Frequency of resting-state BOLD signal in 2-month-old Bangladeshi infants growing up in poverty
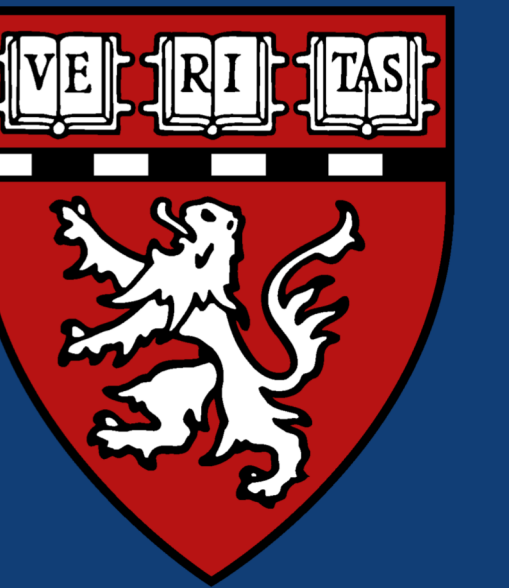
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Introduction

- Peak spectral power of blood-oxygen-level-dependent (BOLD) signal shifts from lower to relatively higher frequencies from early to late infancy[1].

- BOLD spectral power has been associated with cognitive performance in infancy[1] and developmental disorders[2].

- Risk factors associated with poverty have been shown to relate to brain function[3-5].

- Risk factors associated with poverty may also relate to BOLD spectral power.

Methods

Participants: Thirty-two infants (77.8 ± 9.1 days) from families in Dhaka, Bangladesh.

Adversity Variables: Income-to-needs, maternal education, maternal stress, family care, and HAZ, a proxy for malnutrition and infection.

MRI Acquisition: Resting-state MRI acquired on a 3T Siemens scanner.

Processing of MRI Data: Power density spectra computed voxel-wise, then averaged across all gray matter voxels and also in 90 parcels of UNC neonate AAL parcellation.

Statistical Analyses: Semipartial correlations used to compute associations between adversity variables and spectral power. T-test and repeated-measures ANOVA designs used to compare adversity-spectral power associations.
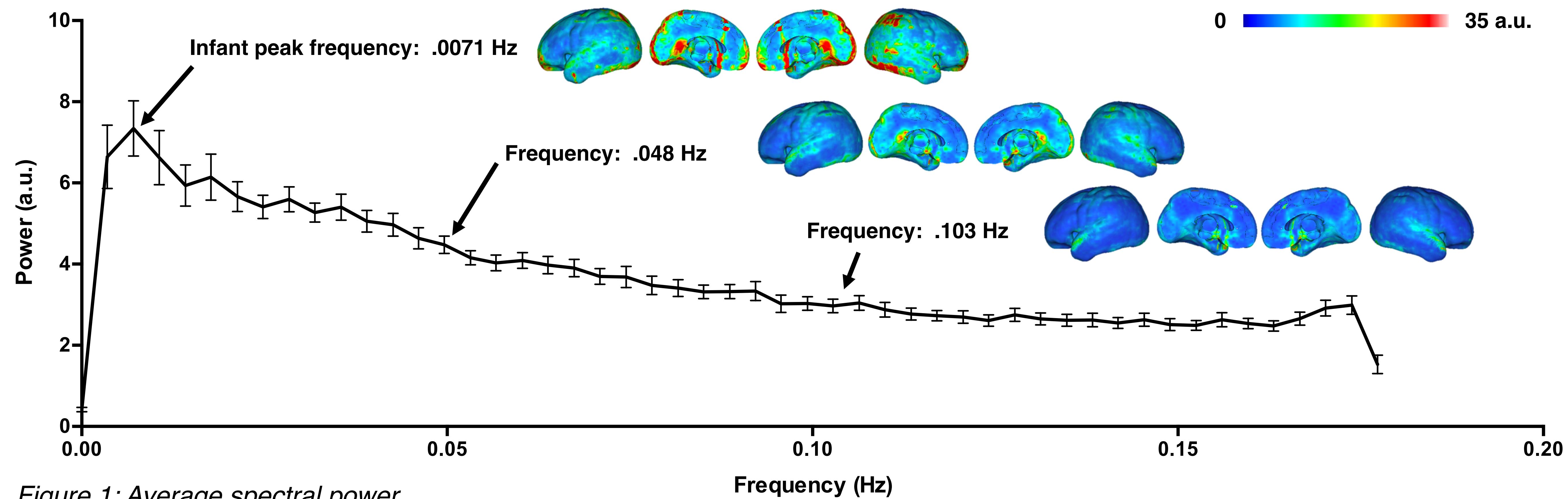
Results
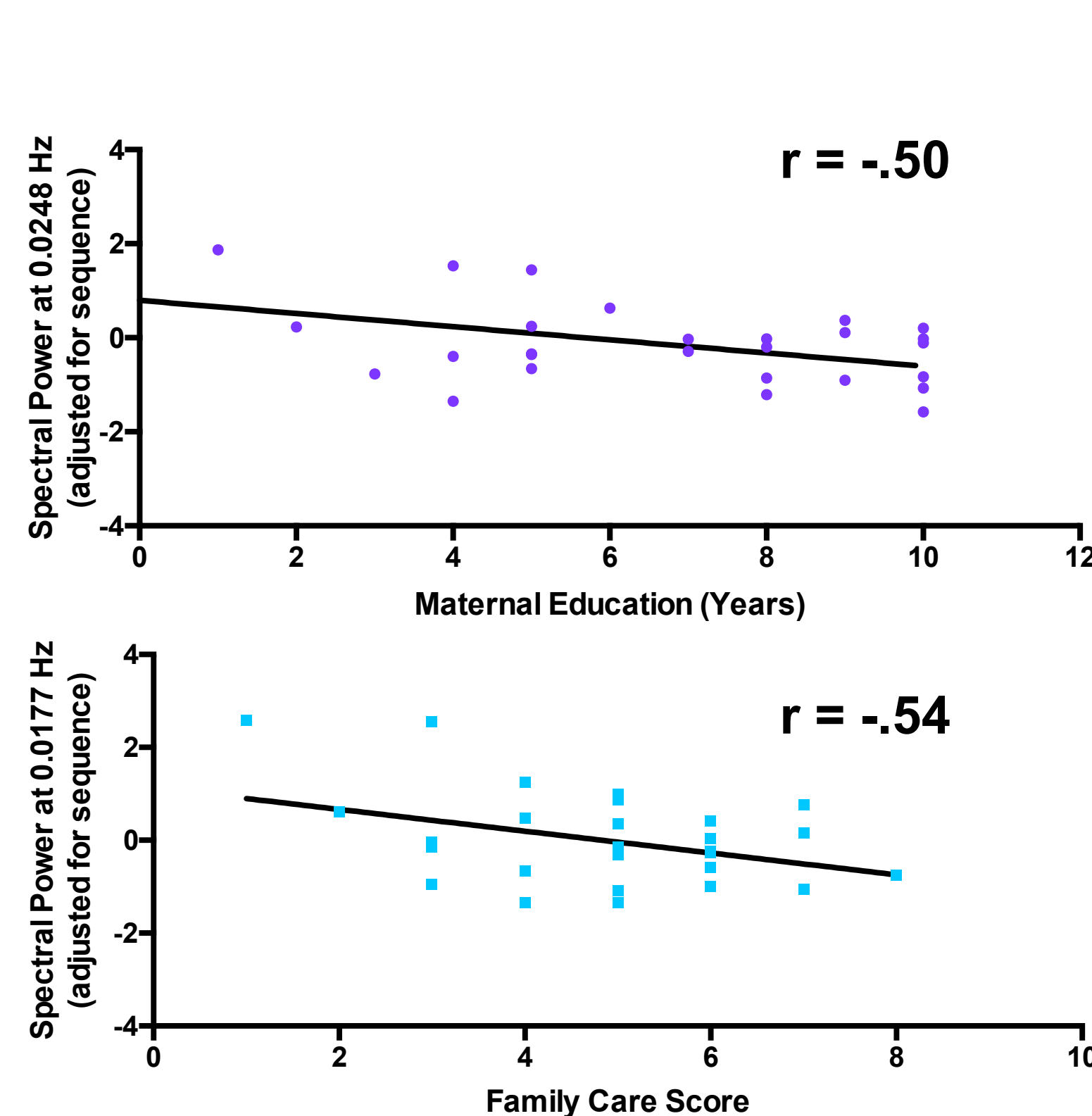

Figure 1: Average spectral power

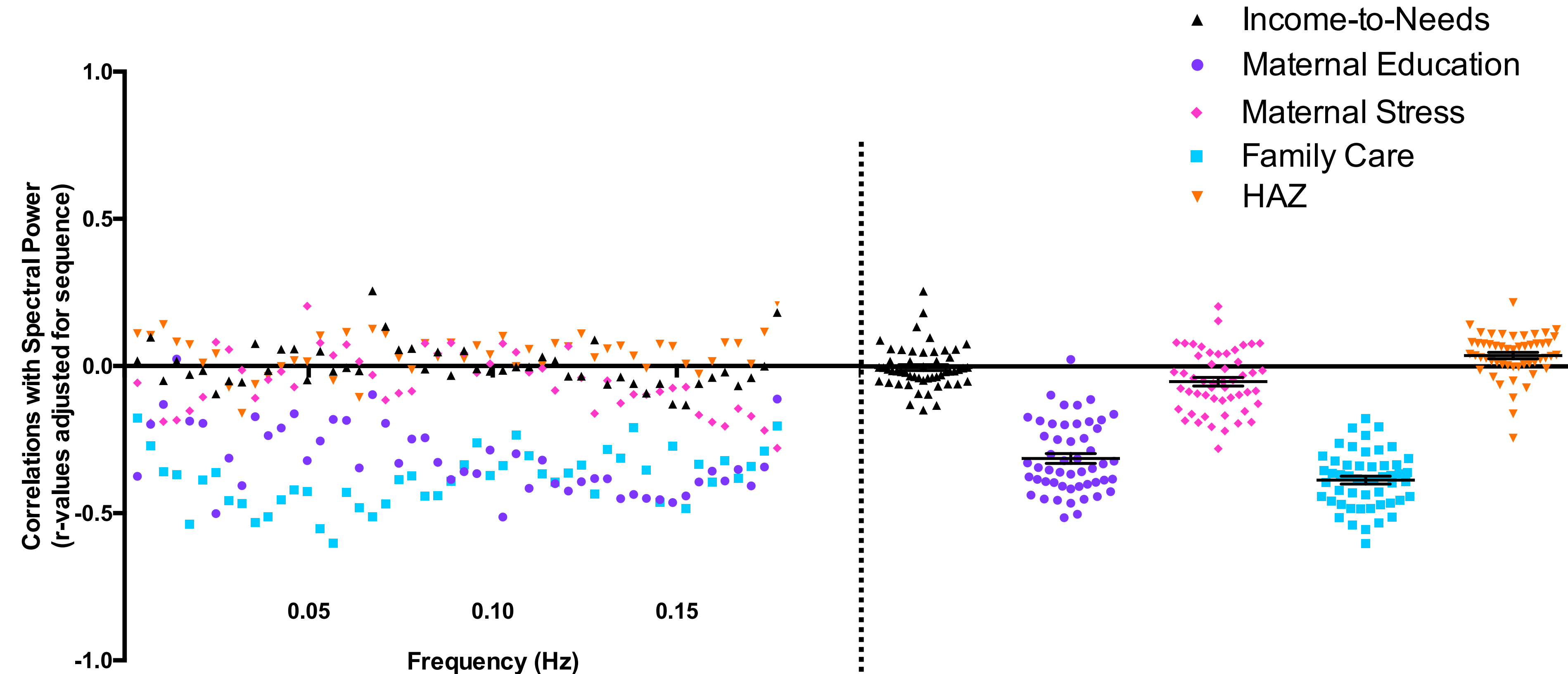Figure 2: Sample adversity-spectral power correlations

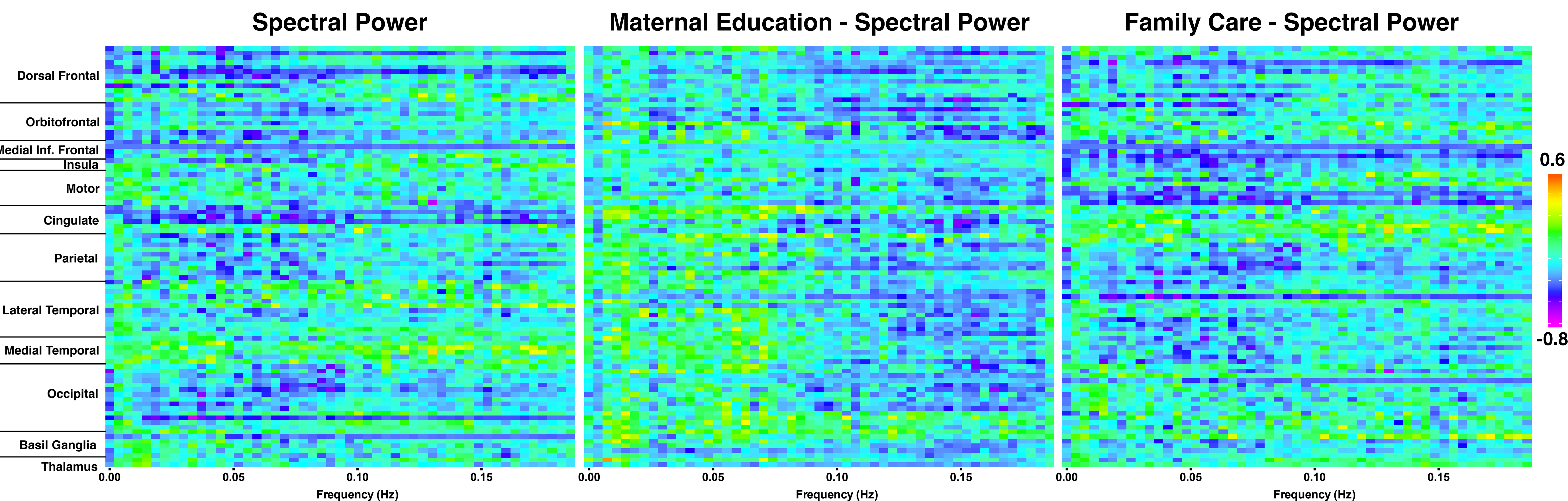Figure 3: Summary of adversity-spectral power correlations

Figure 4: By brain region and frequency, heatmaps depicting (A) spectral power, (B) maternal education-spectral power correlations, and (C) family care-spectral power correlations

Summary & Conclusions

- 2-3-month-old Bangladeshi infants exhibited peak spectral power at a frequency below what is typical in older children[1] and adults[6], consistent with earlier work[1].

- Spectral power manifested strongest in primary sensory, frontal pole, and default-mode areas at peak frequency.

- Spectral power was negatively associated with maternal education, maternal stress and family care and positively associated with HAZ.

- Spectral power was more strongly associated with maternal education and family care compared with other adversity variables.

- Brain-adversity relationships were not localized to areas identified in studies of poverty using other brain measures[3-5,7].

- Variability in neuronal transmission and neurovascular coupling may underlie adversity-spectral power associations.

References

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Acknowledgements

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