Links between maternal distress, brain function, and working memory in early childhood

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Background

- Maternal depression and anxiety have long been associated with adverse child academic and behavioral outcomes[1,2], potentially via changes in the development of key neural systems that support cognitive and emotional regulation[3].
- Early childhood is an important developmental time point when cognitive and emotional regulation develops rapidly.
- Less is known about how underlying neural mechanisms during this period contribute to risk for adverse outcomes.
- We hypothesized maternal depression and anxiety were associated with child brain function in the context of working memory (WM).

Methods

- Participants: children age 4-7 years old (N=28) from low to middle socioecnomic backgrounds. Income to needs ratios ranged from 0.14 to 2.11 (*Mean*=1.15, *SD*=0.60). Children were identified as 35.71% Caucasian, 35.71% African American, and 28.57% other/mixed (60.71% Hispanic).
- Maternal depression and anxiety: Beck depression inventory-II[4] and State‐Trait anxiety inventory.
- Child outcome: child executive functioning was assessed using the Behavioral Rating Inventory of Executive Function (BRIEF)[6].
- Experimental task: a visuo-spatial WM task

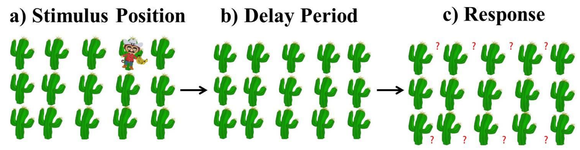

Figure 1

- Functional near infrared spectroscopy (fNIRS) based brain function in prefrontal regions associated with working memory.
- ROI analysis: left and right lateral prefrontal cortices (LPFCs). Each ROI was defined by six adjacent channels highlighted in Fig 2.

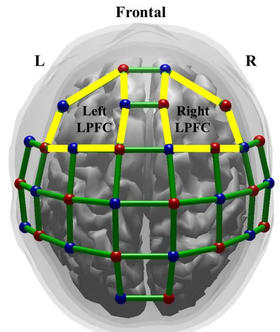

Figure 2

Results

- Maternal distress, a principal component, was derived from the high covariation between maternal depression and anxiety (r=0.61, p<.001).
- **Our ROI results** showed maternal distress was significantly negatively associated with child HbO activation in left LPFC (**t_{HbO}=-2.33, p=.027**), and marginally negatively associated with child HbO activation in right LPFC (**t_{HbO}=-2.00, p=.055**), see Fig.3a.
- **Our ROI results** also showed maternal distress was significantly positively associated with child HbR activation in left LPFC (**t_{HbO}=2.05, p=.050**), see Fig.3b.

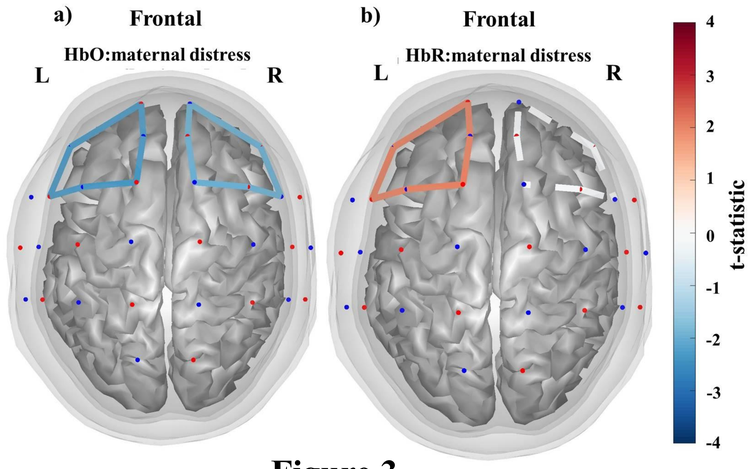

Figure 3

- Post hoc analysis showed maternal depression was significantly negatively associated with child HbO activation in bilateral LPFCs (**left LPFC: t_{HbO}=-3.13, p=.004 ; right LPFC: t_{HbO}=-2.53, p=.018**).
- Post hoc analysis also showed maternal trait anxiety was significantly negatively associated with child HbO activation in bilateral LPFCs (**left LPFC: t_{HbO}=-2.07, p=.048; right LPFC: t_{HbO}=-2.08, p=.047**).

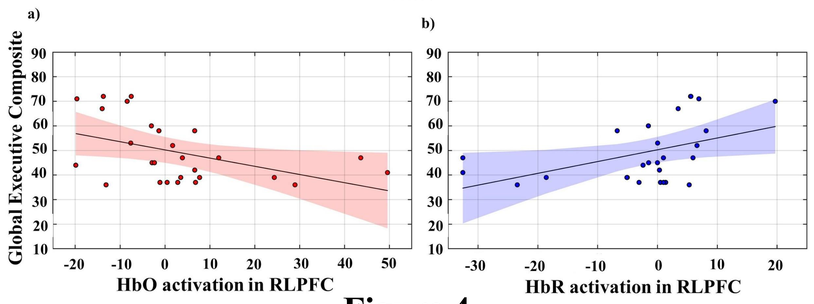

Figure 4

- HbO and HbR activation in the right LPFC, but not task performance (reaction time and accuracy), were associated with executive functioning represented by the BRIEF Global Executive Composite scores (**t_{HbO}=-2.48, p=.020; t_{HbR}=2.59, p=.016**)

Conclusions

- Our results indicate that young children exposed to greater maternal depression and anxiety exhibited lower brain activation in prefrontal regions.
- Variability in LPFC activation was associated with risk for poor executive functioning in early childhood.

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