To determine if early developments in working memory task (n-back task) are associated with higher executive function in children, we analyzed cortical thickness across different lobes from early infancy to childhood.

**INTRODUCTION**

- Working memory is a type of executive function that requires encoding, maintenance, and updating of information.
- Developmentally, working memory has protracted maturation over infancy and childhood.
- The frontal lobe is strongly associated with higher order thinking; however, the parietal lobe is also the dorsal pathway of information which is important for spatial processing. Similarly, the temporal lobe carries information through the ventral pathway such as object recognition.

**OBJECTIVE**

To determine if early developments in cortical thickness is relevant for predicting executive function through a working memory task (n-back task).

**RESULTS**

- **Figure 1. Cortical Thickness Correlated with N-back D-prime Performance**
  - Frontal Lobe Thickness by Age
  - Parietal Lobe Thickness by Age
  - Temporal Lobe Thickness by Age
  - Strongest correlation at last time periods for all three lobes when cortical thickness is compared with n-back D-prime analysis.

- **Figure 2. Cortical Thickness Correlated with N-back Target Accuracy**
  - Parietal Lobe Thickness by Age
  - Temporal Lobe Thickness by Age
  - Strongest correlation at last time periods for all three lobes when cortical thickness is compared with n-back Target Accuracy correlations.

**MATERIALS AND METHODS**

**MRI and Data Collection:**

MRI scans collected at 11 possible time periods, using Infant-specific processing pipeline (iBEAT). Then separated into three main time periods: 0-3 months, 9-12 months, and 48-72 months.

**Participants:**

- 46 at first time periods (0-3 months), 43 at second time point (9-12 months), 28 at last time point (48-72 months)

**N-back Task:**

- Participants must recognize one specific stimulus (a letter, number, or symbol) in a sequence and then recall the same number later depending on what "n" is.

**Statistical Analysis:**

Correlation plots with Cortical Thickness measurements and n-back test and linear regressions controlling for age and sex.

**CONCLUSIONS**

Decreased Cortical Thickness for all three lobes at the last time point was correlated to working memory at pre-adolescent measures (n-back D-prime only):

- Significant for frontal and parietal lobes at last time period, but trending for the temporal lobe.
- Strong Negative Correlation

**Likely cause:** Synaptic Pruning

Initial burst of synaptic connectivity affecting gray matter measurements followed by a steep decrease, indicating pruning of synapses and related gray matter, accompanied by greater myelination of existing connections.

**Limitations and Future Directions**

Participants in fMRI machine during n-back task instead of at computer

Age range of participants (larger compared to previous timepoints)

Dropped participants throughout the longitudinal study for various reasons

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