

## Introduction

- Home experiences play an important role in shaping children's cognitive development.
- Exposure to stimulating materials and interactions in the home is linked to development of academic abilities<sup>1</sup> and inhibitory control<sup>2</sup>.
- Prior work focuses on general behavioral and cognitive outcomes; however, less is known about impacts of cognitive stimulation in the home on brain structure.
- The hippocampus is known to show protracted development and environmental plasticity<sup>3</sup>, making it particularly susceptible to experiences in the home and conditions in early childhood<sup>4</sup>.
- Subregions of the hippocampus (head, body, tail) serve specific functions and follow distinct developmental trajectories<sup>5</sup>.
- We examined associations between the cognitive stimulation of a child's home environment and hippocampal subregion volumes in early childhood with attention to potential sex differences, as previous research shows inconsistency in sex-based findings<sup>6</sup>.

## Methods

- Hippocampal volume was measured using a T1-weighted anatomical scan acquired from a 32-channel coil on a 3T Siemens Prisma and Skyra scanners.
- Subregions (head, body, and tail) were first segmented using FreeSurfer's v7.1.1 automatic hippocampal segmentation pipeline, then by trained coders to ensure accurate identification of anterior-posterior boundaries via the uncus apex and separation of the fornix.
- Partial regression analyses, controlling for age, were conducted first in the full sample and subsequently separately by sex.
  - Right and left regions were analyzed separately.



Figure 3. Scan setup.

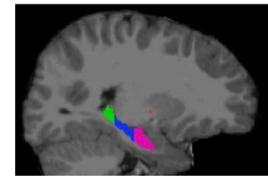
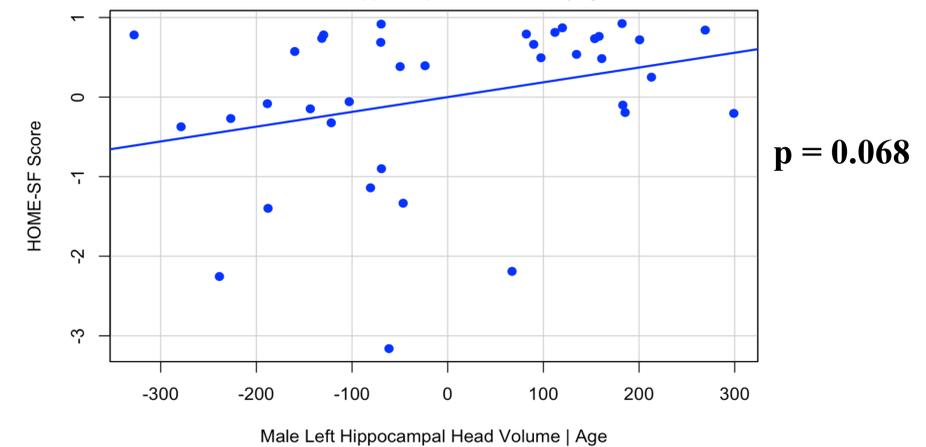
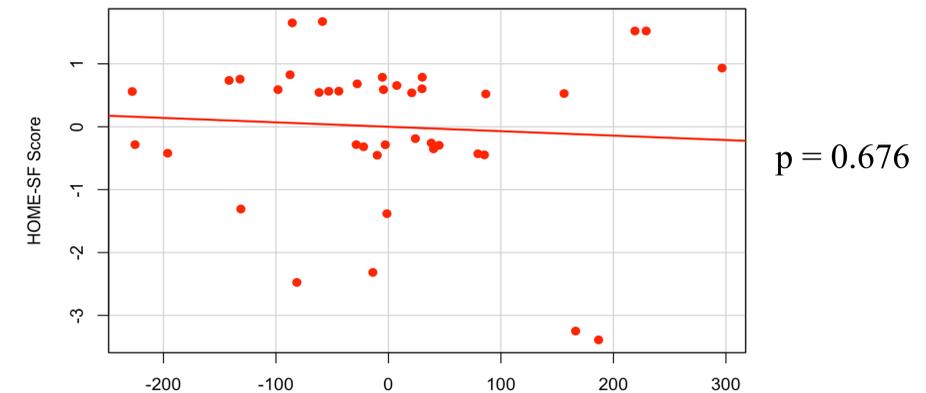


Figure 4. Hippocampus subregions. Pink = head, blue = body, green = tail

## Results

- Partial regression plots by sex (controlling for age) showed that in males, greater cognitive stimulation in the home is marginally associated with larger hippocampal head volume. This marginal association was not found in females.



## Methods

- Participants: 80 children (41 females), 3-5 years ( $M_{age} = 3.72$ ,  $SD_{age} = 0.53$ )
- Parents completed Home Observation for Measurement of the Environment Short Form (HOME-SF) questionnaire.
  - These questions, answered via parent report, measure cognitive stimulation in the home
  - Example questions:
    - "About how many books does your child have?"
    - "Do you or someone else help your child with shapes and sizes?"
  - Scored out of 15 ( $M_{score} = 11.32$ ,  $SD_{score} = 1.12$ ); higher HOME-SF score = higher cognitive stimulation
    - Females:  $M = 11.35$ ,  $SD = 1.21$ ; Males:  $M = 11.30$ ,  $SD = 1.02$

Figure 1. Histogram of Age.

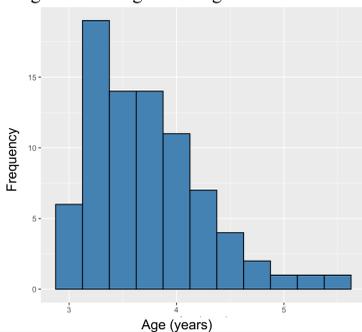
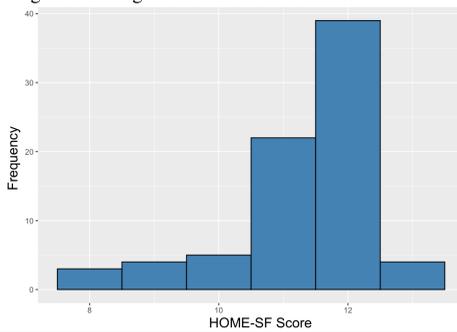


Figure 2. Histogram of HOME-SF Scores.



## Results

- Significant sex differences observed in right and left head and whole hippocampal volumes (males significantly larger volumes than females).

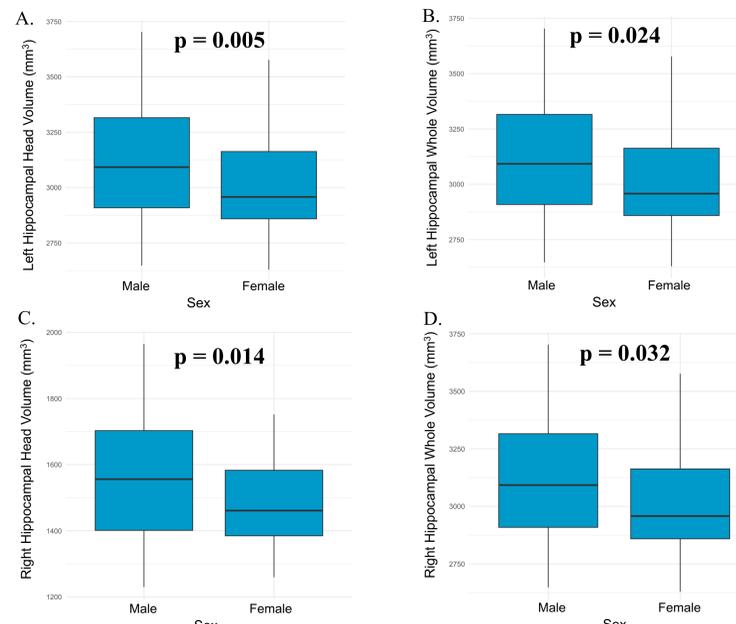


Figure 5. Sex differences in hippocampal volumes. Box-plots comparing males and females for (A) left hippocampal head volume, (B) left hippocampal whole volume, (C) right hippocampal head volume, and (D) right hippocampal whole volume (all volumes in  $mm^3$ ).

## Discussion

- Associations between cognitive stimulation available in the home and hippocampal head volume may be more apparent in male children.
  - This finding may reflect higher reliance on environmental and cognitive enrichment in males during early childhood development.
- Possible limitations include small sample size and limited variability in HOME-SF scores which may have reduced ability to detect effects.
- Future analyses will include a larger sample and longitudinal approach to examine the effects of cognitive stimulation on hippocampal subregion volumes over time.