



Introduction

- Harsh parenting is defined as conscious acts of verbal and physical aggression, such as yelling or spanking, which are directed from parent to child.
- The behavioral consequences of harsh parenting on children are well studied--a higher prevalence of externalizing behaviors (i.e., bullying, lying, defiance), aggression, and poor emotion regulation to name a few.
- On the other hand, less is known about the structural impacts harsh parenting can have on children's brain structures
 - Consistent exposure to aggressive maternal behavior has been associated with thickening in the prefrontal cortex (right superior frontal gyrus) and right lateral parietal cortex over time
 - Harsh corporal punishment is associated with a reduction in gray matter volume (GMV) in the right medial frontal gyrus, while verbal abuse has been correlated with an increase in GMV in the left superior temporal gyrus
- It remains unclear what relationship lies between brain structure and negative normative parenting behaviors--behaviors which may be harsh but not at the degree of abuse

Research Question

What effect does normative harsh parenting style have on child brain structure?

Methods

Sample

Demographics	
N	113
Age range	4-9
Male	49
White	45.1%

Parenting Style	
Harsh	20
Non-Harsh	93

Parent-reported measures

- Parent short answer responses from the Home Observation Measurement of the Environment (HOME) questionnaire were coded for mentions of physical or verbal aggression in response to a child misbehaving.

Question: If child got so angry that s/he hit you, what would you do?

- Parents who employed harsh parenting tactics were given a score of 1 while parents who did received a score of 0
- Responses which did not answer the question were also excluded from the sample
- In accordance with the Parent-Child Conflict Tactics Scale (CTSPC) used by Hidalgo et al., non-harsh parenting included responses mentioning timeouts, taking away privileges, talking with the child whereas harsh parenting encompassed actions such as spanking, pushing, hitting, or yelling.

Neuroimaging

- T1 structural images were examined and given quality scores from 1 to 4, with a better quality assigned to a lower score, by two researchers who were blind to any other data about the participants.
- T1 rating averages were demeaned and all participants with an average equal to 4 were excluded from the sample
- Cortical thickness was calculated using the FreeSurfer software

Results

Testing for group differences between experience of harsh versus non-harsh parenting, controlling for age, race, gender, and brain scan quality, cluster-wise corrected at a p-value of 0.001

Figure 1. Left hemisphere significance map



Significant association between rostral middle frontal gyrus thickening and non-harsh parenting

Discussion

- Thickening in areas of the prefrontal cortex like the superior frontal gyrus and rostral frontal gyrus have been previously associated with harsh parenting behaviors
 - The results of this study suggest an opposite relationship from past literature, prompting a need for more research into this area
- Consistent positive parental behaviors have been associated with cortical thinning from youth to adolescence.
 - The fact that no cortical thickness changes were significantly associated with negative parental behaviors in any region of the brain may suggest that acute instances of harsh parenting which fall within the normative range (non-abusive) do not have any permanently lasting structural effects on children's brains.



Figure 2. Cortical thickness visualization

Analysis

- Whole brain analysis was preferred to identify areas of association between parenting behavior and cortical thickness over a priori region of interest (ROI) paradigm because this effect is not yet well studied enough
- All statistical analysis was completed on FreeSurfer and controlled for age, gender, and brain scan quality
 - Structural MRI data were preprocessed to generate thickness, volume, and curvature maps at different kernel smoothing sizes
 - All the individual maps were then combined into a single dataset and fitted to the fsaverage template in MNI space
- Group difference analysis was run comparing harsh versus non-harsh parenting for a two-sided hypothesis
 - A general linear model was fitted to the data four times to analyze each hemisphere and tail of the hypothesis separately at a smoothing kernel of 10mm for cortical thickness
- A cluster-wise correction for multiple comparisons was also performed by synthesizing, smoothing, and thresholding a z-map
 - Areas of maximum cluster were recorded and simulated at a rate greater than 5,000 iterations at a vertex-wise/cluster-forming threshold of 2 ($p < 0.001$)

Future Directions

- One of the limitations of the current study is that the criteria for harsh parenting was based on a hypothetical short answer response, future studies would benefit from either a parent self-report measure or observational confirmation of parenting style as definitively harsh or non-harsh
 - Choi et al. developed a verbal aggression scale to quantify parent self-reports of behaviors which could be used in future studies
 - Furthermore, a portion of participants were excluded from the sample because they did not answer the question, thus using non open-ended question formats could be useful
- Analysis in the present study did not control for socially constructed categories such as race or SES because they are imprecise and do not take into account factors like experience of discrimination and culture, but future steps should be taken to confirm the found results when controlling for such variables
- The current study employed a cross-sectional design and controlled for age; however, it could be interesting to look at possible developmental effects of harsh parenting on brain structure with a longitudinal study

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