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Introduction

- SES has a profound impact on cognitive development, however the neurological basis for this effect is not fully understood.
- White matter network organization assesses the topology of the brain and is associated with general cognitive ability.
- It is unknown if SES impacts white matter network organization.
- If SES impacts white matter network organization, then it may mediate the effect of SES on general cognitive ability.

Objectives

To determine if socioeconomic status impacts white matter network organization in adolescents and if this relationship mediates the impact of socioeconomic status on general cognitive ability.

Methods

Adolescent Brain Cognitive Development study (ABCD) data

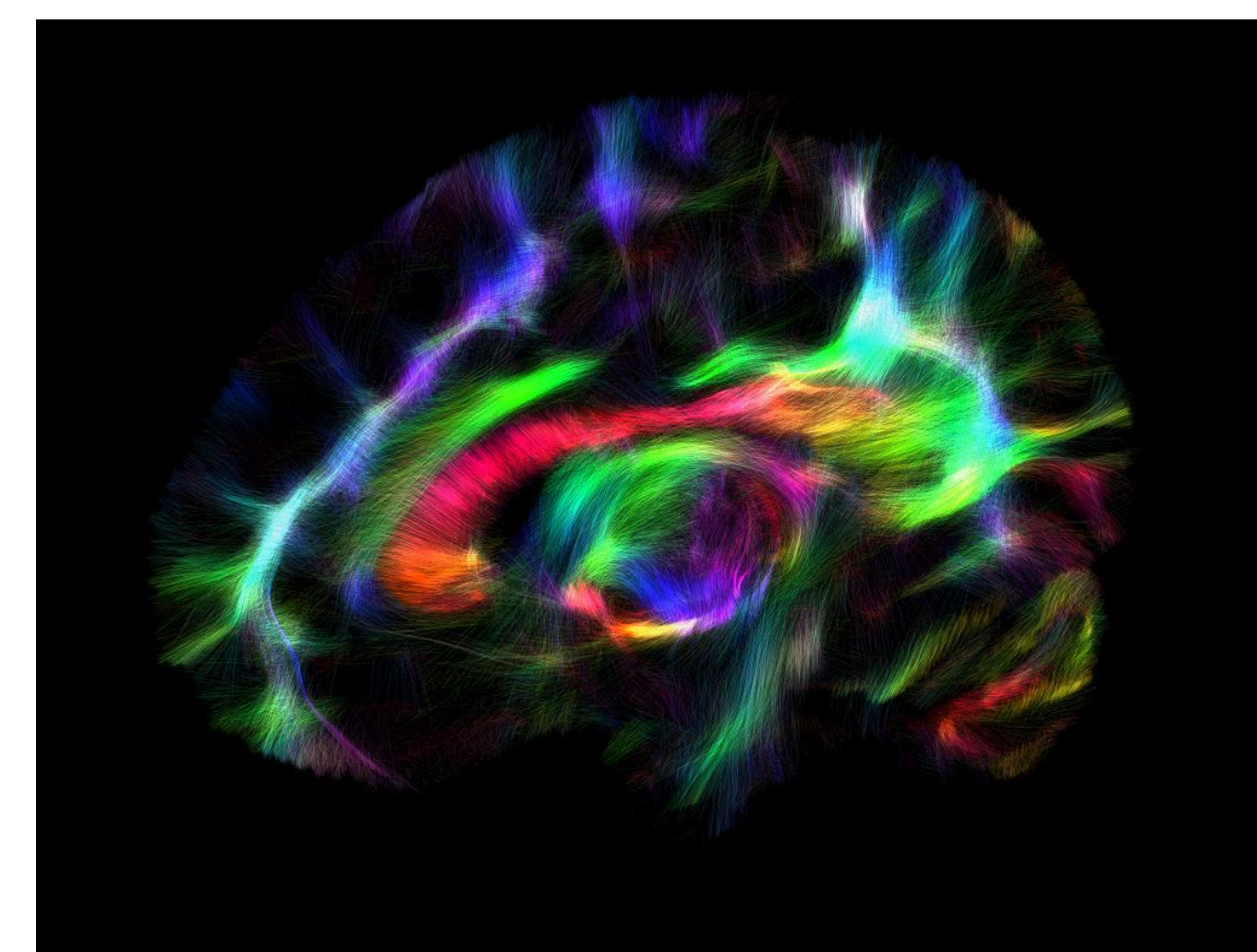
- The ABCD contains high-quality SES reports, cognitive assessments, and magnetic resonance imaging data for 11,880 sociodemographically diverse 9- and 10-year-old children. The current findings are based on the analysis of 3946 of participants.
- 16 environmental variables were analyzed to produce latent variables of SES.

White Matter Tractography

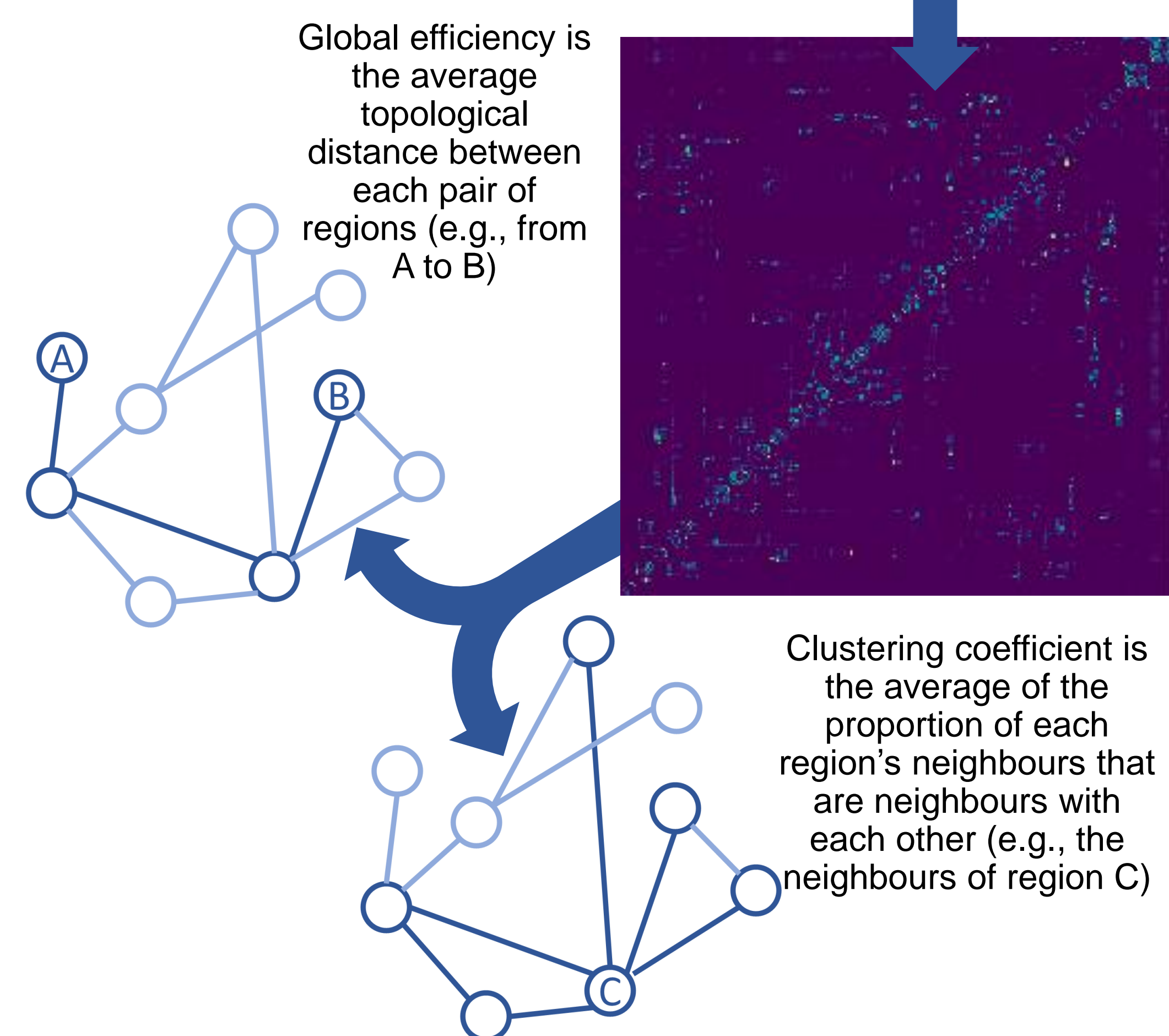
- 1 million streamlines were generated using MRtrix3 probabilistic tractography to estimate the relative number of white matter connections between 360 cortical areas and 19 subcortical regions from the Human Connectome Project Multi-Modal Parcellation 1.0.

White Matter Network Organization Metrics

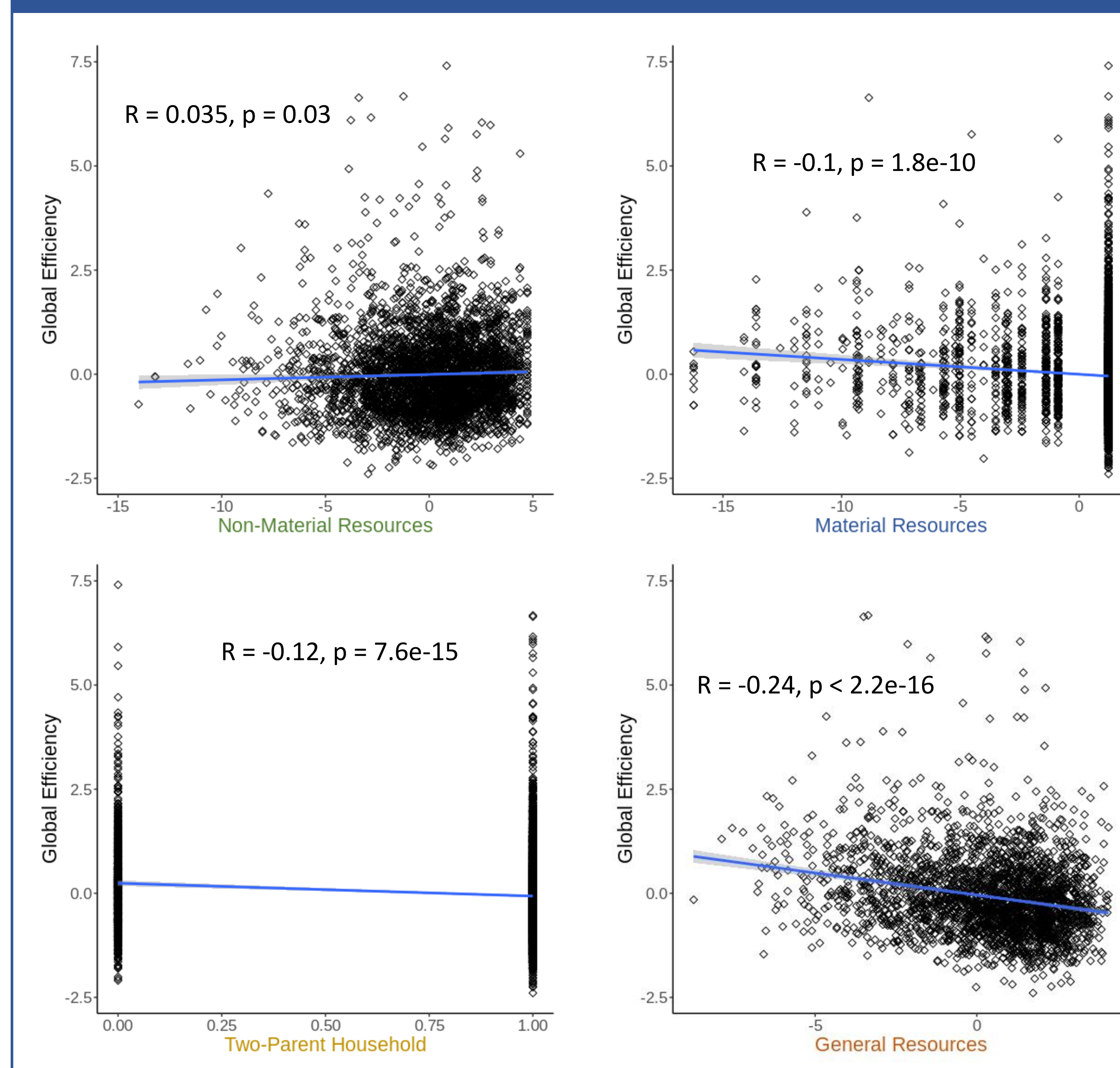
- White matter network organization can be estimated using graph-theory-based metrics.
- The Brain Connectivity Toolbox was used to calculate global efficiency (a measure of network integration) and clustering coefficient (a measure of network segregation).



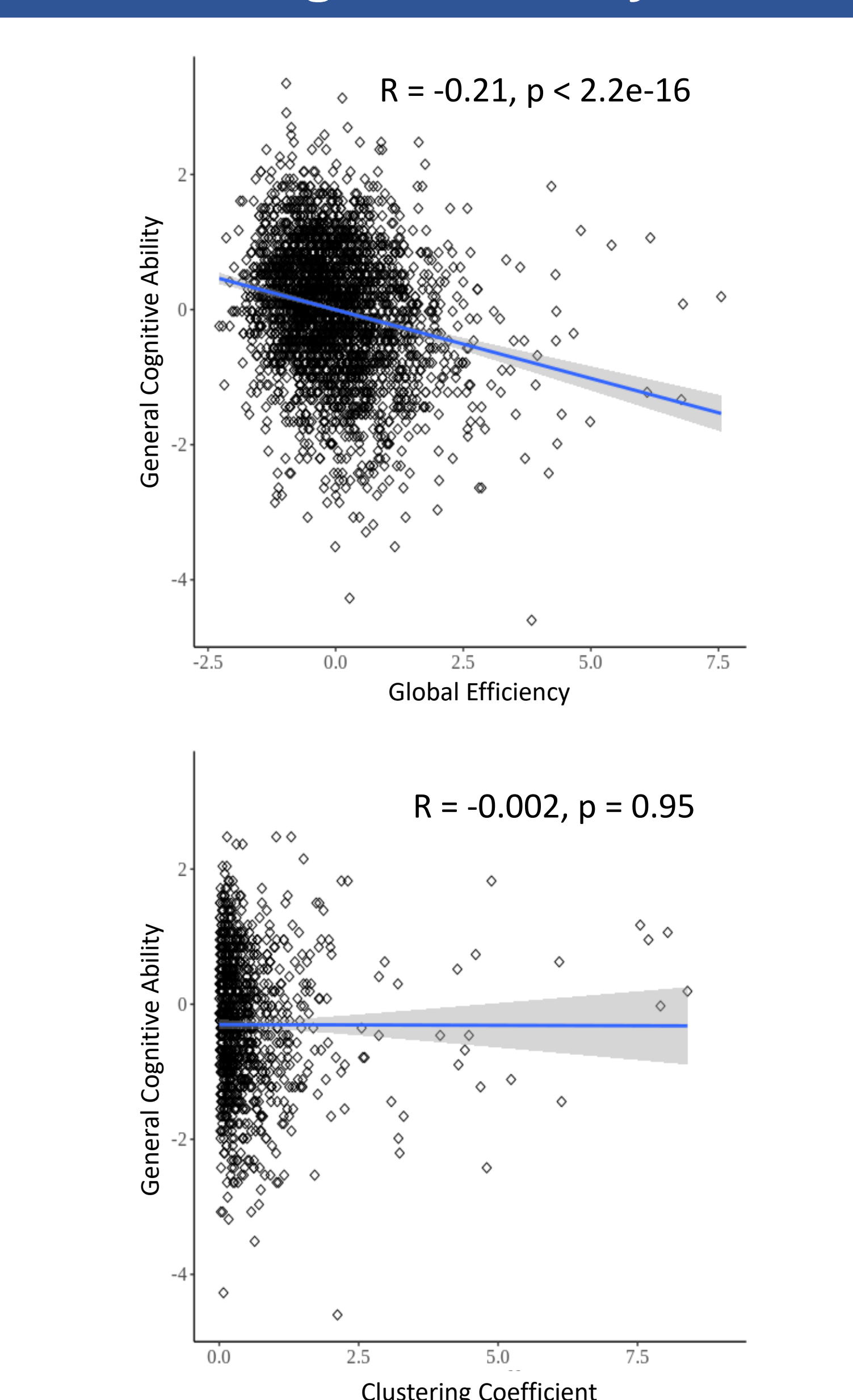
The number of white matter-based streamlines connecting each pair of regions are calculated to form a connectivity matrix



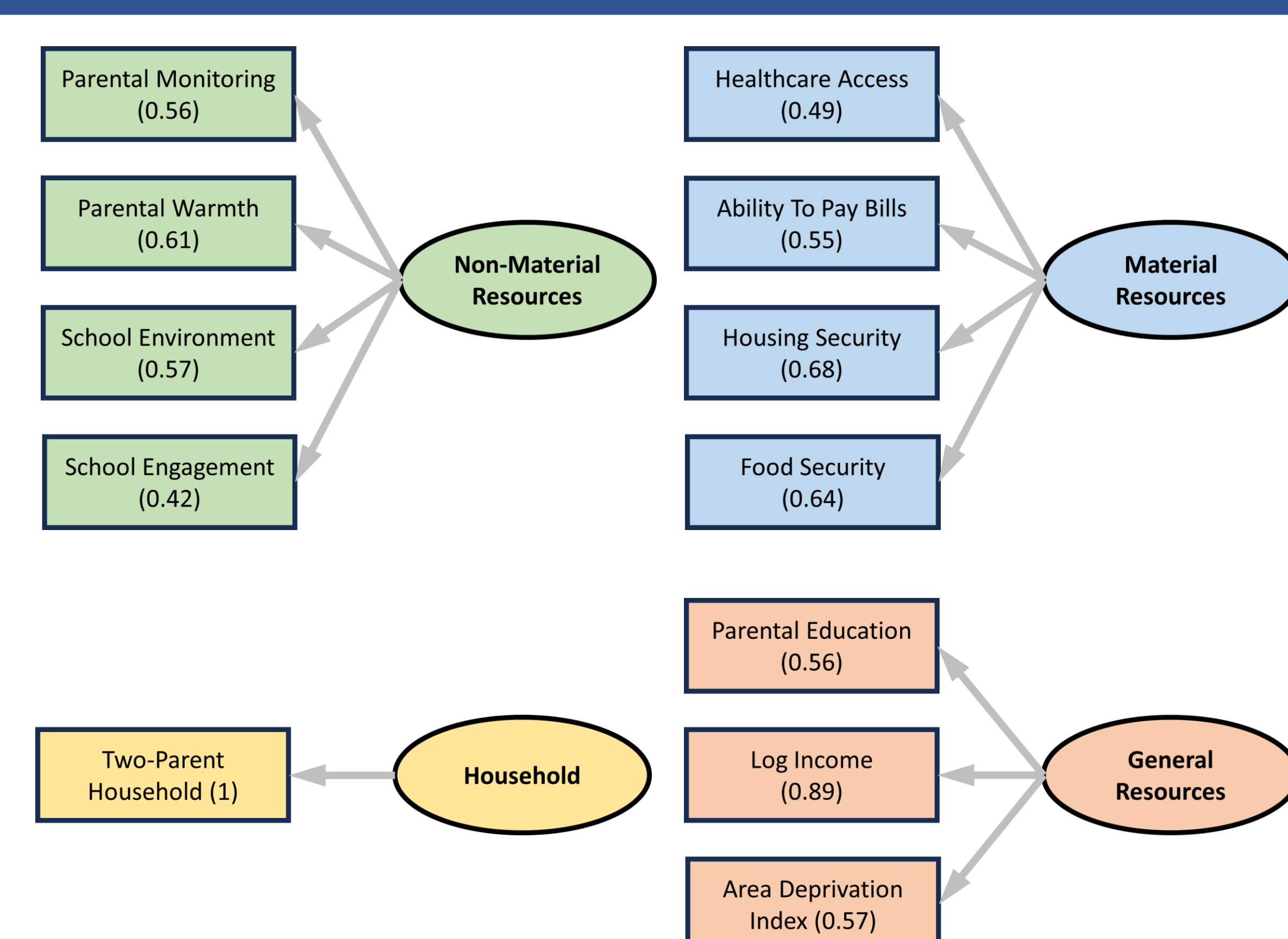
High Non-Material Resources And Low General, Household, And Material Resources Are Associated With More Integrated, But Not More Segregated, Networks



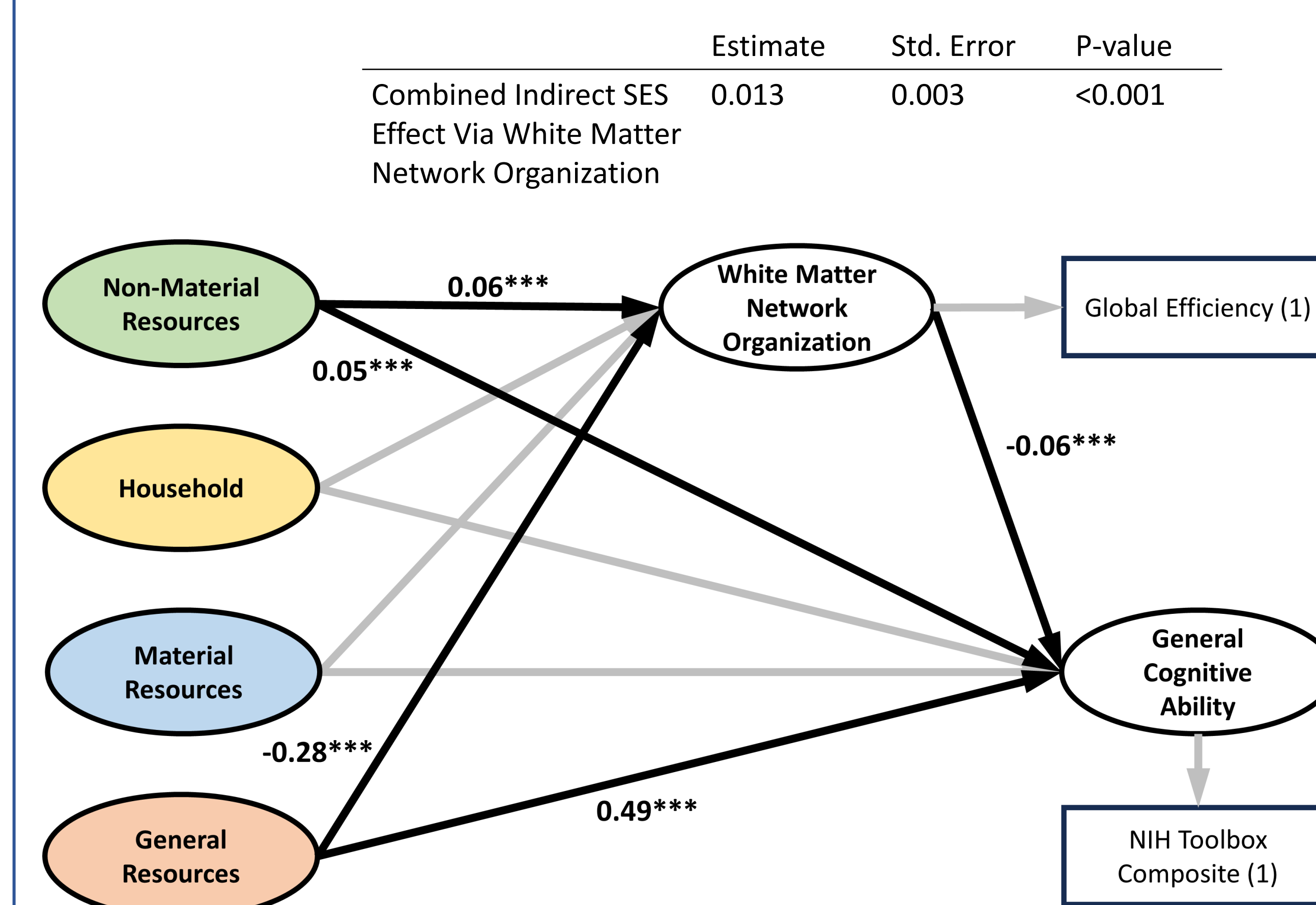
More Integrated, But Not More Segregated, Networks Are Associated with Low General Cognitive Ability



Exploratory Factor Analysis Revealed 4 SES Latent Variables



White Matter Network Organization Partially Mediates Association Between Socioeconomic Status and General Cognitive Ability



Conclusions

- This study found an unexpected negative association between network integration and general cognitive ability, and between network integration and SES
- **Low SES may lead to more integrated, but less optimal networks, which in turn leads to reduced general cognitive ability**

Future Directions

- Complete analysis of all available participants is currently underway
- Further analysis will assess whether sex and race impact how SES affects white matter network organization and general cognitive ability
- Future analysis can use longitudinal data from subsequent ABCD timepoints to assess the developmental trajectories of the SES-white matter network organization-general cognitive ability relationships

Acknowledgements

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