

# Near-Infrared Spectroscopy may be a promising way to detect pain in children with Autism Spectrum Disorders when they can not tell someone

## Examining the utility of Near-Infrared Spectroscopy (NIRS) in detecting discomfort in children with Autism Spectrum Disorders

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### INTRODUCTION

- Pain is typically evaluated through verbal self-assessment.
- Self-assessment and communication of distress can be challenging for children with autism spectrum disorder (ASD).
- Near-infrared spectroscopy (NIRS) is a non-invasive and portable brain monitoring modality suitable for clinical use.
- **Objective:** Investigate the potential of using NIRS to detect a brain response to pain or discomfort in children with ASD.

### METHODS

- Males 10-15 yrs old participated (7 typically developing, 15 with ASD)
- Brain activity was measured using a continuous-wave NIR spectrometer.
- To induce discomfort, participants placed their hand in cold water (10°C) for as long as tolerable. For comparison, they also put their hand in tepid, room temperature water (fig. 1).

### Outcome Measures:

- **Subjective Rating** – Participants rated pain level using the Numeric Pain Scale NRS-11 (scale from 0-10) (Dworkin et al, 2005).
- **Brain Response** – Amplitude and timing of the changes in oxygenated hemoglobin concentration ([HbO]) were evaluated.

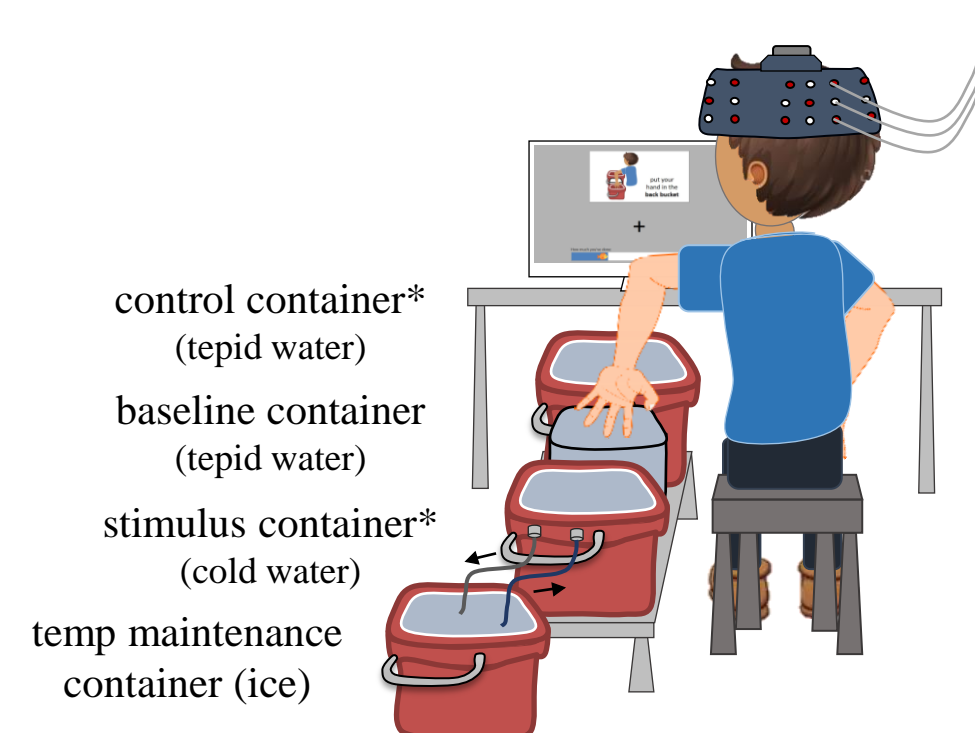


Figure 1: Experimental setup



### Analysis:

- A mixed model linear regression was used to compare measures between: (1) study group (TD, ASD), (2) task (cold, tepid water), and (3) brain region (left & right prefrontal & parietal cortices).

### RESULTS

- Pain ratings between cold and tepid water tasks were significantly different ( $p < 0.001$ ), but not between ASD and TD ( $p = 0.885$ ).
- Magnitude and timing of the brain response induced by the cold and tepid water were significantly different ( $p < 0.001$ , fig. 2).
- The effect of the task on the brain response depended on the study group (group \* task interaction:  $p < 0.001$ ).

### DISCUSSION/ RELEVANCE

- Higher pain ratings for the cold water vs tepid water trials indicated that discomfort was experienced.
- Despite the mild noxious stimulus, a significant difference in brain activity was captured, likely representing a response to discomfort.
- ASD group exhibited a blunted response to the cold stimulus relative to TD group, despite similar subjective pain ratings.
- Findings indicate the potential of using NIRS in an objective pain assessment tool that does not rely on verbal assessment. However a larger sample is needed to further explore this possibility.

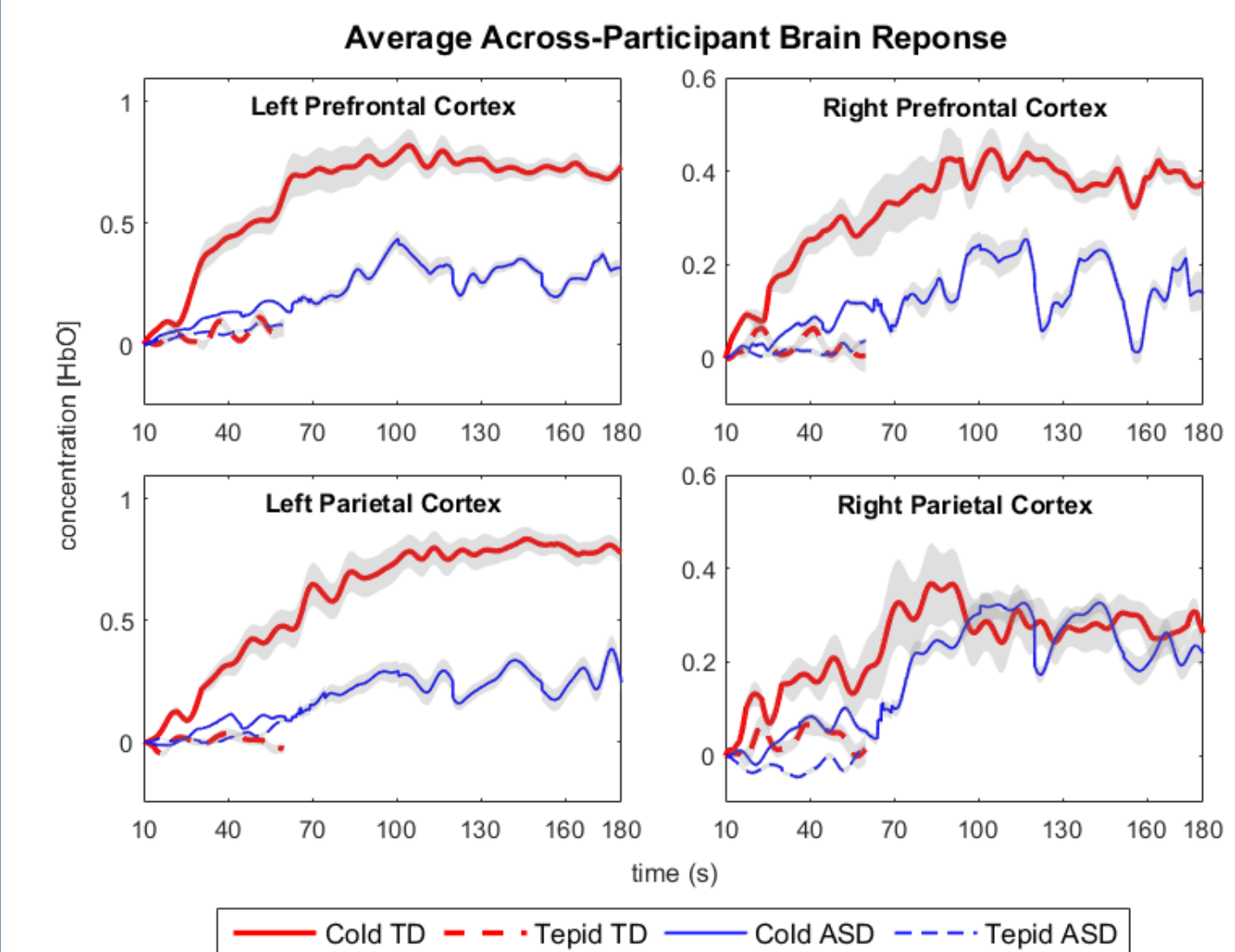


Figure 2: Average across-participant brain response (oxygenated ([HbO]) to cold water and tepid water stimuli. Shaded areas represent standard error of the mean.