

# Parsing Variability in the Childhood Environment: Relations with Brain Development and Mental Health in Youth



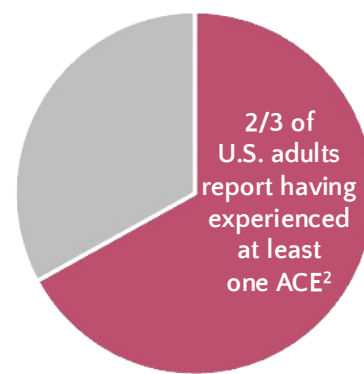
Alexandra Martinez-Garcia<sup>1</sup>; Felicia Hardi, PhD<sup>2,3</sup>; Taylor J. Keding, PhD<sup>3</sup>; Bailey Holt-Gosselin, PhD<sup>3</sup>; Elizabeth V. Goldfarb, PhD<sup>2,3,4,5</sup>; Dylan G. Gee, PhD<sup>2,3,4</sup>

1. Yale College, Yale University | 2. Wu Tsai Institute, Yale University | 3. Department of Psychology, Yale University | 4. Department of Psychiatry, Yale University | 5. National Center for PTSD

## Background

Early-life exposure to adversity, stress, and/or trauma is a common experience that can profoundly influence neurodevelopmental and mental health outcomes in both the short- and long-term.<sup>1,3</sup>

Variability in dimensions of adversity and in aspects of the childhood environment (e.g., caregiver involvement, developmental timing, socioeconomic status) produces significant heterogeneity in neurobehavioral outcomes.<sup>4,5,6</sup>

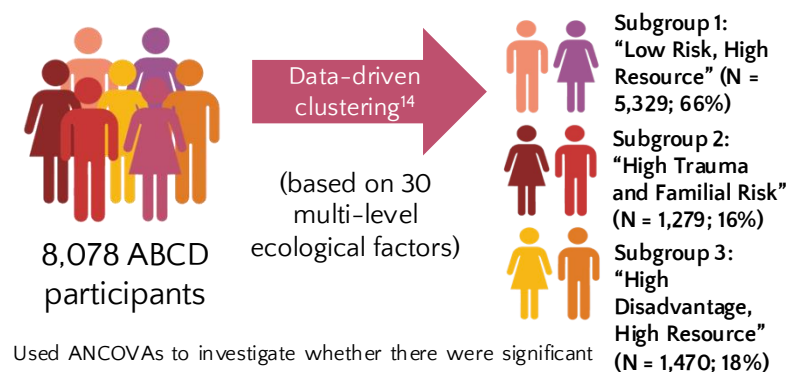


Emotion regulation:

- Can become altered across many mental health and behavioral conditions<sup>7,8,9</sup>
- Is particularly liable to exposure to caregiver-related adversity<sup>10,11</sup>
- May be a potential buffer for youths following early-life adversity<sup>12,13</sup>

The present study leverages data from the Adolescent Brain and Cognitive Development (ABCD) Study to parse heterogeneity in childhood environments and in neurobehavioral outcomes related to emotion regulation.

## Methodology



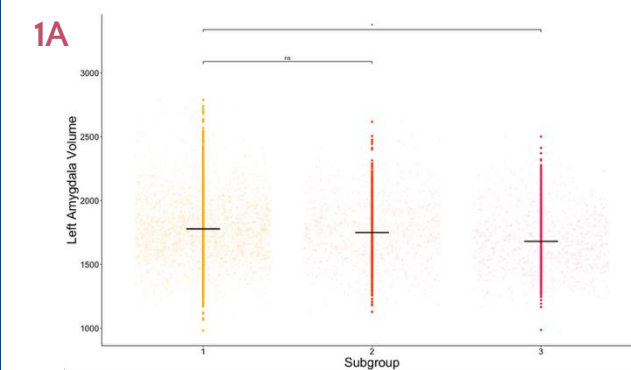
Used ANCOVAs to investigate whether there were significant differences across subgroups for:

- Amygdala and hippocampus volumes, EN-back task BOLD activation levels (emotion vs neutral), and rsFC to the cingulo-opercular network (CON)
- EN-back task accuracy and mean reaction times
- Responses to parent-report DERS and youth-report ERQ

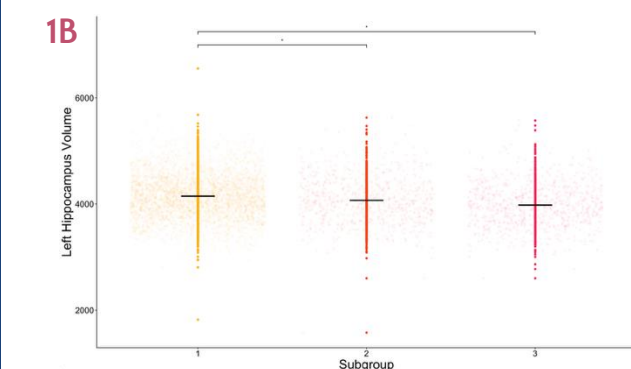
## Results

### Subgroup Differences in ROIs' Volumes

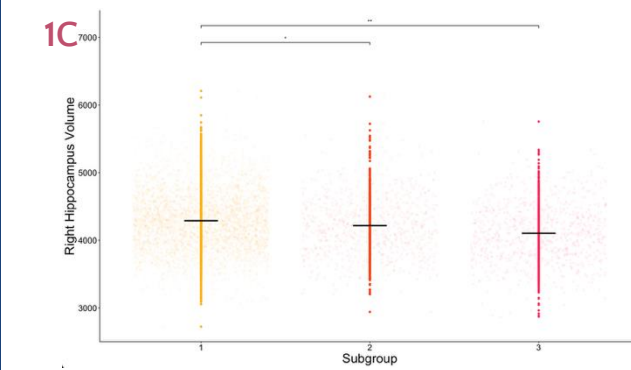
Left Amygdala Volumes: Low-Risk Group > High-Disadvantage Group (Fig. 1A)



Left Hippocampus Volumes: Low-Risk Group > High-Trauma and High-Disadvantage Groups (Fig. 1B)

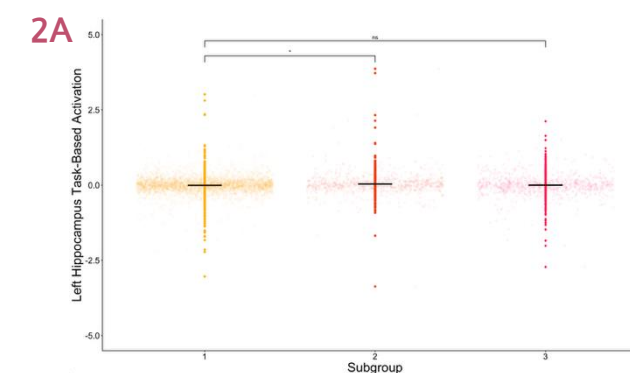


Right Hippocampus Volumes: Low-Risk Group > High-Trauma and High-Disadvantage Groups (Fig. 1C)

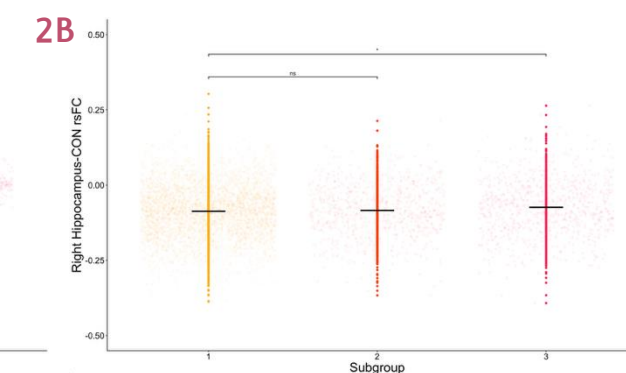


### Subgroup Differences in Hippocampal Task-Based Activation and rsFC with CON

Left Hippocampus EN-Back BOLD Activation (E vs N): High-Trauma Group > Low-Risk Group (Fig. 2A)

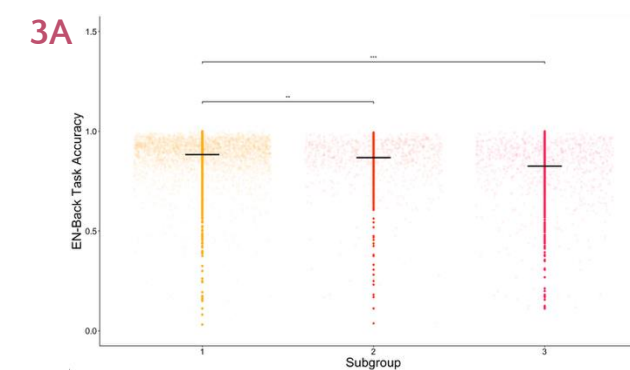


Right Hippocampus-CON rsFC: High-Disadvantage Group > Low-Risk Group (Fig. 2B)

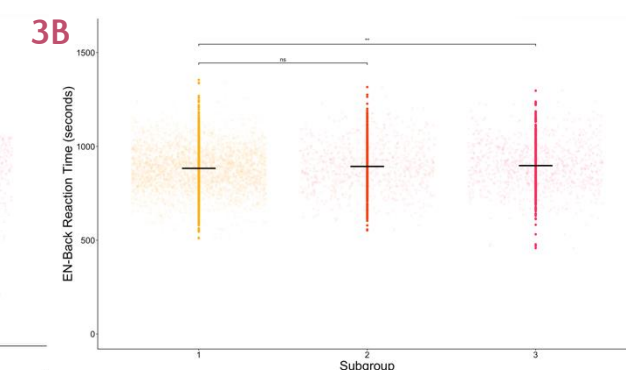


### Subgroup Differences in EN-Back Task Overall Task Accuracy and Mean Reaction Times

Overall Task Accuracy: Low-Risk Group > High-Trauma and High-Disadvantage Groups (Fig. 3A)

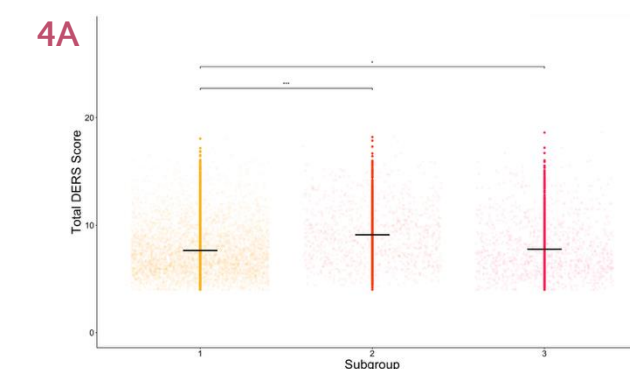


Mean Reaction Times: High-Disadvantage Group > Low-Risk Group (Fig. 3B)

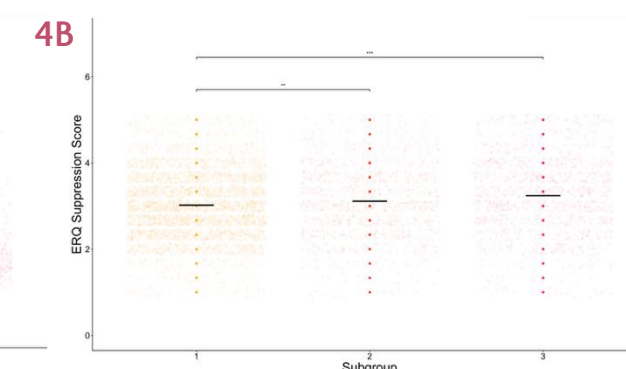


### Subgroup Differences in Total DERS Scores and ERQ Suppression Scores

Total DERS Scores: High-Trauma and High-Disadvantage Groups > Low-Risk Group (Fig. 4A)



ERQ Suppression Scores: High-Trauma and High-Disadvantage Groups > Low-Risk Group (Fig. 4B)



## Discussion & Conclusions

- Reduced left amygdala volumes in the high-disadvantage group are consistent with previous findings, but broader effects of different parts of childhood environment may emerge past our sample's mean age (12 yrs)
- Lower bilateral hippocampus volumes in both high-trauma and high-disadvantage groups aligns with previous findings of associations of early-life adversity with reductions in hippocampal volume in both youths and adults
- In contrast to our findings, previous work has found a relationship between more negative life events (NLEs) and lower hippocampal activation during the EN-back task for E vs N contrast
  - The lack of further functional activity differences in hippocampus and amygdala, which have emerged in previous studies, indicate further that effects of childhood environment may emerge later in adolescence
- Characteristics of the high-disadvantage group's childhood environment may delay the typical development of right hippocampus-CON rsFC
  - The lack of further between-group differences in CON-amygdala/hippocampus rsFC contrasts prior studies; childhood environment may influence rsFC change over time, or NLEs' influence on these circuits may change with more environmental considerations
- Reductions in EN-back task performance weren't specific to the profile of childhood environment experienced, while increased average task reaction times in only the high-disadvantage group indicate a potential unique effect on cognitive processing speed
- Increases in general emotion regulation difficulties and suppression scores did not differ in magnitude by profile of childhood environment experienced
  - The high-trauma group's high mean DERS score may indicate broader negative impacts of high trauma and familial risk with moderate resources, whereas high disadvantage with high resources may have a specific impact on the tendency to engage in suppression
- Limitations: Potential unaccounted facets of childhood environment, smaller sample sizes for the high-trauma and high-disadvantage groups
- Future Directions: Changes in variables of interest over time in the ABCD study, investigation of the prefrontal cortex's role in these processes, analysis of whether emotion regulation differences mediate childhood environment and youths' psychopathology

## Acknowledgements and References

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References	8. McLaughlin et al., 2011
1. Gee, 2021	9. Young et al., 2019
2. Swedo et al., 2023	10. Heleniak et al., 2016
3. Kessler et al., 2010	11. Weissman et al., 2019
4. Chodros et al., 2020	12. Daniel et al., 2020
5. Heifer et al., 2016	13. Schweizer et al., 2016
6. Sisk and Gee, 2021	14. Hardi et al., in review
7. Alkai, Nolen-Hoeksema, and Schweizer, 2010	