Background:
- Emotion regulation is the adaptive ability to modulate one’s own affect to achieve desirable social, cognitive, and environmental outcomes (Eisenberg & Spinrad, 2004; Graziano et al., 2007).
- Evidence suggests that emotion regulation can impact cognition, particularly memory, and vice versa (McGaugh, 2018; Pessoa, 2018).
- These relations may arise due to overlapping neural substrates, as the hippocampus and amygdala play pivotal roles in both emotion and cognition, as well as their interaction (Pessoa, 2010; Phelps, 2004).
- However, these links are under-investigated in development.
- A recent paper, we reported that empathic responding was related to hippocampal, but not amygdala volumes in young children (Stern et al., in press).
- Both memory and emotion regulation were proposed to be possible mechanisms linking empathic responding with hippocampal volume.

Present Study:
- The goal of this study was to explore relations among parent-reported emotion regulation, memory, hippocampal and amygdala volumes in typically developing young children.

Methods:
- Participants: 85 participants (46 male) ages 4-8 years (M = 6.28, SD = 1.06) who provided complete emotion regulation, memory, and neuroimaging data (n = 60, 30 male) were recruited from a larger study on memory development (Riggins et al., 2018).
- Measures:
  - Parents reported their child’s ability to regulate emotion using the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997).
  - 24 items split across 2 subscales:
    - Emotional Regulation (ER; 8 items), ex.: “Responds positively to neutral or friendly overtures by peers.”
    - Lability/Negativity (L/N; 15 items); ex.: “Is easily frustrated.”
  - Items were scored on a 4-point Likert-type scale ranging from “never” to “almost always”.
  - Memory was assessed via multiple measures [adapted from literature]:
    - Primacy Discrimination (Matthews & Fouard, 1970).
    - Temporal Order Recall (Bauer et al., 2013).
    - Source Memory Task (Drummey & Newcorn, 2002).
  - Magnetic resonance imaging (MRI) conducted to provide brain region volumes:
    - A standard resolution (9mm³), T1-weighted whole brain structural scan was acquired during neuroimaging and processed using FreeSurfer (v5.3).
    - Hippocampal and amygdala volumes in left and right hemisphere were obtained, along with gray matter volume.
    - Hippocampus was divided into subregions (head, body, and tail).

Results:
- Table 1: Bivariate correlations between children’s emotion regulation, memory, brain volumes, and covariates.
  - Most notable correlations were found between emotion regulation and memory task performance.
  - Positive correlations between ER and memory task performance approached significance, specifically for source memory task.
  - Negative correlations were present but failed to meet traditional levels of significance.

Discussion:
- Findings:
  - Emotion regulation, as measured by parent-reported ER and L/N, was associated with hippocampal volumes in typically developing young children.
  - Interestingly, the direction of L/N and hippocampal volume associations varied across different hippocampal subregions; specifically, significant associations were predominantly within right hippocampus subregions.
  - Left hippocampus may be more involved in autobiographical memory recall (Burgos et al., 2002).
- Relations between parent-reported emotion regulation and memory performance were present but failed to meet traditional levels of significance.
- Memory task performance was positively associated with hippocampus subregion volumes, but not amygdala volume.
- Possibly the result of immaturity or reduced neoplasticity; brain-memory links could occur along many pathways and be less specialized in young children.
- Overall consistent with Stern et al. (in press) which found similar associations between empathy and hippocampus volumes but not amygdala volumes.

Limitations:
- High SES sample, emotion regulation may be less impactful (Troy et al., 2017).
- Small sample size due to incomplete participant data.

Future Directions:
- Compare memory performance and brain region volumes/maturations in a sample encompassing adults and children.
- Use memory tasks covering a more diverse span of memory types (e.g., autobiographical memory).
- Further investigate relations between hippocampus and amygdala volumes, memory, emotion regulation, and empathic responding.

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Selected References:
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