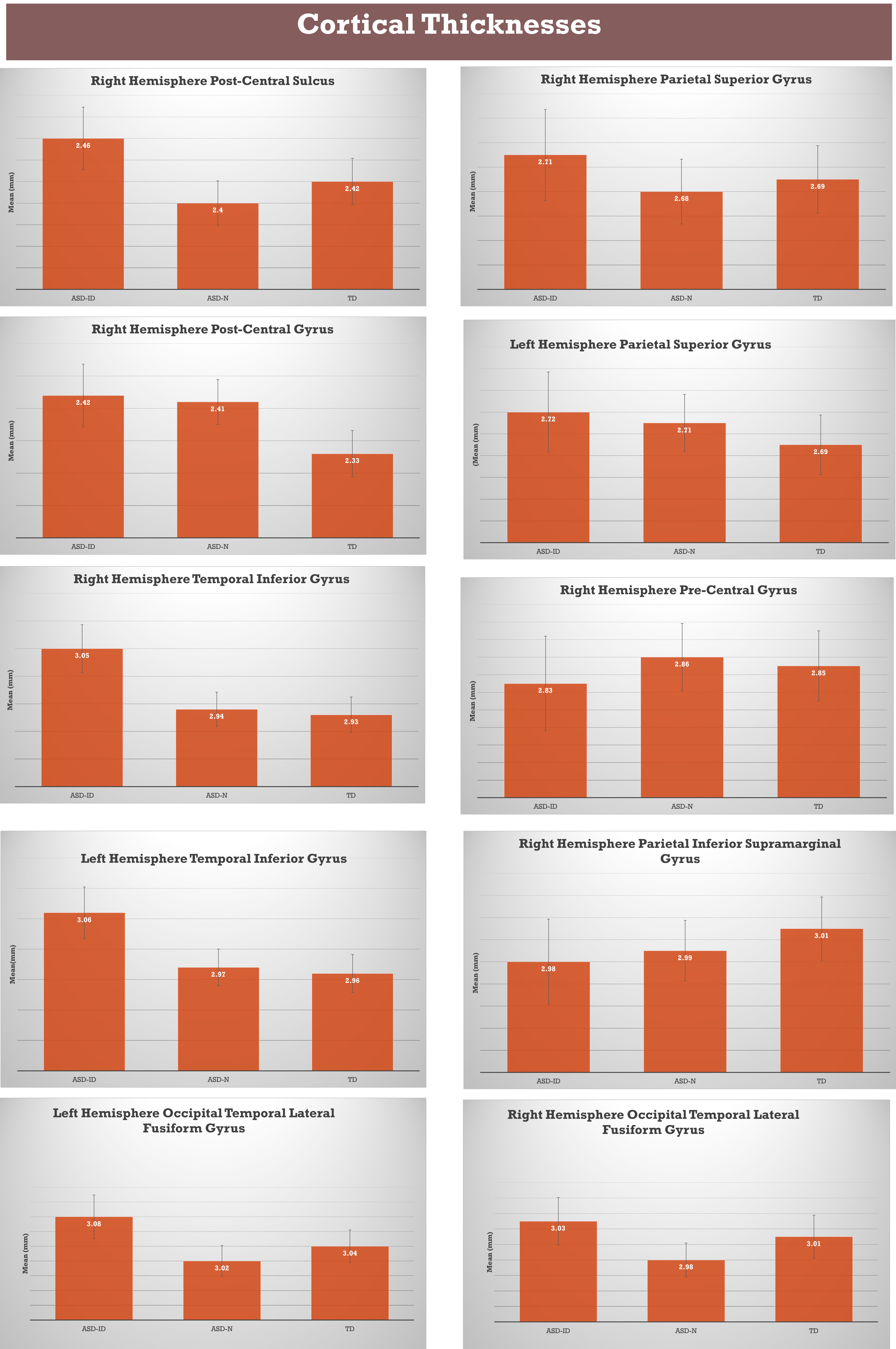
METHODS

- Performed multiple linear regression on each ROI comparing each group (ASD-ID, ASD-N, TD) while controlling for age, and sex.



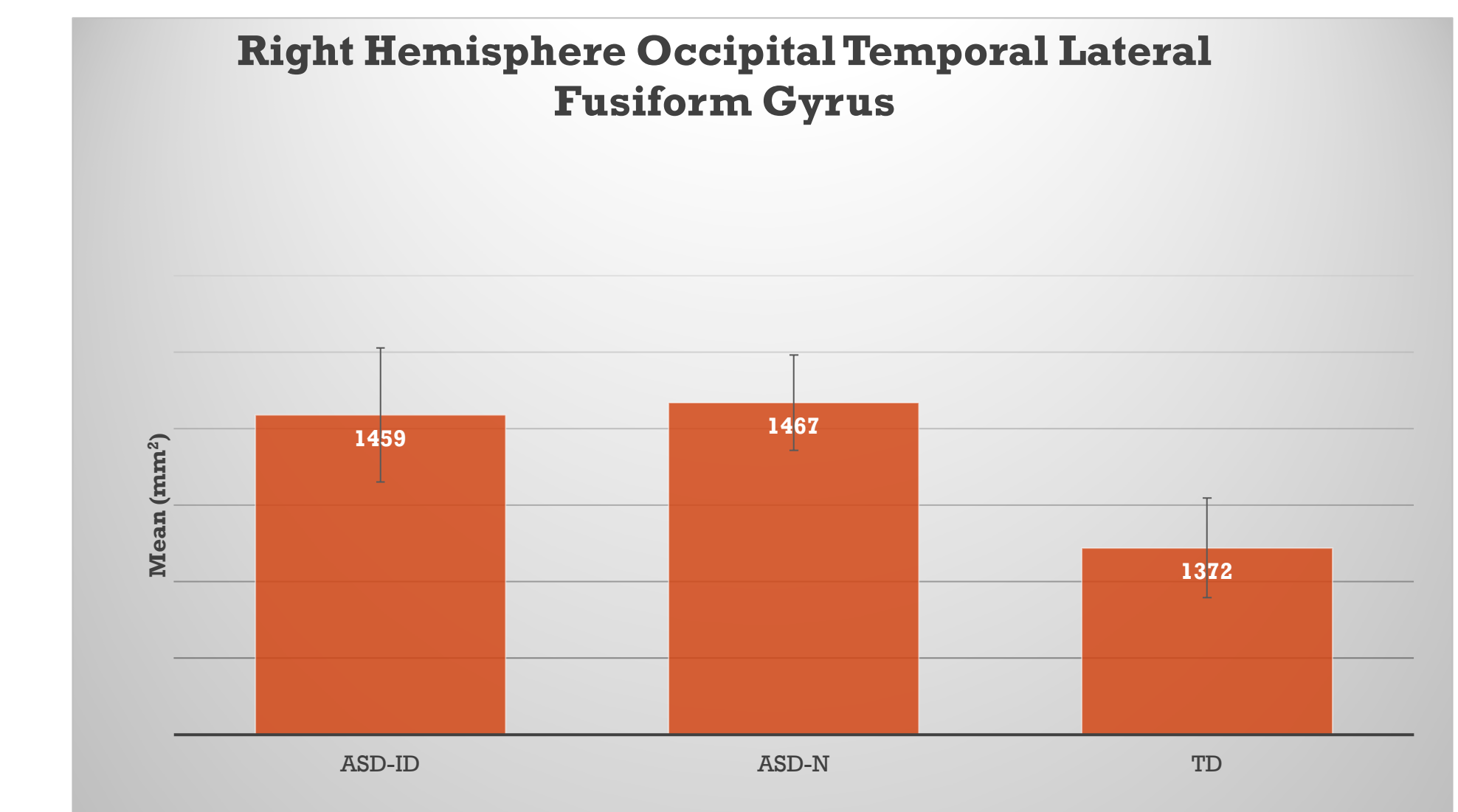
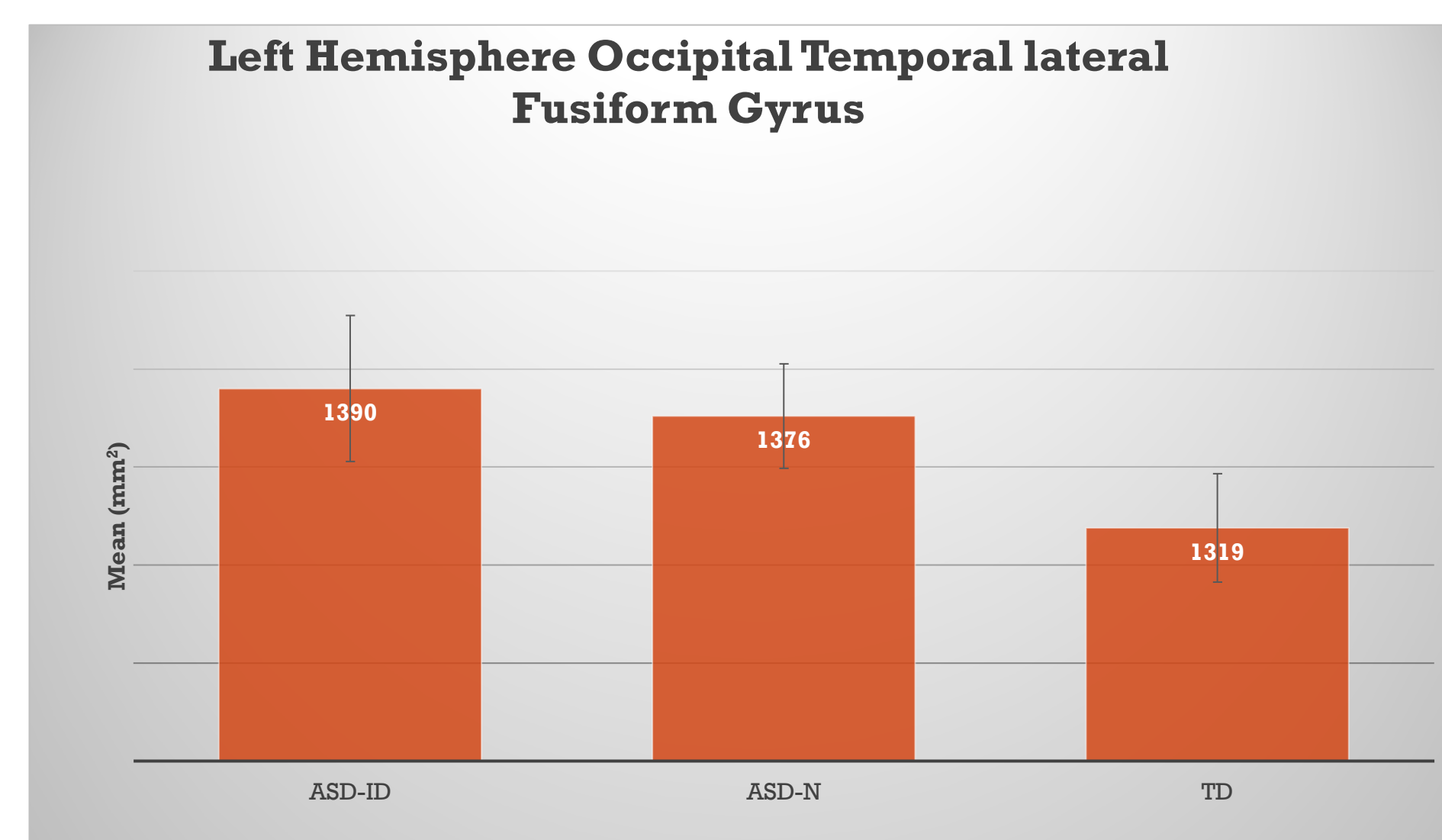
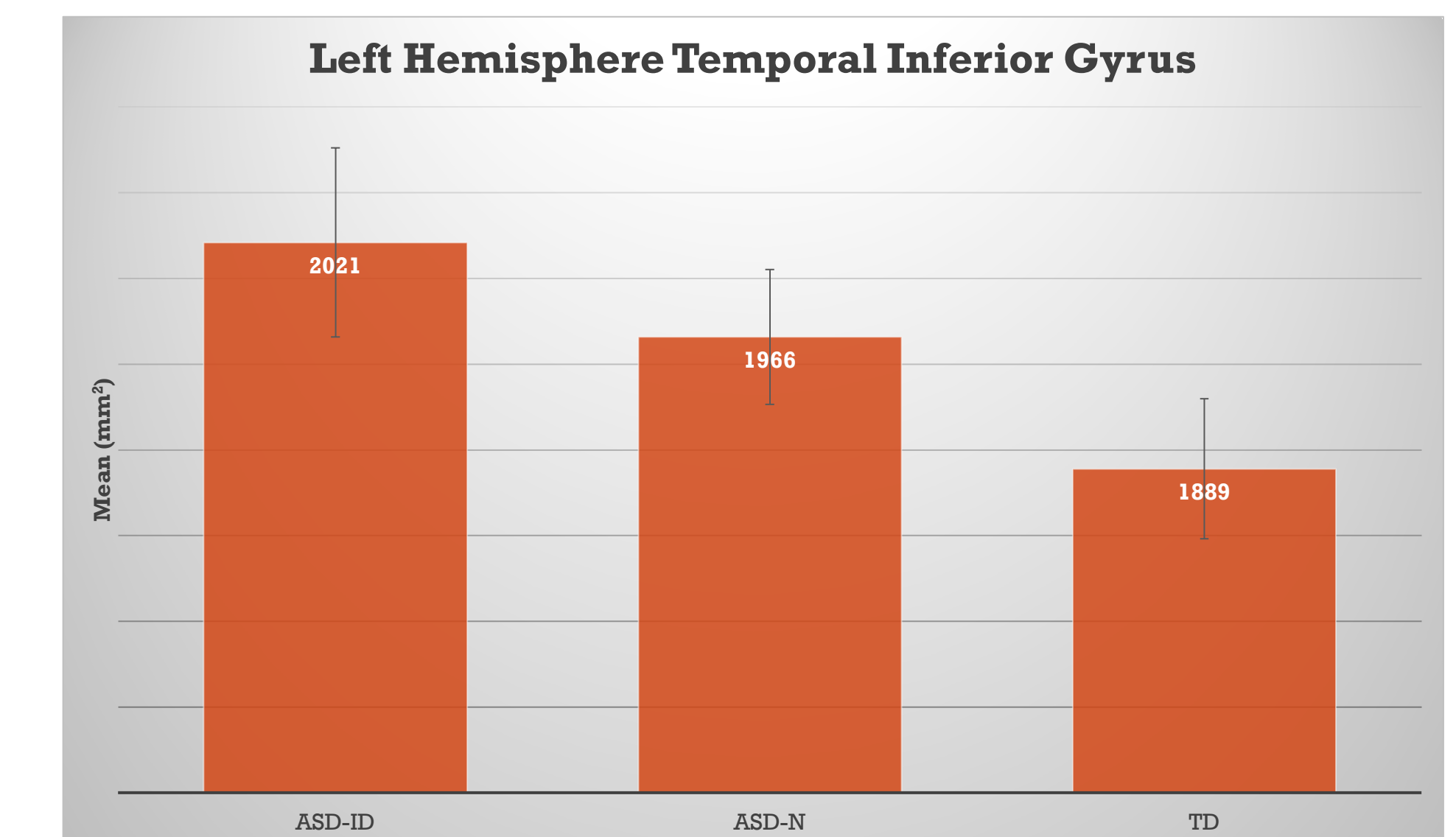
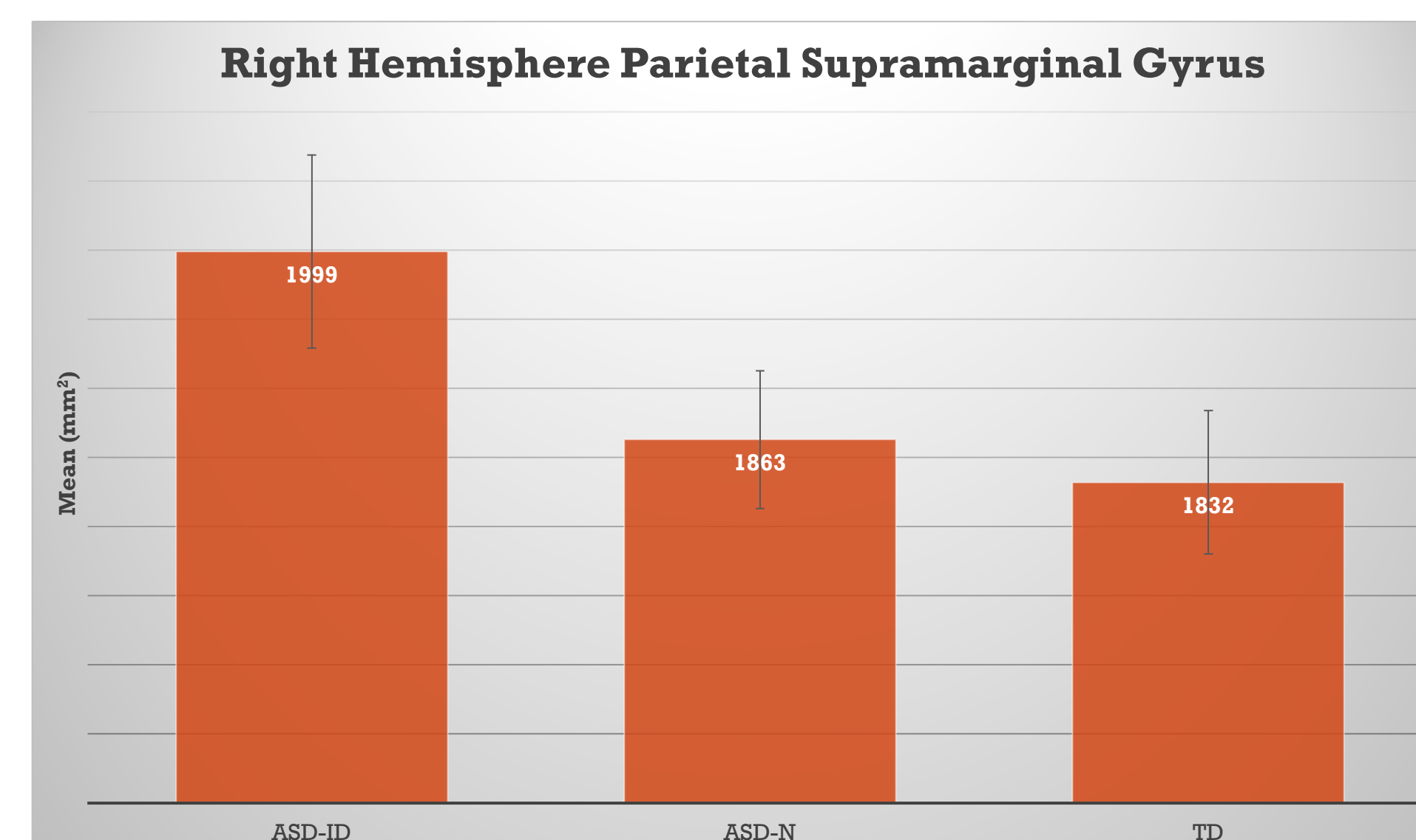
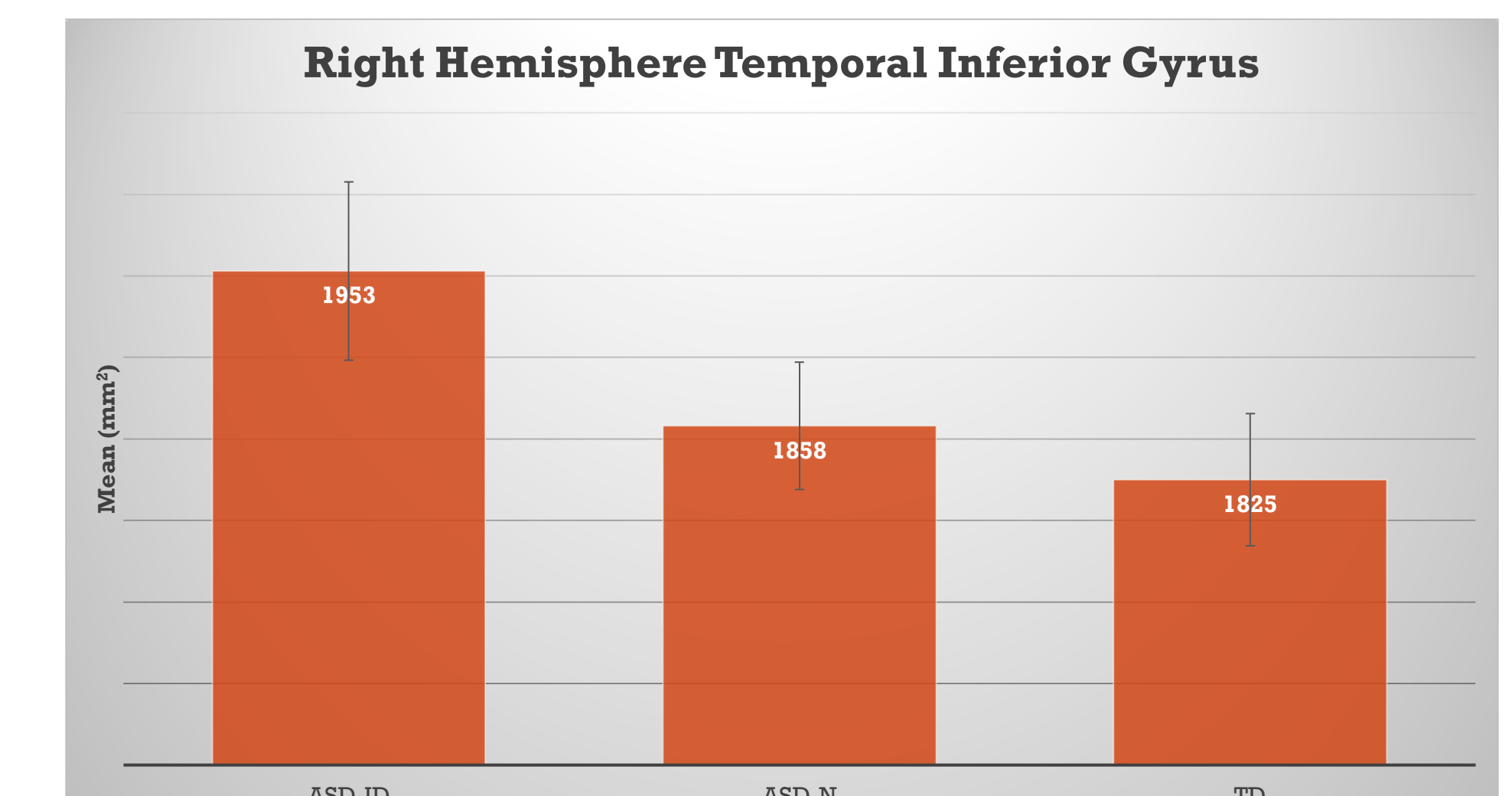
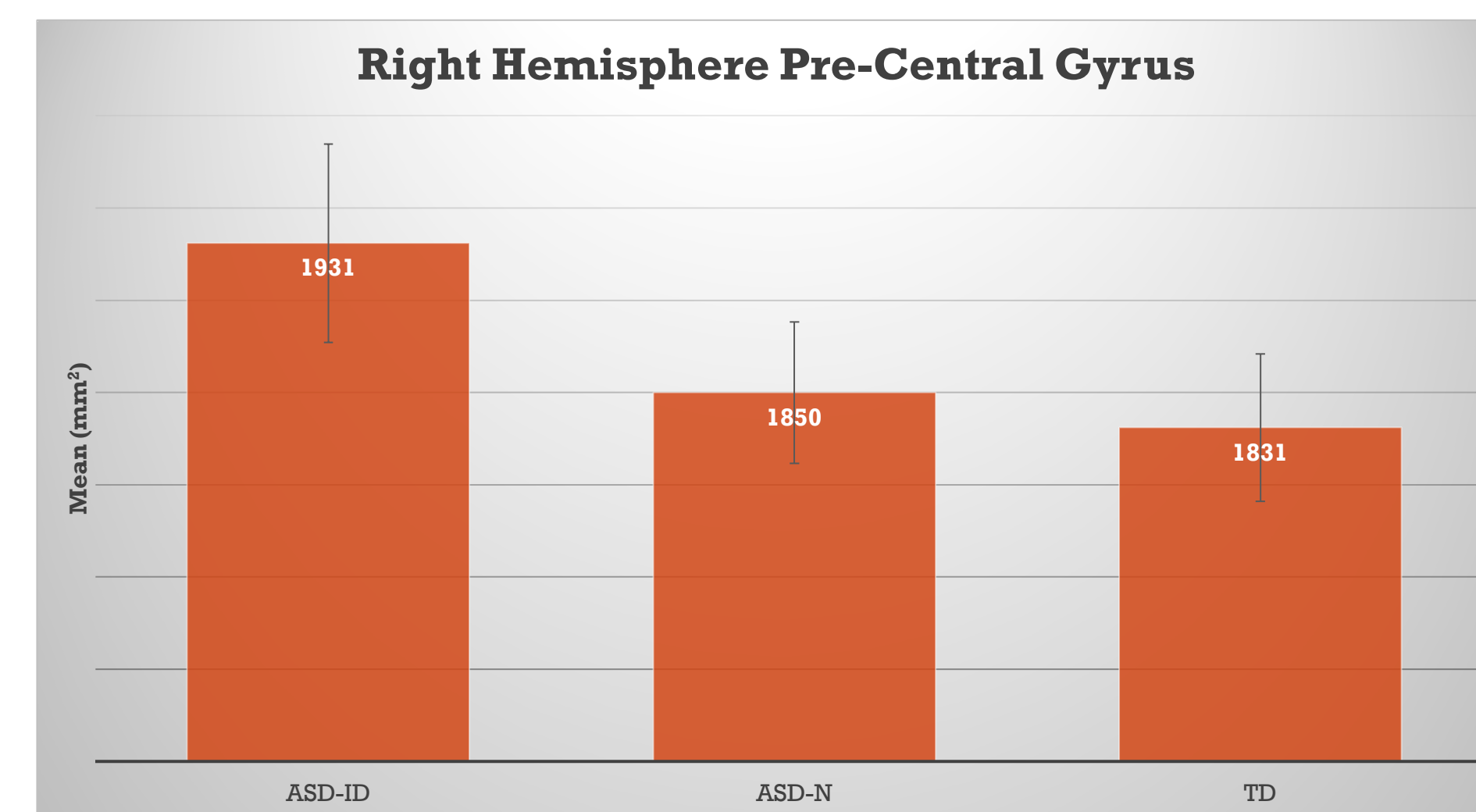
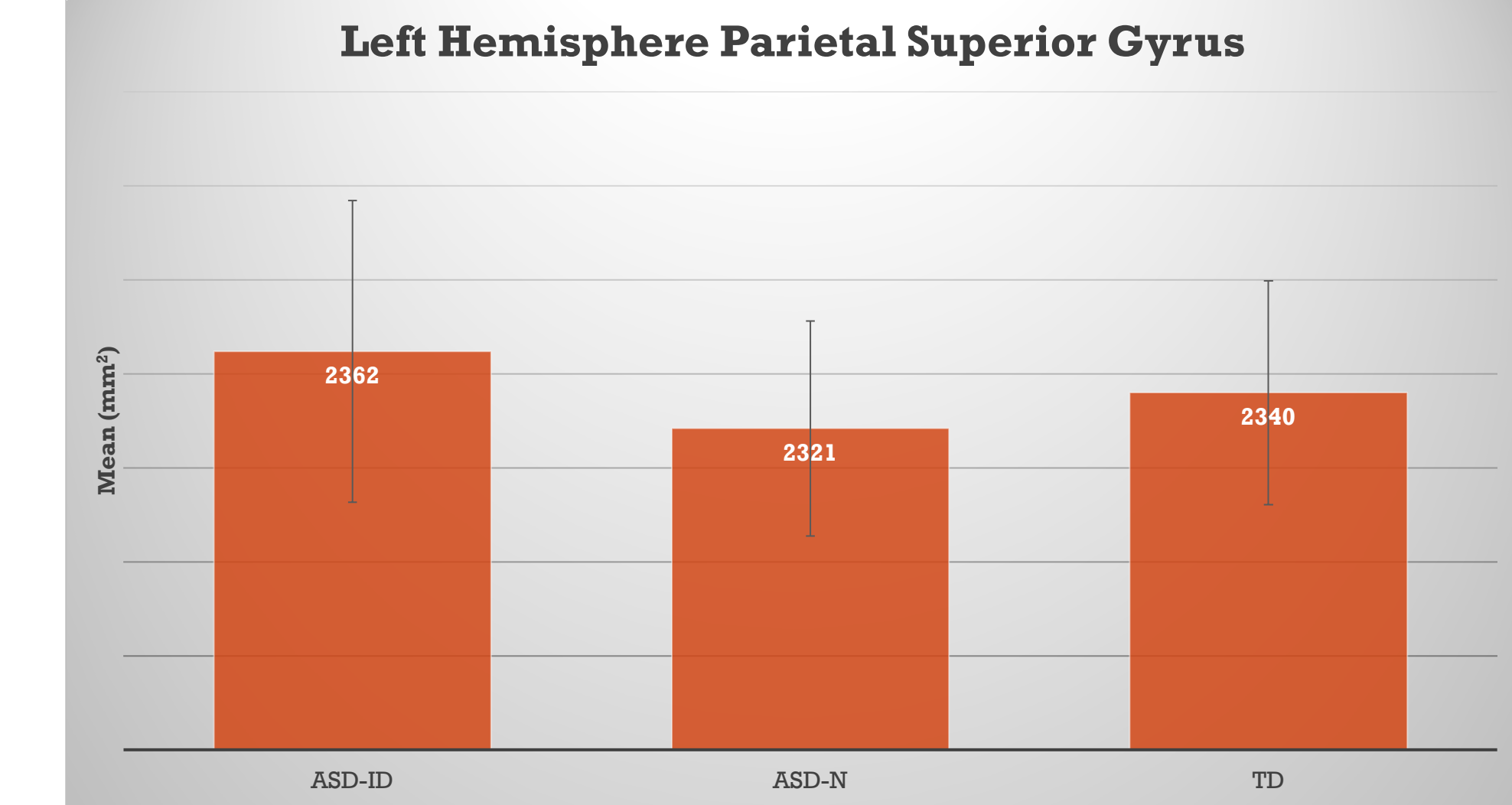
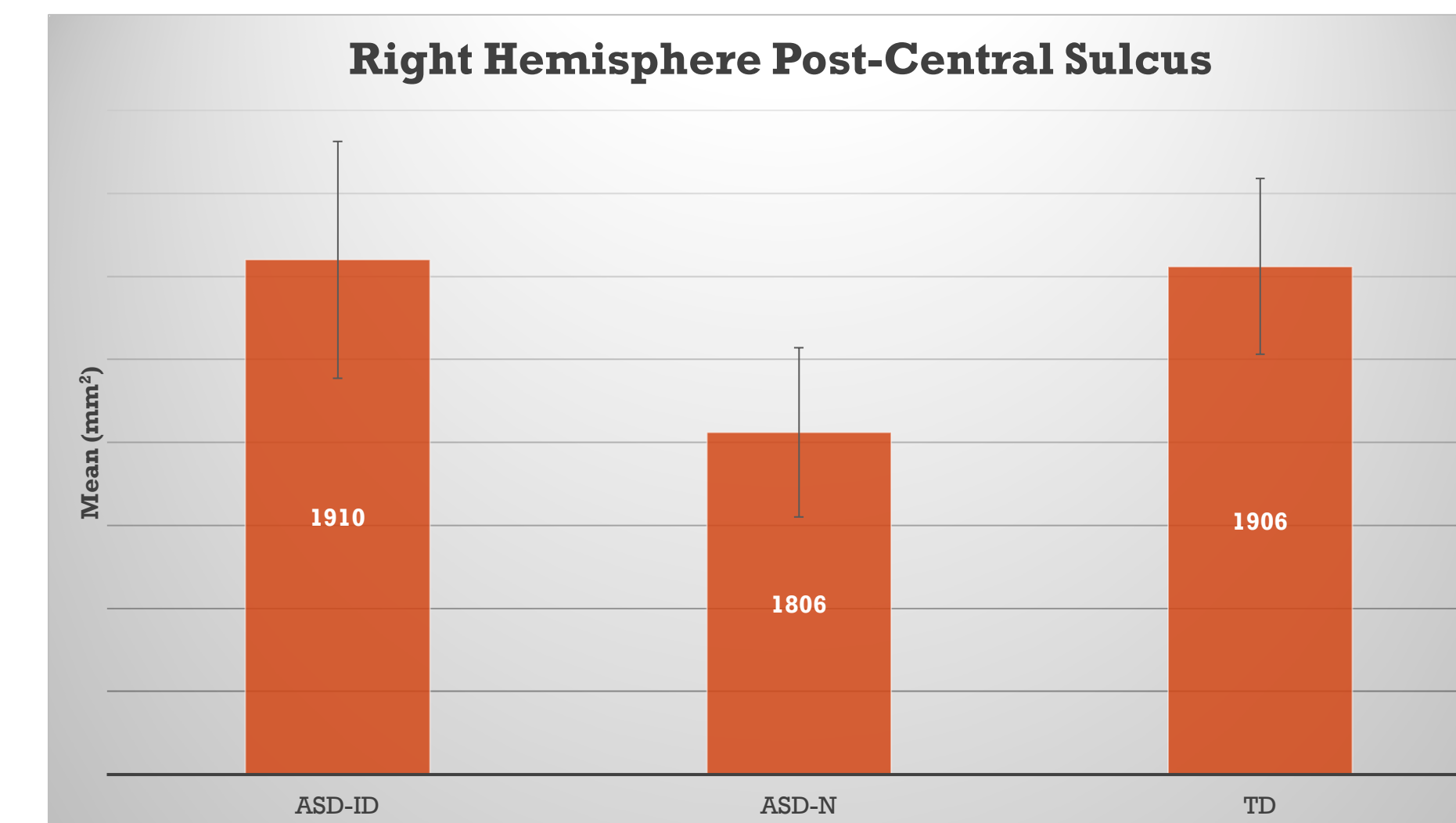
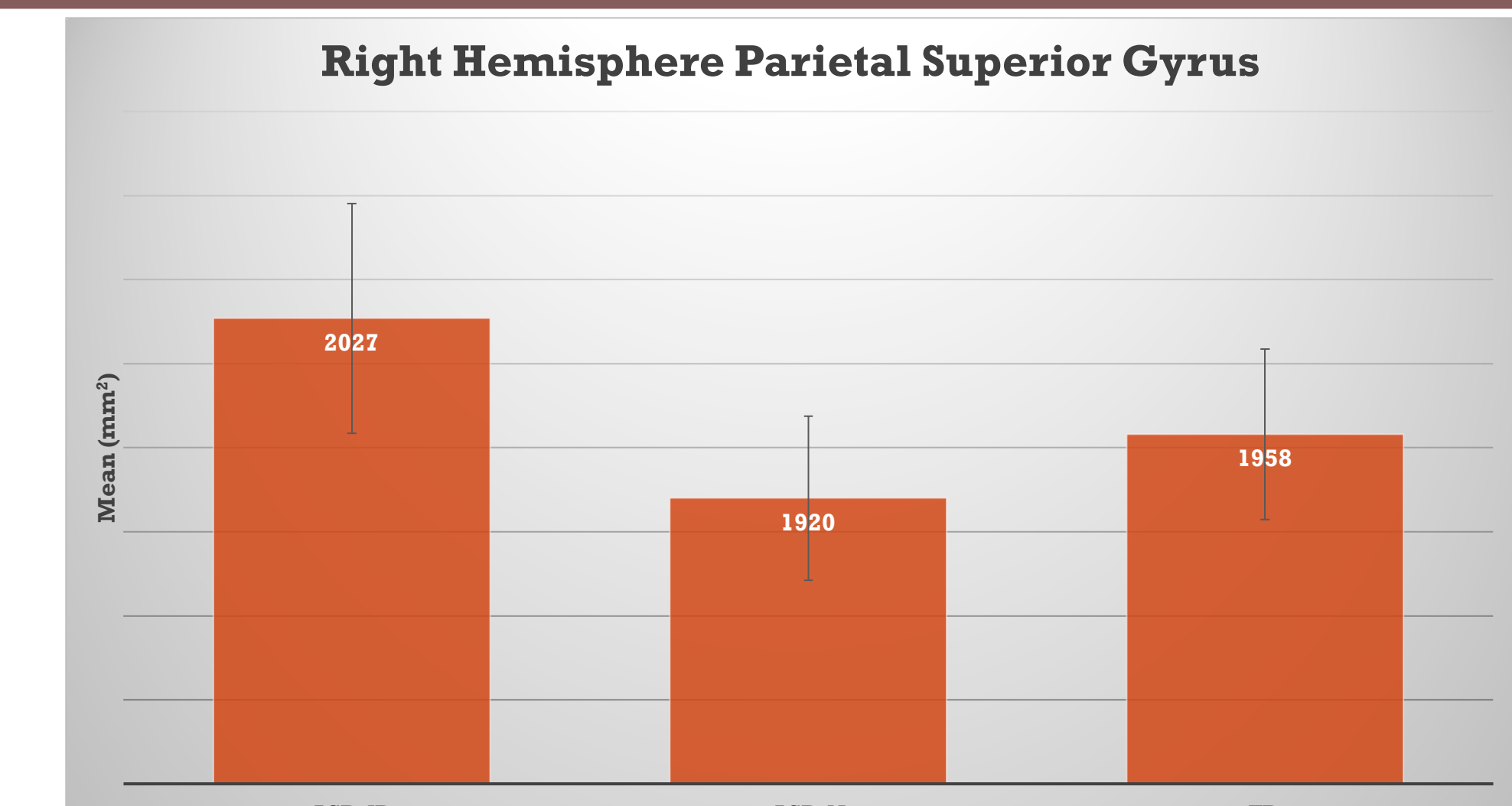
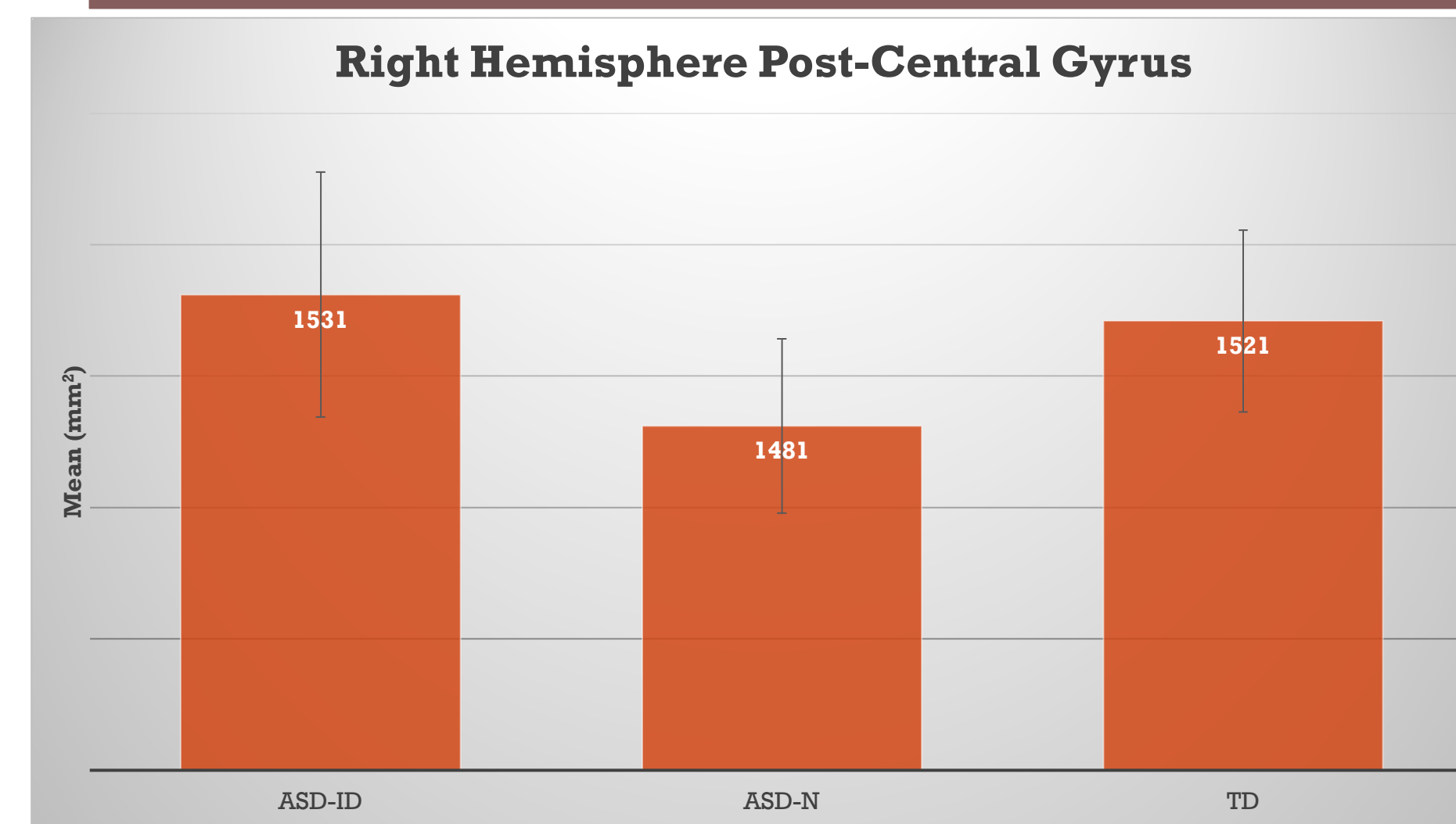


CORTICAL THICKNESS RESULTS



CORTICAL SURFACE AREA RESULTS

Cortical Surface Areas



DISCUSSION AND CONCLUSION

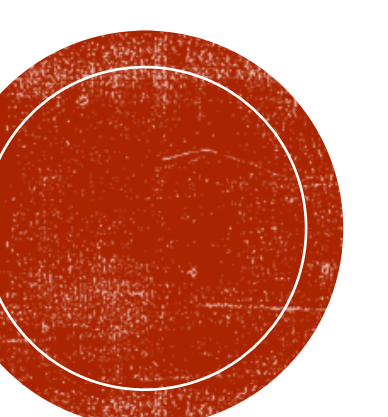
- This analysis of cortical thickness and surface area revealed no significant differences with a p-value less than 0.05
- However, broader patterns across ROIs were suggested.

Strengths

- one of the first studies to assess brain differences in autism as a function of intellectual disability

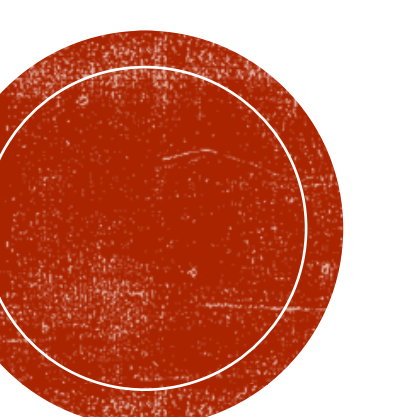
Limitations

- modest sample size
- analysis was restricted to these regions of interest
- **Future directions**
 - multivariate analyses to identify broader more general patterns across ROIs
 - more inclusive research on autistic children with ID



THANK YOU

- to the families who participated in the APP study
- to my mentors, Dr. Joshua Lee and Dr. Christine Nordahl, for your guidance and mentorship throughout this study
- to KKI Group and UC Davis for the wonderful opportunity to participate in the RISE-UP Program
- to my RISE-UP UC Davis Cohort for your overall support and enriching my experience in this program



REFERENCES

