

# Multivariate brain structure-cognition signatures of early psychosis

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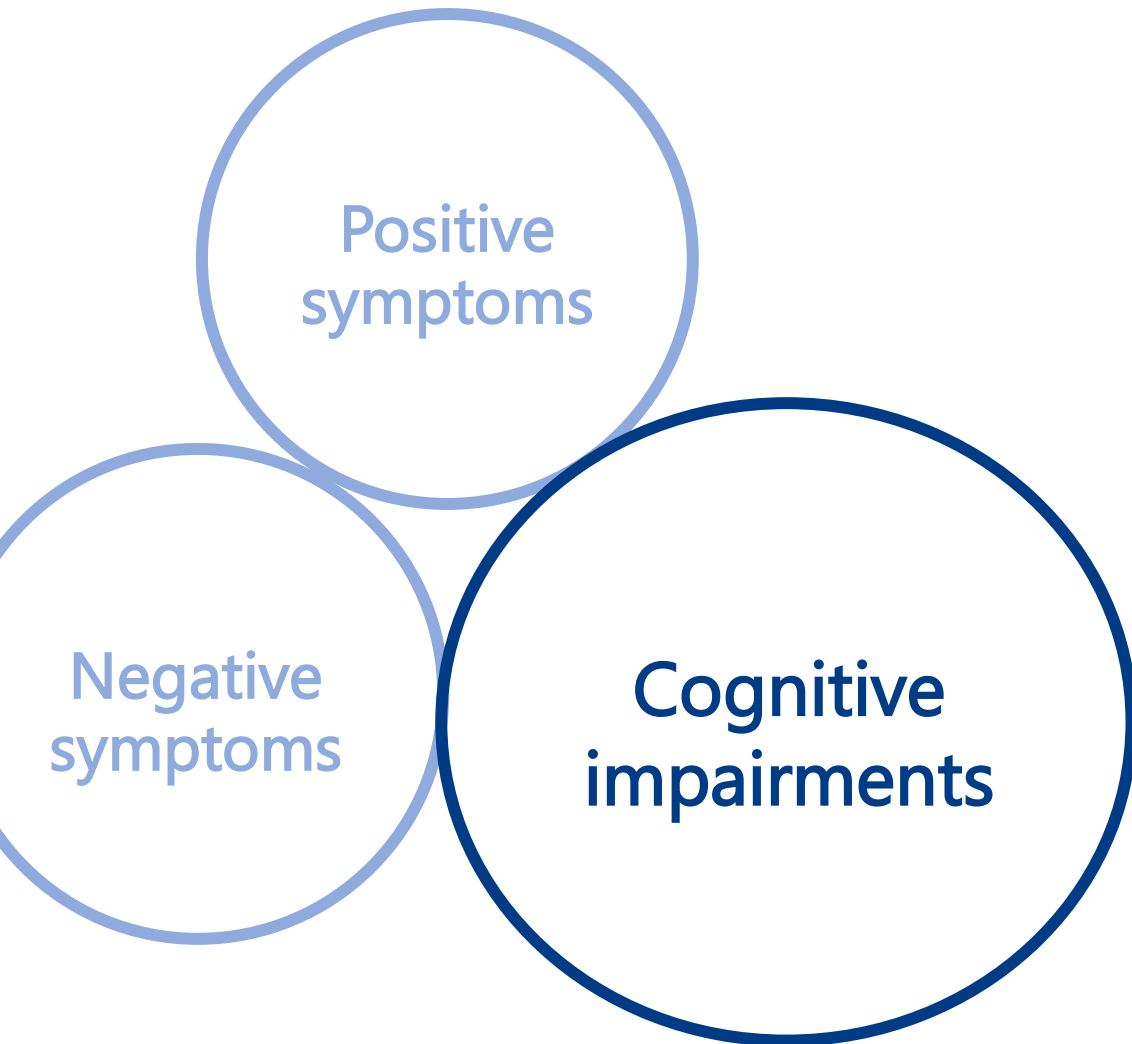


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# Introduction Cognitive impairments



## Types of cognition

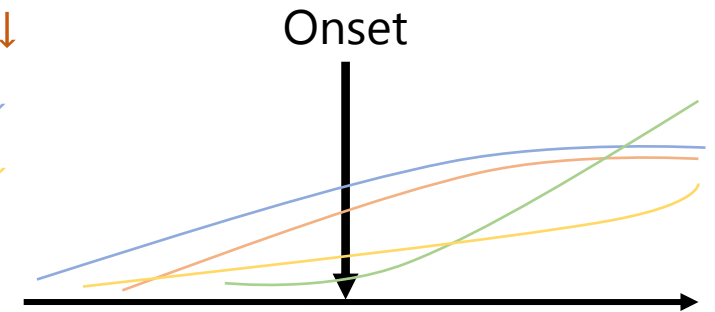
Working memory ↓

Episodic memory ↓

Processing speed ↓

Attention ↓

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## Medication



Cognitive impairments are not significantly improved by pharmacological intervention (Keefe et al., 1999; Nielsen et al., 2015; Baldez et al., 2021)

## Functional outcome

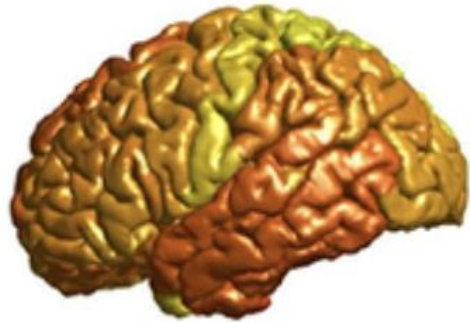


Cognitive impairments predict patients' functional outcomes (Green et al., 2000; Green, 2016)

Research question : Cognitive impairments ↔ Brain changes

# Introduction Structural changes

## Grey Matter (GM)



Widespread GM reduction, mainly in the frontal and temporal regions

van Erp et al., 2018

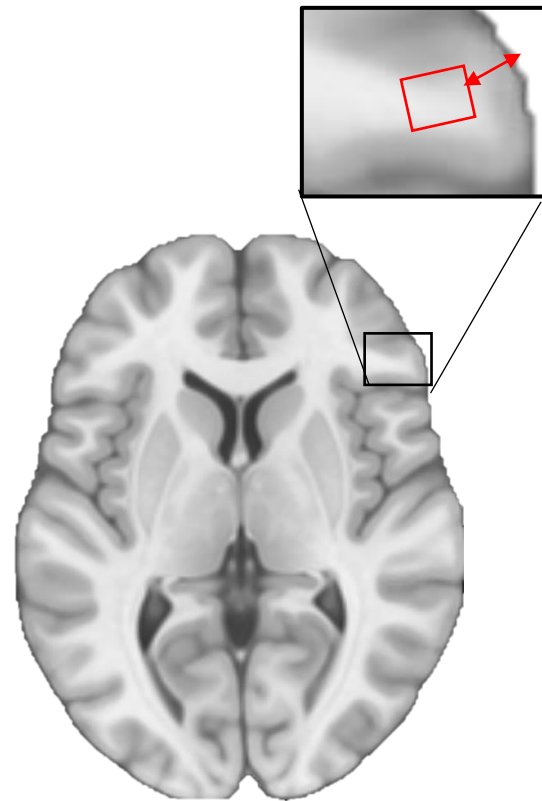
## White Matter (WM)



Widespread WM abnormality manifesting later than GM

Kelly et al., 2018;  
Cropley et al., 2017

## Grey Matter and White Matter



Strong correlations between fractional anisotropy (FA) in adjacent WM regions and GM thickness

Di Biase et al., 2019

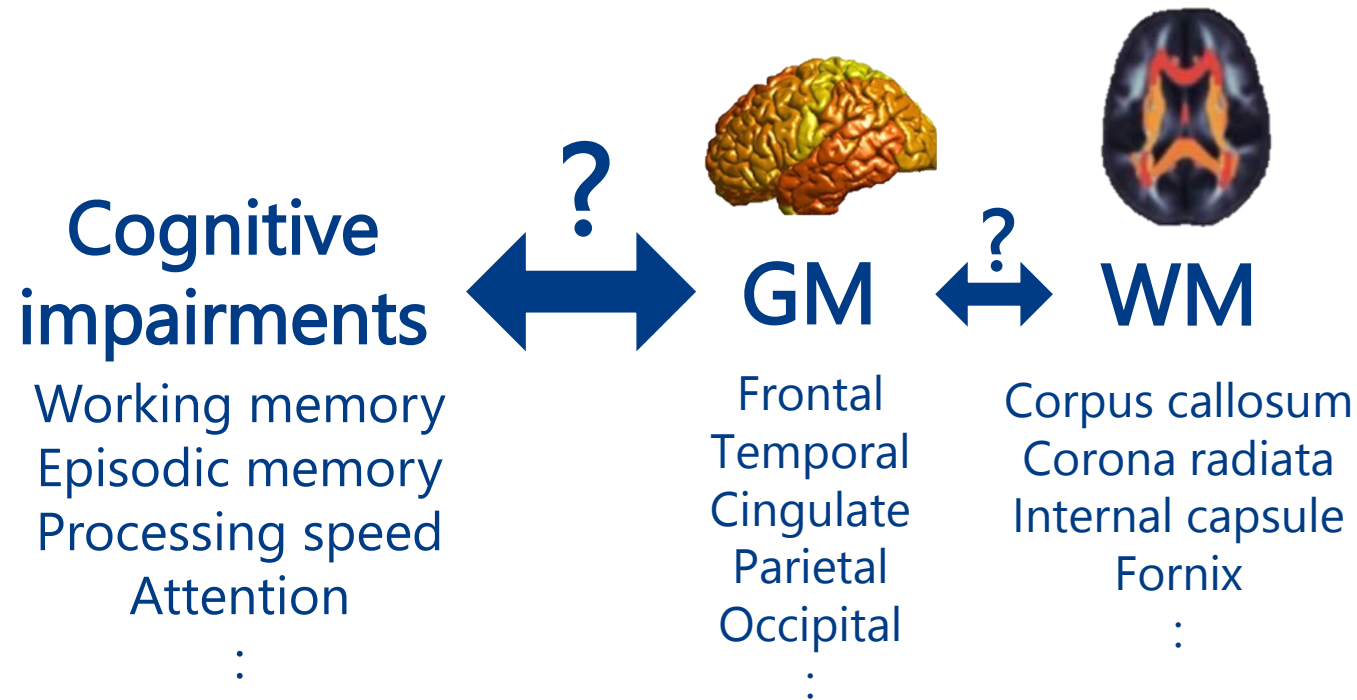
The distribution of cortical thickness reduction is explained by the brain network based on structural covariance

Cauda et al., 2018; Wannan et al., 2019

Research question : Cognitive impairments ↔ GM ↔ WM

# Introduction

## Cognitive impairments and structural changes



Previous studies have investigated the relationship between cognitive impairments and GM and WM abnormalities; **however, a consistent consensus has yet to be established.**



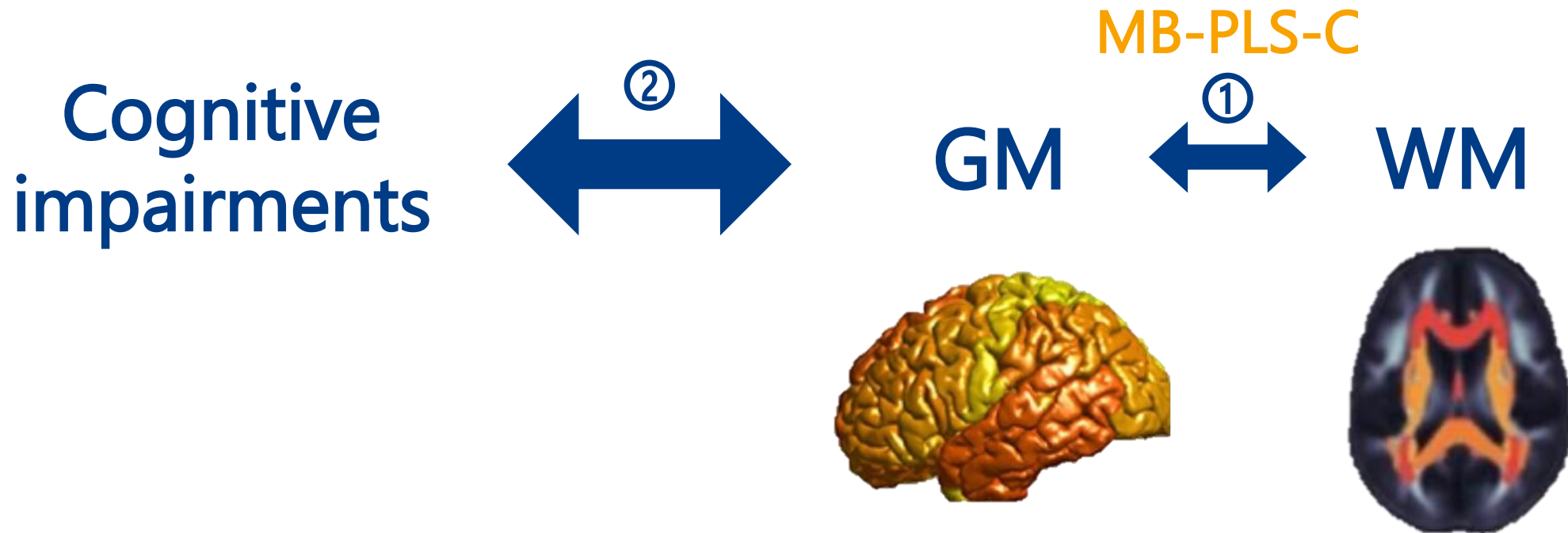
**Multiblock Partial Least Squares Correlation (MB-PLS-C)**

An advanced statistical technique in neuroimaging analysis to explore the comprehensive interaction between variables

(Krishnan et al., 2011; Mihalik et al., 2022; Syeda et al., 2022)

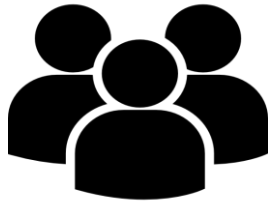
# Research aims

- ① To identify multivariate patterns of GM-WM coupling in individuals with recent-onset psychosis (ROP)
- ② To identify relationships between GM-WM measures and cognition in individuals with recent-onset psychosis (ROP)



# Methods

## Human Connectome Project for Early Psychosis



71 recent-onset psychosis (ROP) individuals/ 71 Healthy controls

Age. 22.05 (3.21) / 22.09 (3.08)

Sex, male. 50 (70.4%) / 49 (69.0%)



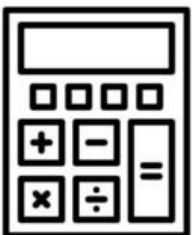
NIH toolbox cognition measures

Attention, Cognitive flexibility, Episodic Memory, Vocabulary, Reading, Working Memory, and Processing Speed



3T structural and diffusion MRI

GM: surface area, thickness, volume (DK atlas)  
WM: FA and MD (JHU atlas)

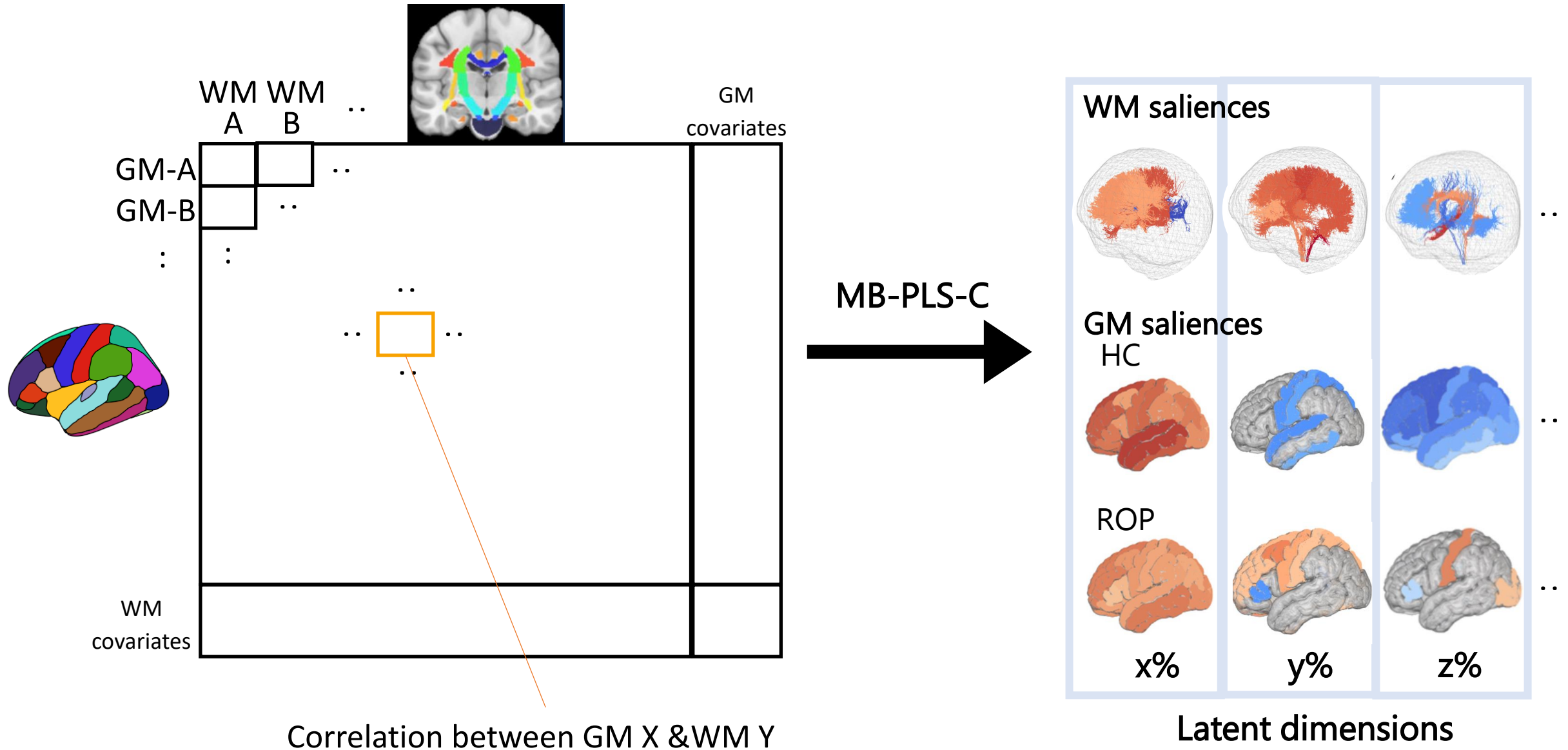


MB-PLS-C

1) between GM surface area and FA

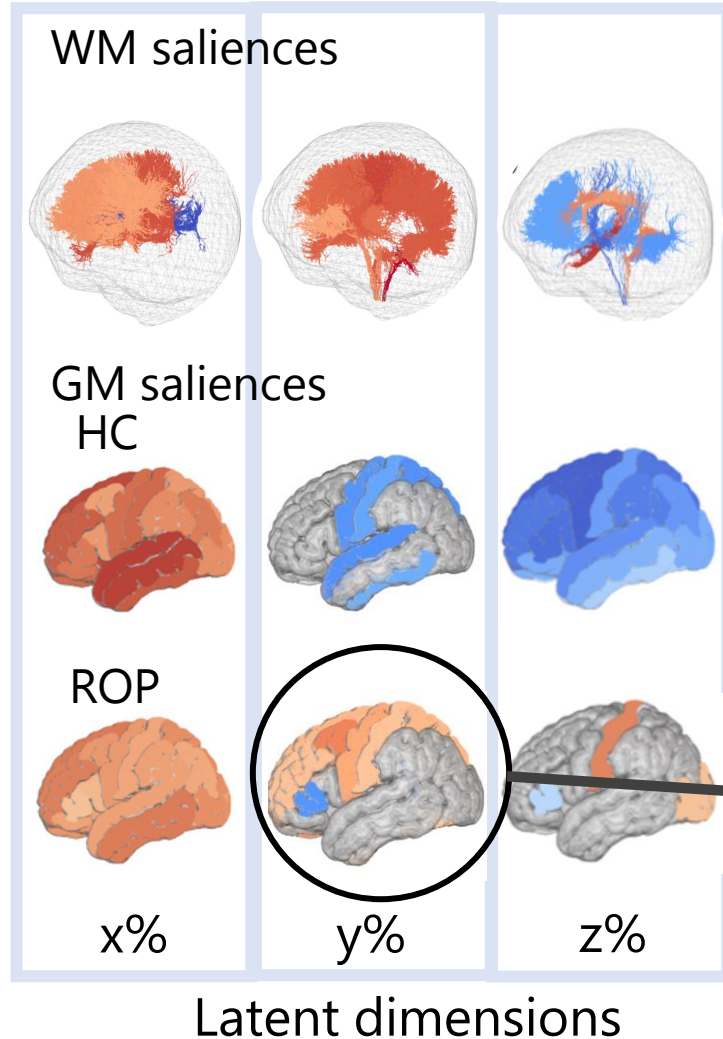
2) between GM thickness and FA

# Methods Multiblock Partial Least Squares Correlation Model

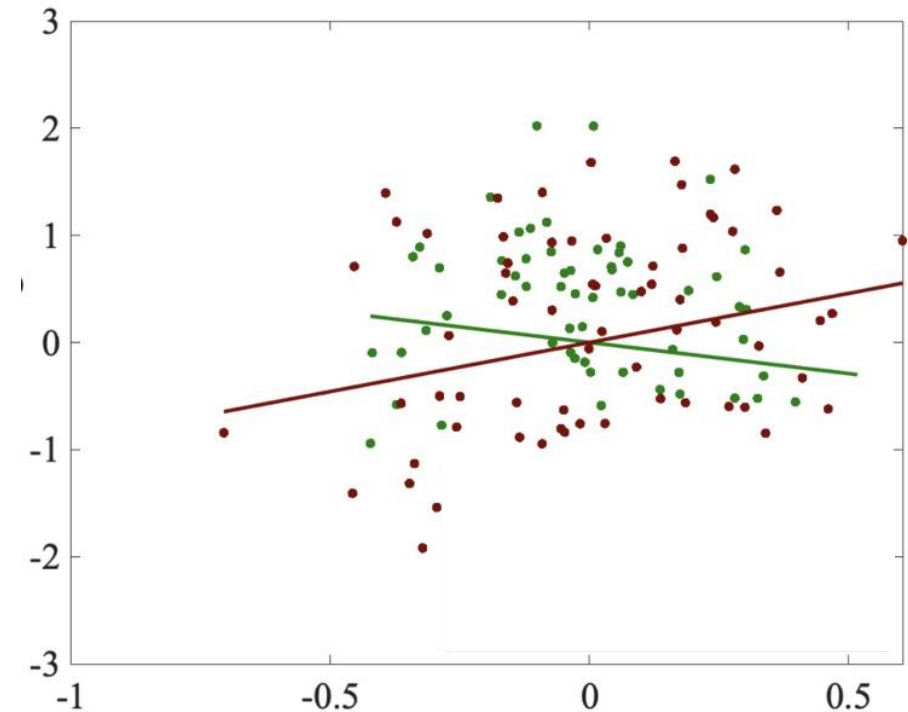


# Methods

Correlation between Latent variables and cognitive variables



Cognitive  
variables

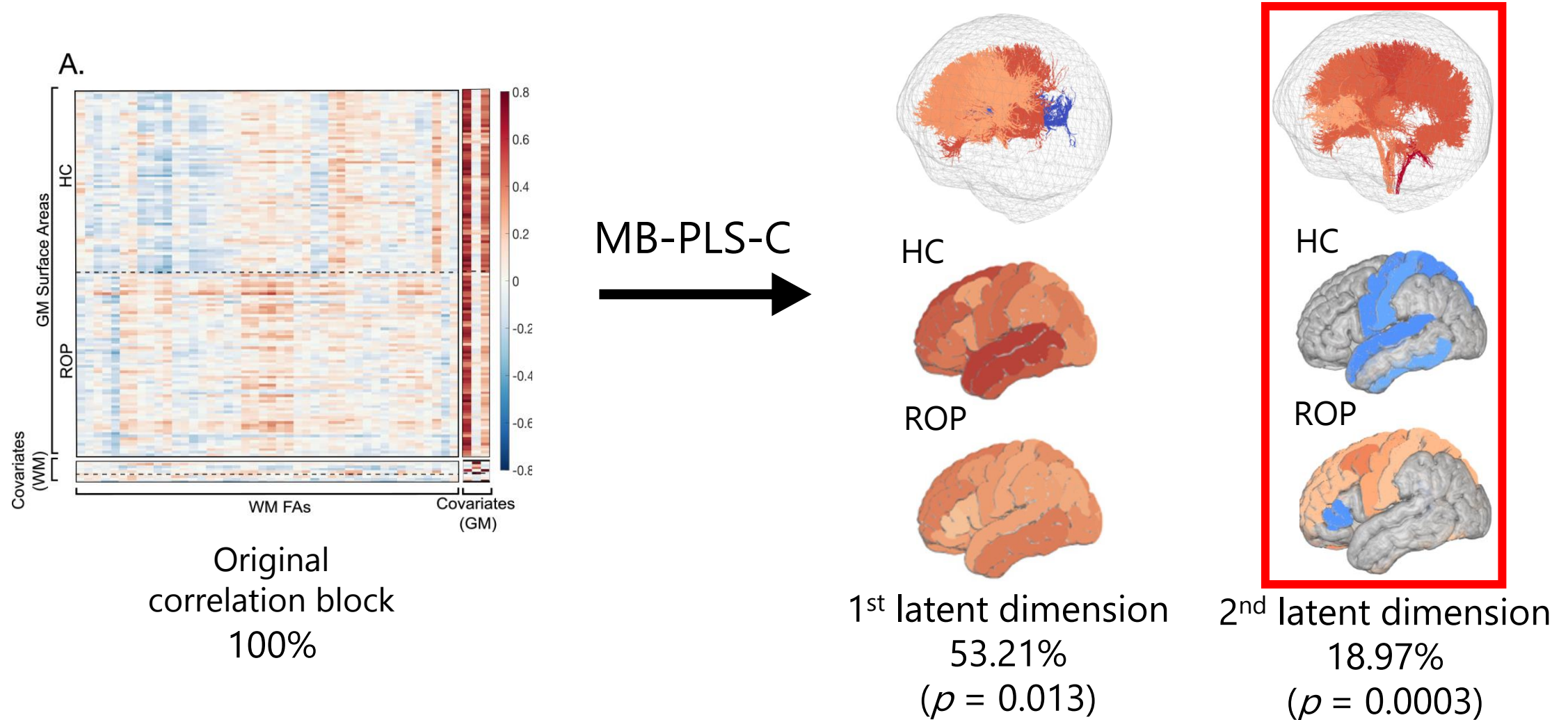


GM/WM  
Latent variables



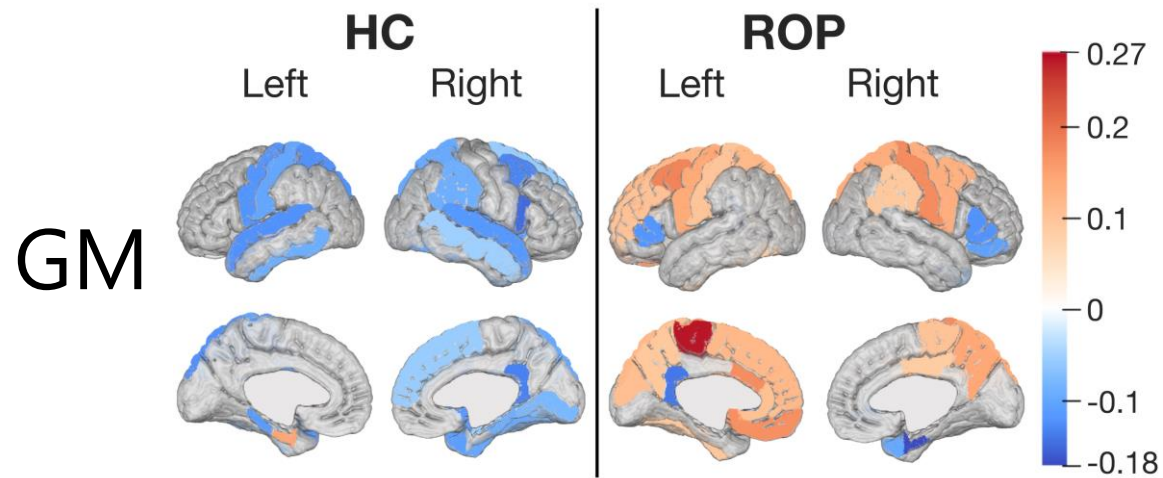
# Results

## MB-PLS-C between GM surface area and FA



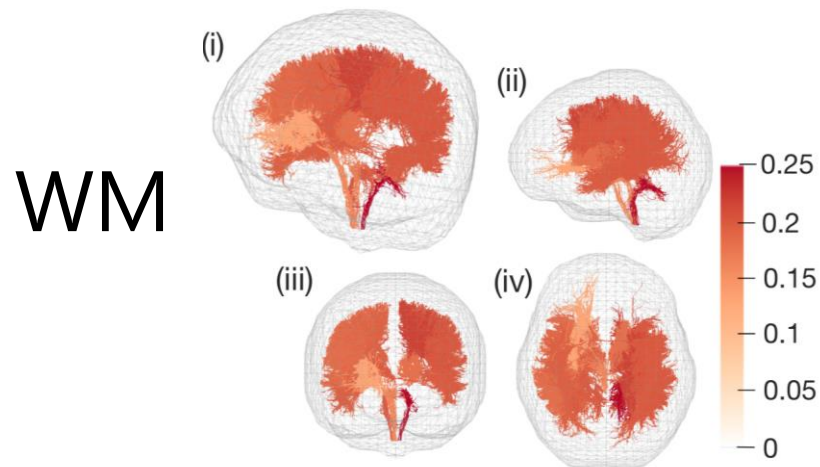
# Results

## 2<sup>nd</sup> Latent Dimension: Group differential pattern



Largest saliences were in:

- the right cingulate and frontal and left parietal regions in ROP individuals
- the right cingulate and frontal and left parietal, and temporal regions in controls

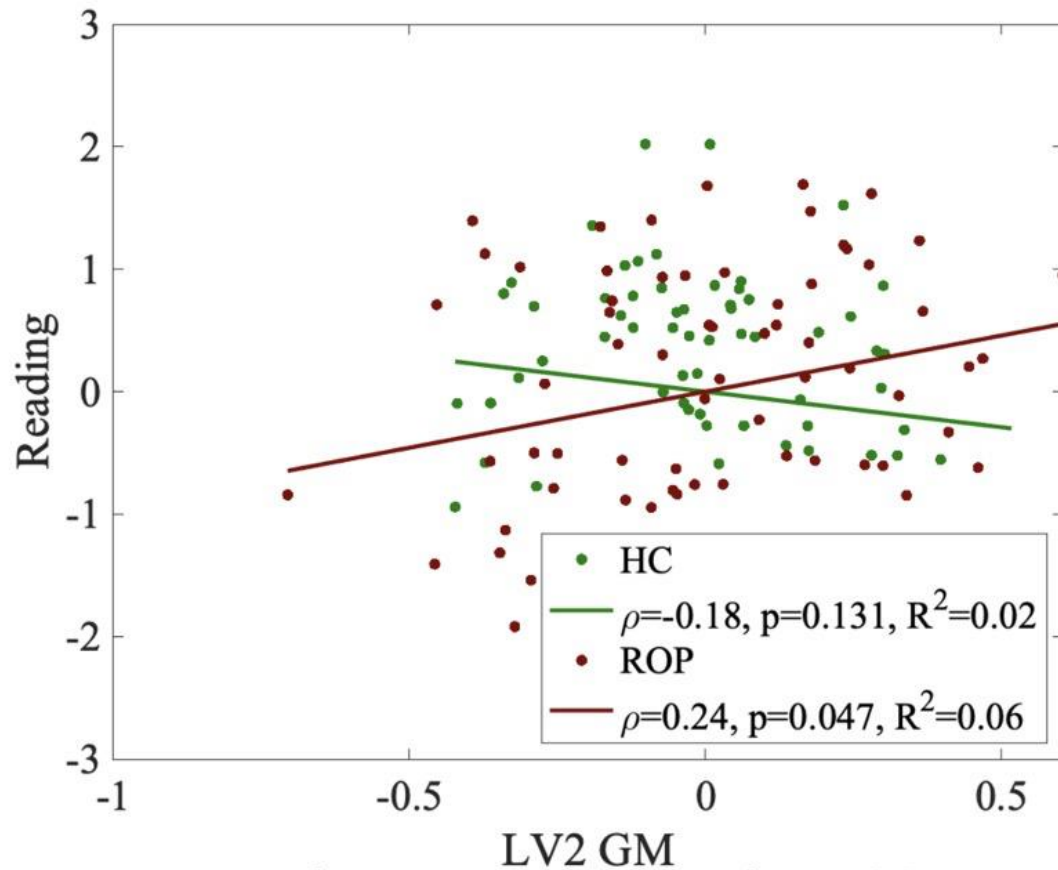


Largest saliences were

bilaterally in inferior cerebellar peduncles and posterior corona radiata, and in the left superior corona radiata and superior longitudinal fasciculus.

# Results

## 2<sup>nd</sup> Latent Dimension: Group differential pattern



Group differential pattern  
of GM surface area and WM

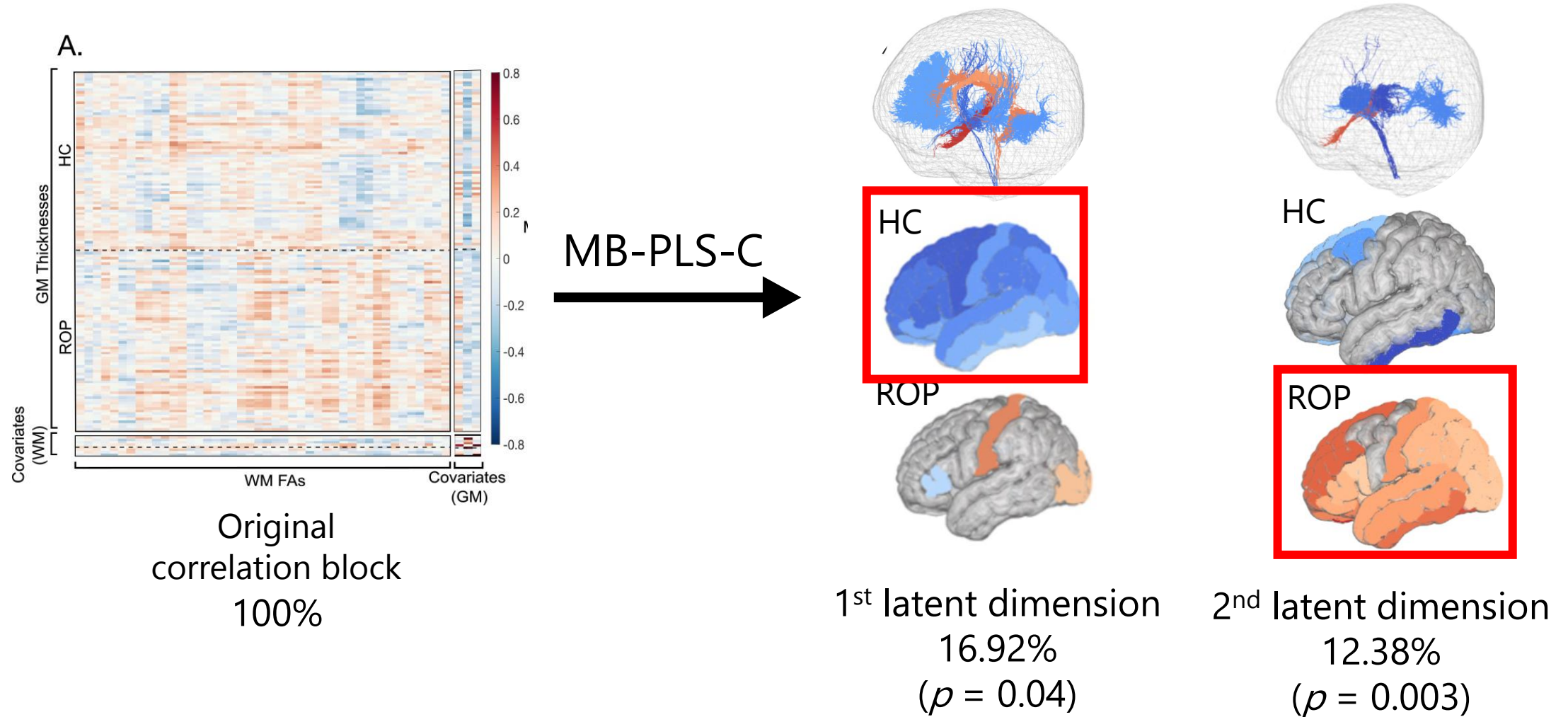


Reading

A significant correlation in ROP (uncorrected)

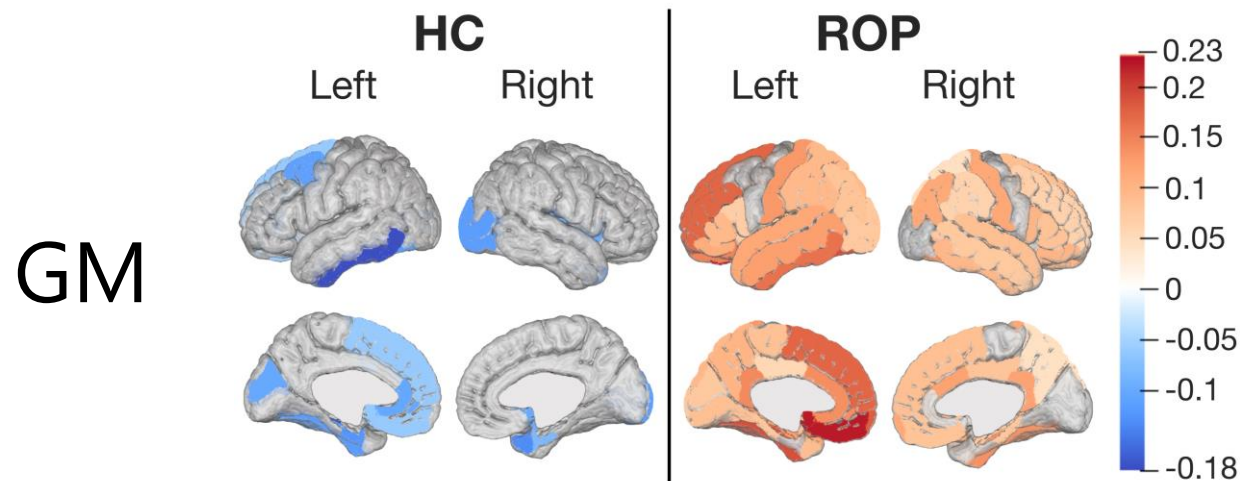
# Results

## MB-PLS-C between GM thickness and FA



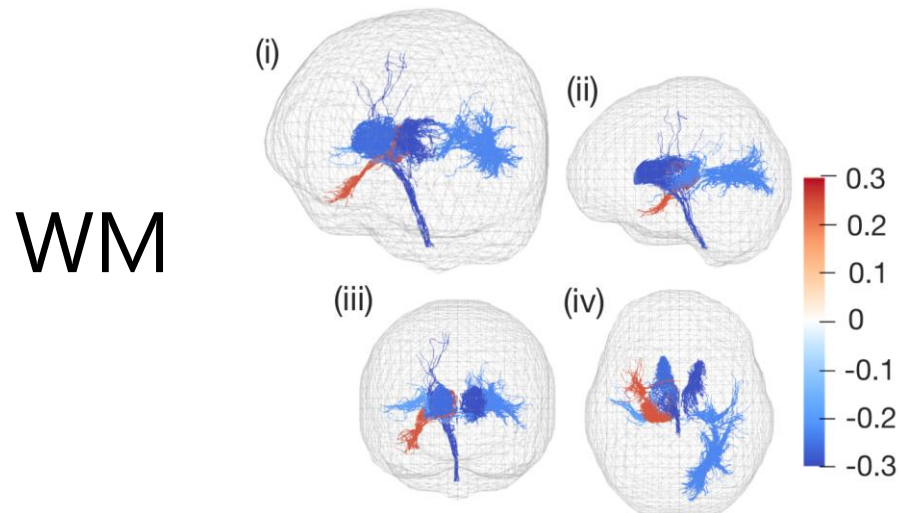
# Results

## 2<sup>nd</sup> Latent Dimension: ROP-specific pattern



Largest saliences were in:

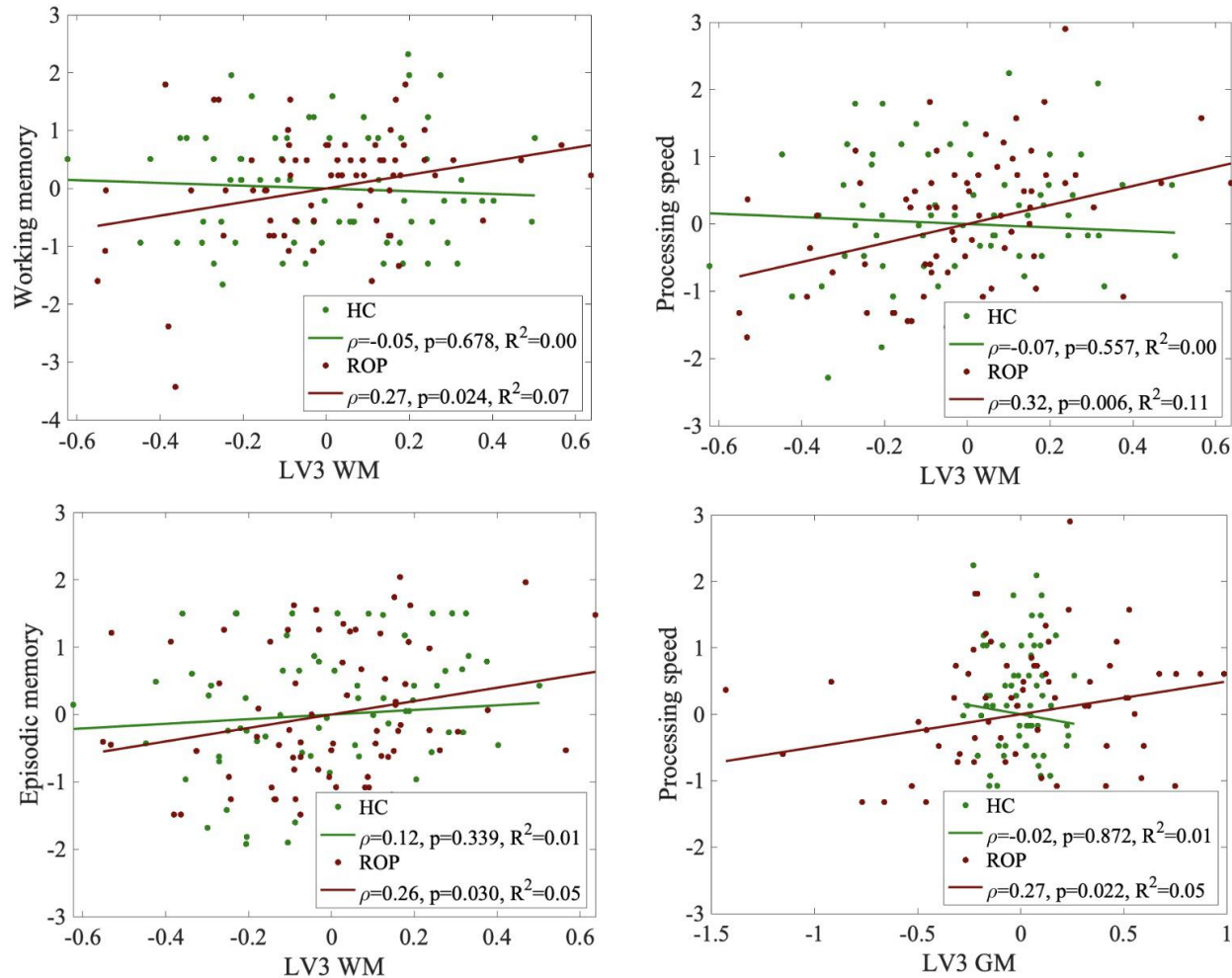
- the left frontal and temporal regions in ROP individuals
- the bilateral occipital and temporal regions in controls



Largest saliences were in the anterior limb of internal capsule bilaterally, left posterior thalamic radiation, left retrolenticular limb of the internal capsule, and right corticospinal tract.

# Results

## 2<sup>nd</sup> Latent Dimension: ROP-specific pattern



ROP-specific pattern  
of GM thickness and WM



Processing speed  
Working memory  
Episodic memory

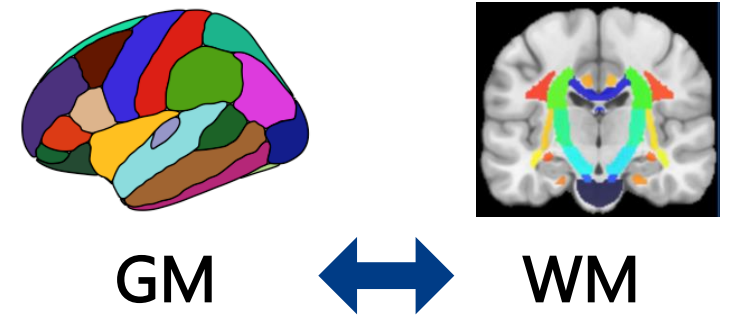
Significant correlations were in ROP (uncorrected)

# Conclusion

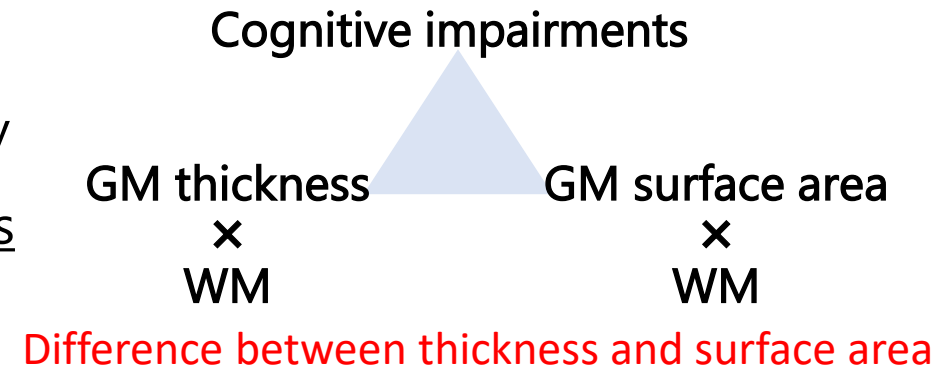
MB-PLS-C identified a differential or ROP-specific pattern between grey matter and white matter.

The differential or ROP specific patterns were driven by the cingulate, frontal, parietal and temporal regions, and some WM tracts, including the inferior cerebellar peduncle, retrolenticular limb of internal capsule, and corticospinal tract.

Latent variables of these patterns were correlated with some cognitive abilities. The difference in the types of cognitive ability suggests that surface area and thickness reflect different aspects of intellectual abilities in schizophrenia.



Differential or ROP-specific Pattern





Thank you

**Melbourne Neuropsychiatry Centre**  
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**Warda Syeda**

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