



# Lack of Sexual Dimorphism in Language Processing Gray Matter Regions in Early Psychosis



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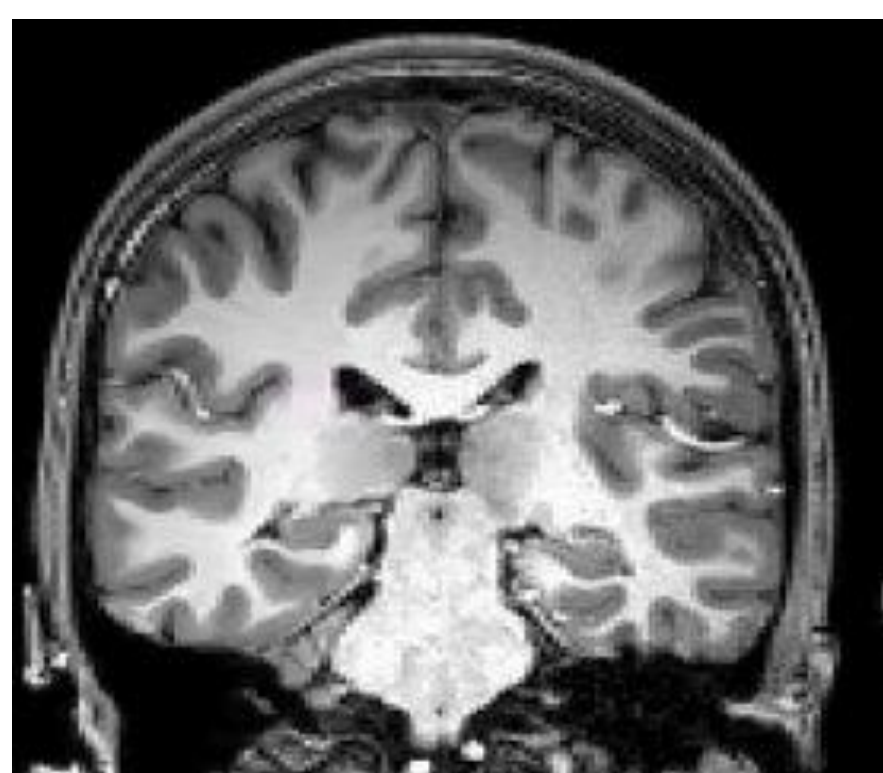
## Background

- It is well established that individuals suffering from psychosis show a diminished functional and anatomical hemispheric lateralization in language processing brain regions compared to healthy controls<sup>1</sup>.
- Gray matter asymmetry is associated with sex differences in the healthy population<sup>2</sup>. However, there are few conclusive neuroimaging studies that explore sex related differences in gray matter morphology in regions related to language processing in early-course psychosis.

## Aims

- Our primary aim was to characterize the variation in thickness and hemispheric lateralization of language processing gray matter regions as a function of group (healthy control or early psychosis) to determine the presence and extent of sexually dimorphic cortical characteristics.

## Methods



**Figure 1:** T1 axis aligned image.



**Figure 2:** T1 structural mask.



**Figure 3:** FreeSurfer parcellation.

**MR Acquisition:** A sagittal 3D magnetization-prepared rapid acquisition with gradient echo (MPRAGE;T1-weighted) sequence was acquired (TR/TE = 2400/2.14 ms, flip angle=8°, FOV = 224 x 224 mm, effective slice thickness = 5 mm with 128 slices).

**Cortical Thickness Measures:** Cortical thicknesses (CT) were extracted from regions approximating Broca's, Wernicke's, and Geshwind's areas using FreeSurfer 7 software. Broca's area is represented as the average CT of pars opercularis, pars triangularis, and pars orbitalis. Wernicke's area is the average CT of lateral occipital, supra marginal, and inferior parietal gyri.<sup>3</sup> Whereas Geshwind's area is composed of the average CT of superior temporal, banks superior temporal, middle temporal gyri.<sup>4</sup>

## Sample Characteristics

Table 1.	Healthy Controls		Early Psychosis		HC vs. EP p-values
	Males (n=43)	Females (n=24)	Males (n=86)	Females (n=48)	
<b>Age</b>	24.6 ± 4.13	23.8 ± 4.06	22.8 ± 2.97	24.3 ± 4.29	0.12
<b>Handedness</b>					0.90
Right	36	20	75	42	
Non-right	7	4	11	6	
<b>Education</b>	8.72 ± 2.17	8.58 ± 2.59	6.70 ± 1.59	7.37 ± 2.04	1.39e-06
<b>IQ</b>	112 ± 20.2	115 ± 11.7	103±15.9	104 ± 23.6	0.0003082
<b>Verbal IQ</b>	59.5 ± 8.14	61.1 ± 9.59	52.7 ± 12.2	57.1 ± 11.7	0.00014
<b>Site</b>					0.93
Indiana U	14	5	30	19	
McLean	6	2	2	2	
MGH	0	6	12	7	
BIDMC	14	11	42	20	
<b>eTIV</b>	1100000 ± 82700	949000 ± 75800	1070000 ± 102000	950000 ± 99000	0.29

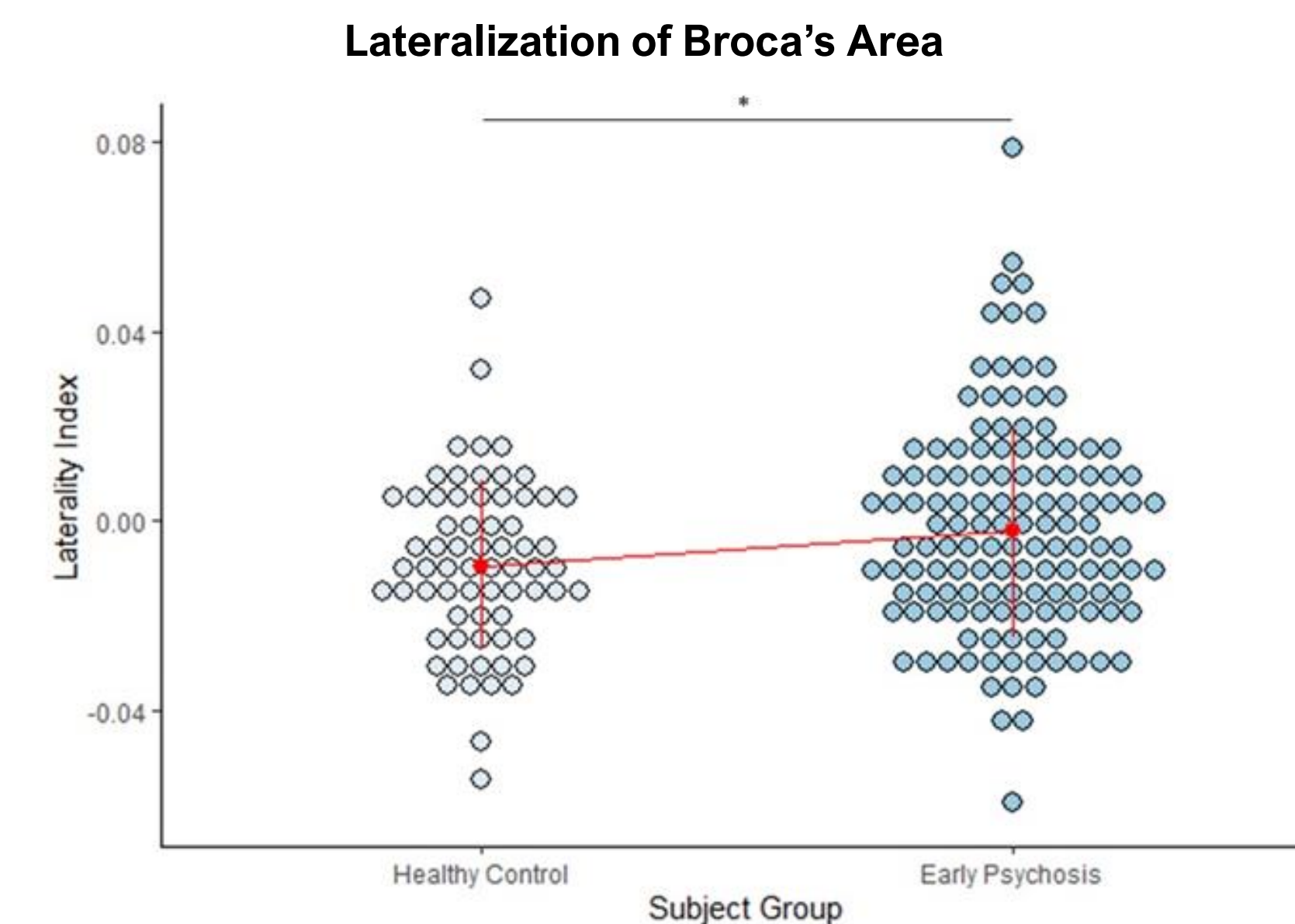
Subjects part of the Human Connectome Project for Early Psychosis (HCP-EP)<sup>5</sup> included healthy controls and outpatients with a DSM-V diagnosis of schizophrenia, schizophreniform, schizoaffective, psychosis NOS, delusional disorder, brief psychotic disorder, major depression or bipolar disorder with psychosis with onset within the past five years prior to study entry.

**Table 1:** Background information on the patient group and HC group demonstrating the lack of a significant difference in age, sex, handedness, site, and estimated intracranial volume, and a significant difference in education level, IQ, and Verbal IQ.

## Analyses

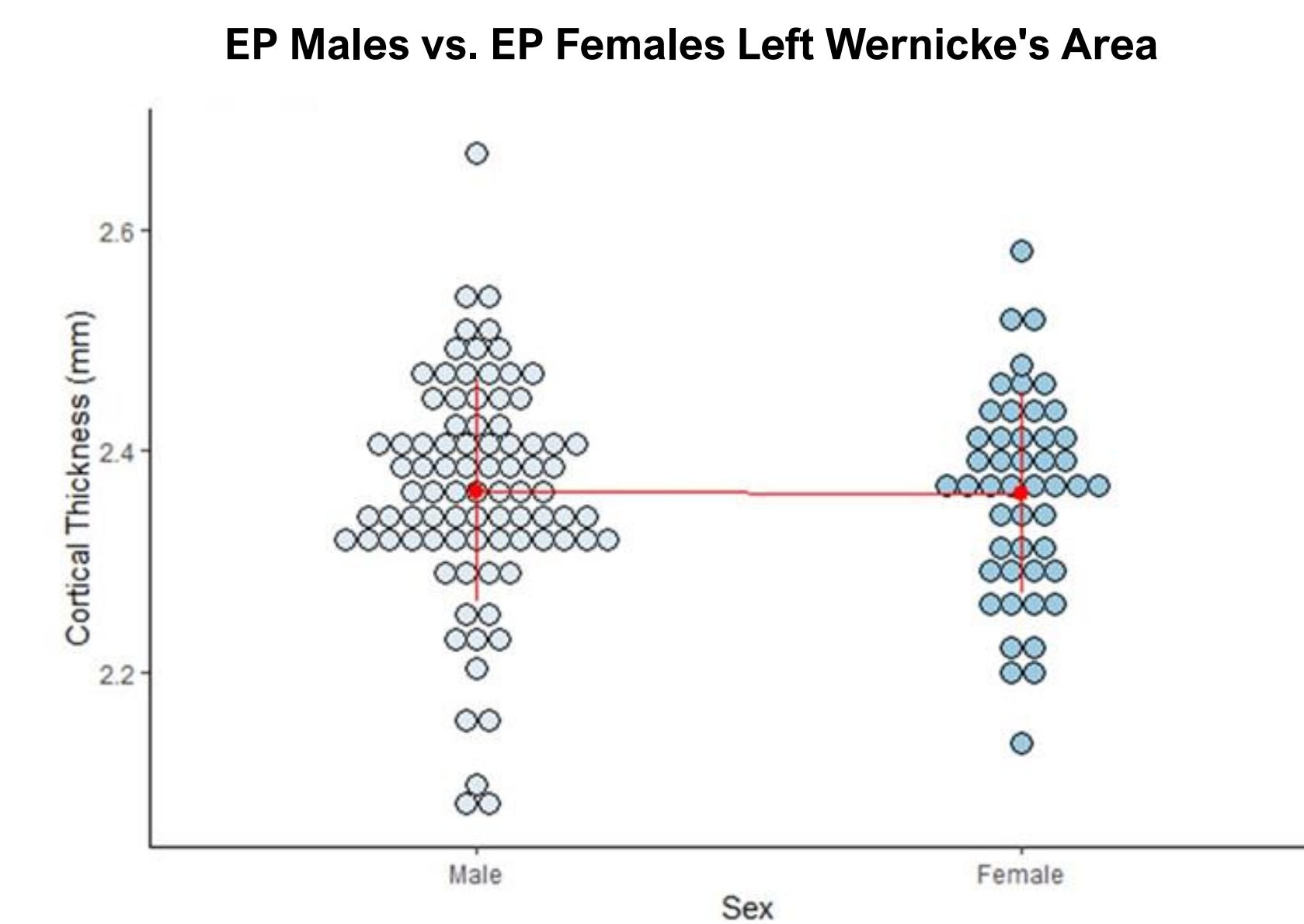
- Laterality Index was calculated using the equation Laterality Index (LI) = (Right ROI – Left ROI)/(Right ROI + Left ROI).<sup>6</sup> LI was calculated for each bilaterally represented region, tested for normality, and compared between HC and EP as well as the sexes in each group using Welch's t-tests.
- Differences in cortical thickness between HC males and HC females and EP males and EP females were calculated for each ROI after establishing normality using Welch's t-tests.

## Results

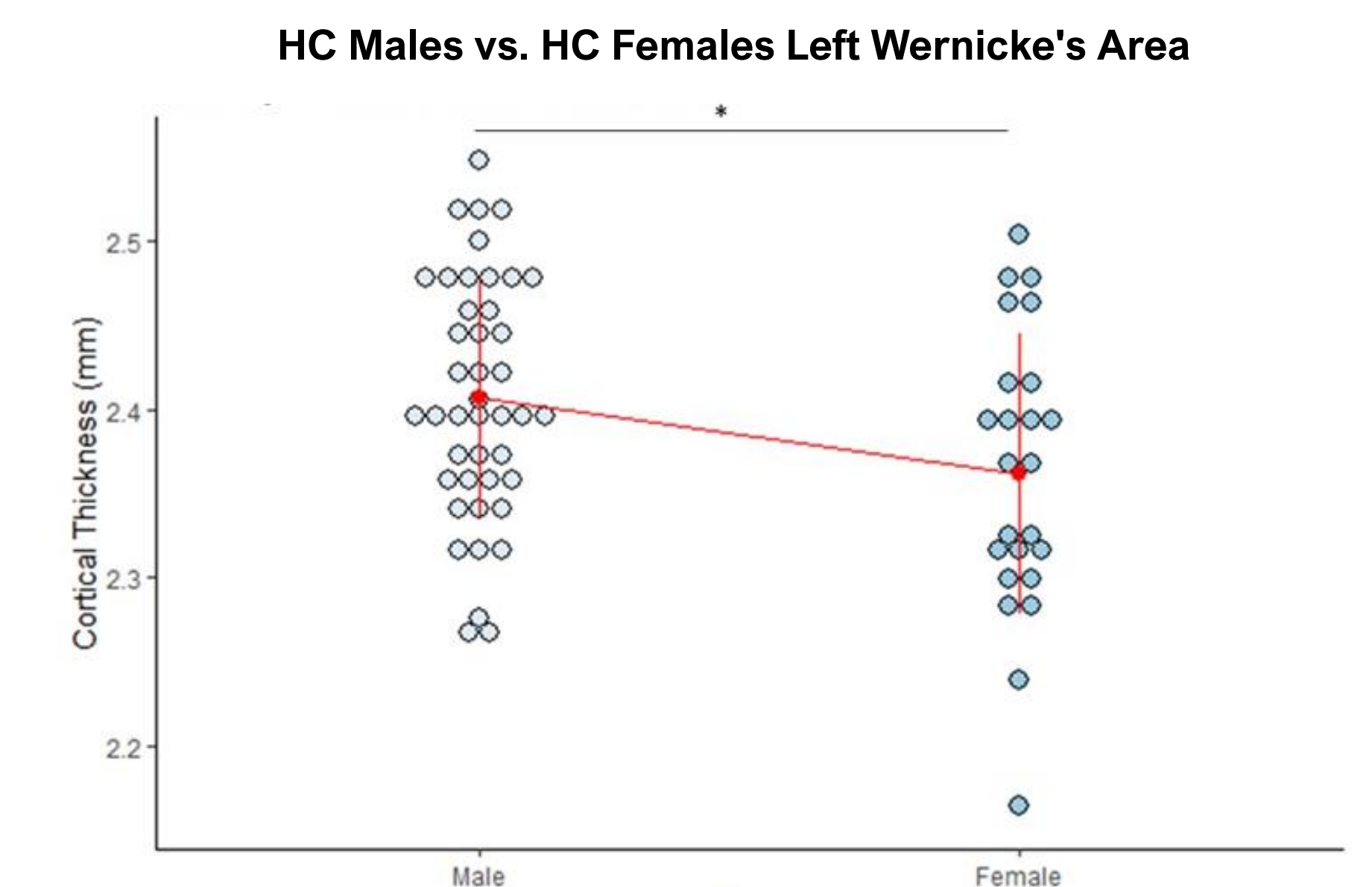


**Figure 4:** Calculated statistical difference between LI in HC and EP.  $t(57.70) = 2.28$ ,  $p = 0.02$ , Cohen's  $d = -0.35$

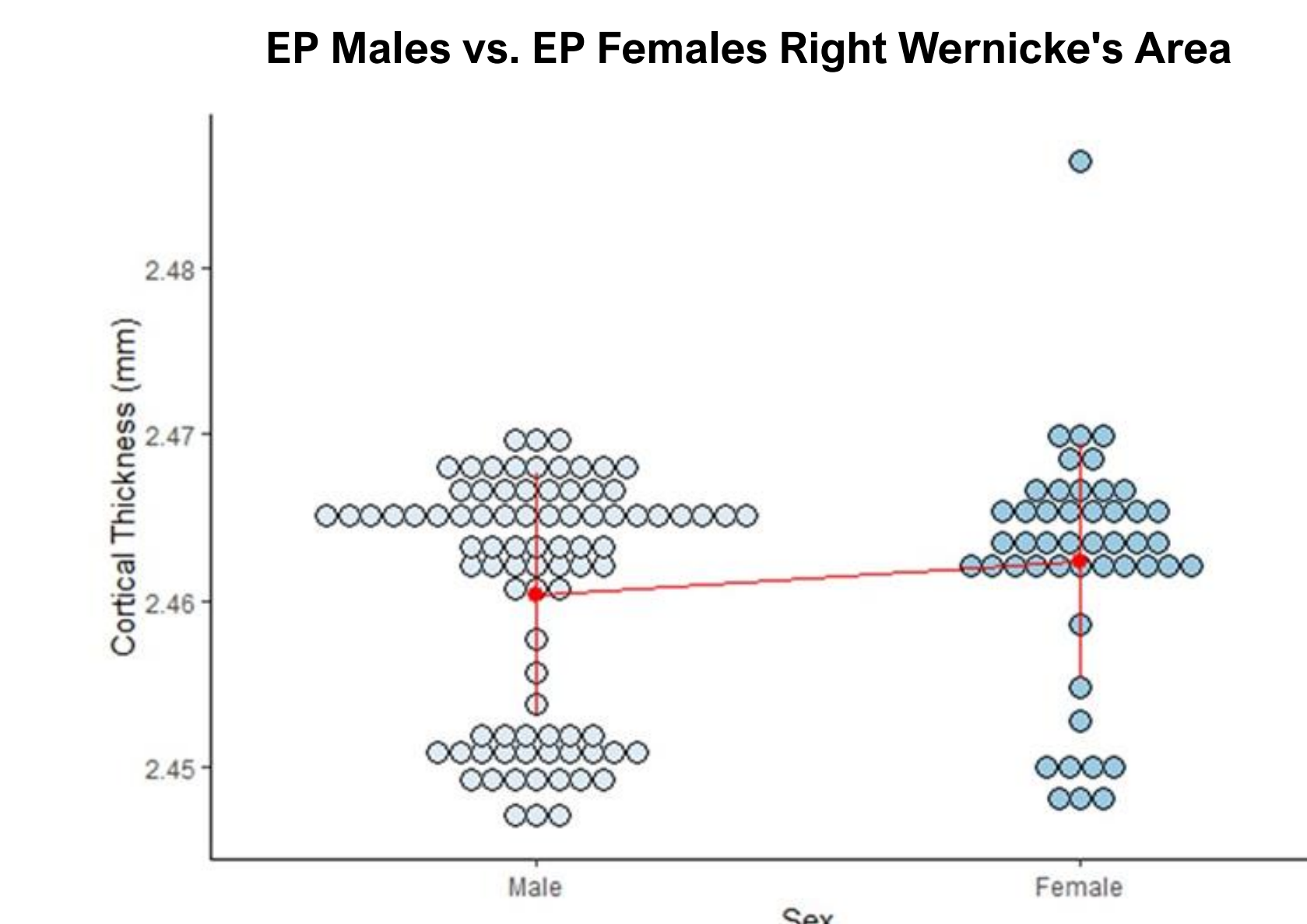
- The graph (left) shows the difference between the Laterality Index of Broca's Area between HC and EP participants.
- The graphs (below) show the difference in CT of Wernicke's Area between HC males and HC females and EP males and EP females.
- Significant differences are noted by an asterisks (\*).
- The P value of significance was  $p < 0.05$ .



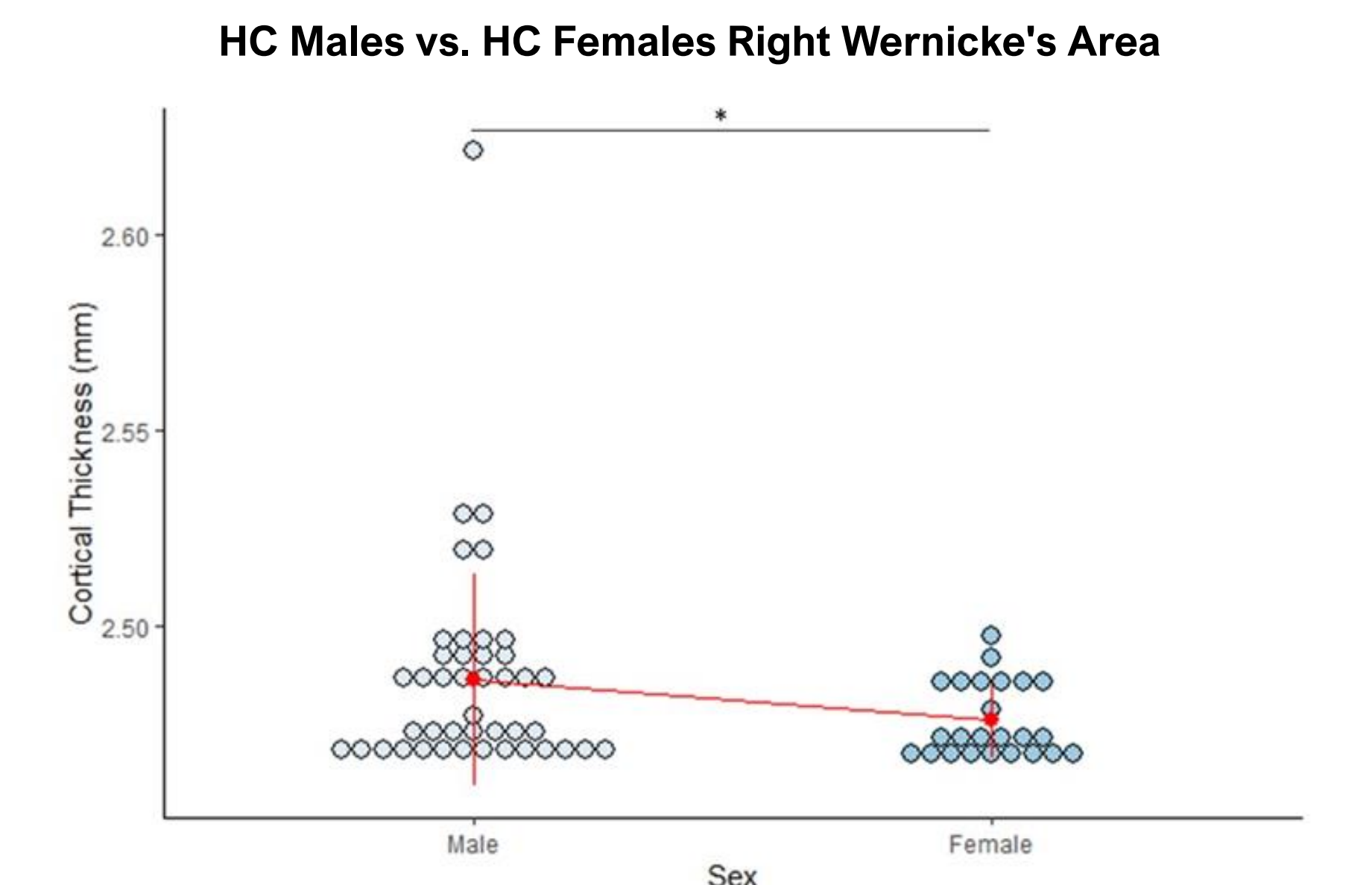
**Figure 5:** Calculated statistical difference between CT in EP males and EP females.  $t(105.46) = 0.11$ ,  $p = 0.91$ , Cohen's  $d = -2.89$



**Figure 8:** Calculated statistical difference between CT in HC males and HC females.  $t(41.65) = 2.25$ ,  $p = 0.03$ , Cohen's  $d = 0.60$



**Figure 6:** Calculated statistical difference between CT in EP males and EP females.  $t(98.78) = -1.56$ ,  $p = 0.12$ , Cohen's  $d = -3.24$



**Figure 7:** Calculated statistical difference between CT in HC males and HC females.  $t(57.70) = 2.28$ ,  $p = 0.02$ , Cohen's  $d = 0.46$

## Conclusions & References

- We saw a significant left lateralization of Broca's Area between HC and EP; there was not group by sex interaction.
- There was a significant difference in cortical thickness in the right and left Wernicke's Area between males and females in the HC sample. In contrast, there was a lack of gray matter dimorphism between males and females in the EP sample.
- These findings suggest that individuals suffering from early psychosis lack the sex-related structural differences that are characteristic of the normal, healthy brain.

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