

Sex Differences in the Effects of Maternal Prenatal Stress on Temperament Changes:

A Superstorm Sandy Cohort

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Abstract

Objective: To examine the relationship between degree of prenatal maternal stress (PNMS) and sex difference in temperamental changes throughout the infant's first year.

Methods: Participants (N=331) completed the Infant Behavior Questionnaire-Revised (IBQ-R) to assess temperament of infant when 6-months and 12-months old. Mothers also completed the Perceived Stress Scale (PSS-14) to evaluate PNMS, and scores were categorized into low, moderate, and high groups.

Results: Male infants exhibit overall decreases in self-regulatory over time. Higher PNMS is associated with more negative emotionality in males as well as poor regulatory temperament in both sexes. Further, female infants exposed to higher stress demonstrate significantly more negative affect temperament in their first year.

Conclusion: This research demonstrates that effects of PNMS on affective and regulatory temperaments manifests differentially in male and female infants in their first year of life.

Background

- Prenatal maternal stress is ascribed to increasing stress hormones in the placenta through which it accesses and plausibly affects the developing fetus.¹ PNMS is often associated with adverse health and behavioral outcomes in children, including later developments of psychopathologies.^{2,3}
- In relation to temperament, disaster-related PNMS predicted greater negative emotionality and less emotional regulation across child development.^{4,5}
- Further, research supports the sexual dimorphism of the placenta is regards to its function and structures.⁶ As such, it is anticipated that temperament is expressed differently among males and females. Yet, few studies have conclusively demonstrated the sex-specific effects of PNMS related to temperament profiles over time.

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Methodology

Sample Population:

A cohort of 331 mother-child dyads recruited at the OB/GYN clinics of New York Presbyterian Queens and Mount Sinai Hospital, and they were routinely assessed throughout pregnancy and child's development as part of a longitudinal pregnancy study (SIP Study, PI Yoko Nomura).

Measures:

Prenatal Maternal Stress, assessed with the Perceived Stress Scale (PSS-14) during pregnancy, was categorized into three groups: low, moderate, and high.

Infant Temperament was assessed with the Infant Behavior Questionnaire-Revised (IBQ-R) containing 14 subscales of temperament. This measure was collected when the child was 6- and 12-months.

Data Analysis: To predict temperament trajectories, maternal prenatal stress and sex were analyzed by a mixed model repeated measures analysis of covariance (RM-ANCOVA). The model contained age (within-subjects factor: 6-months and 12-months) and maternal prenatal stress group (between-subjects factor: low, moderate, and high). Separate models were used for each domain of the IBQ-R, and they were executed individually for the sex of the infant. Maternal education, marital status, race, parity, prenatal substance use, and maternal age were included in the analyses as covariates. Pairwise comparisons with Bonferroni adjustments were run to determine group differences. There were no differences in demographics between participants with or without missing data.

Results

Age Main Effects:

- Only male infants exhibited significant main effects of age for Cuddliness ($p = .013$), and Soothability ($p = .021$)

Prenatal Stress Main Effects:

- Test of between-subject effect revealed significant main effects of prenatal stress on temperament.
 - **Males:** Smiling ($p = .021$), Distress to Limitations ($p = .032$), Low-Intensity Pleasure ($p = .040$), and Soothability ($p < .05$),
 - **Females:** Cuddliness ($p < .05$) and Soothability ($p = .008$)

Prenatal Stress and Age Interactions:

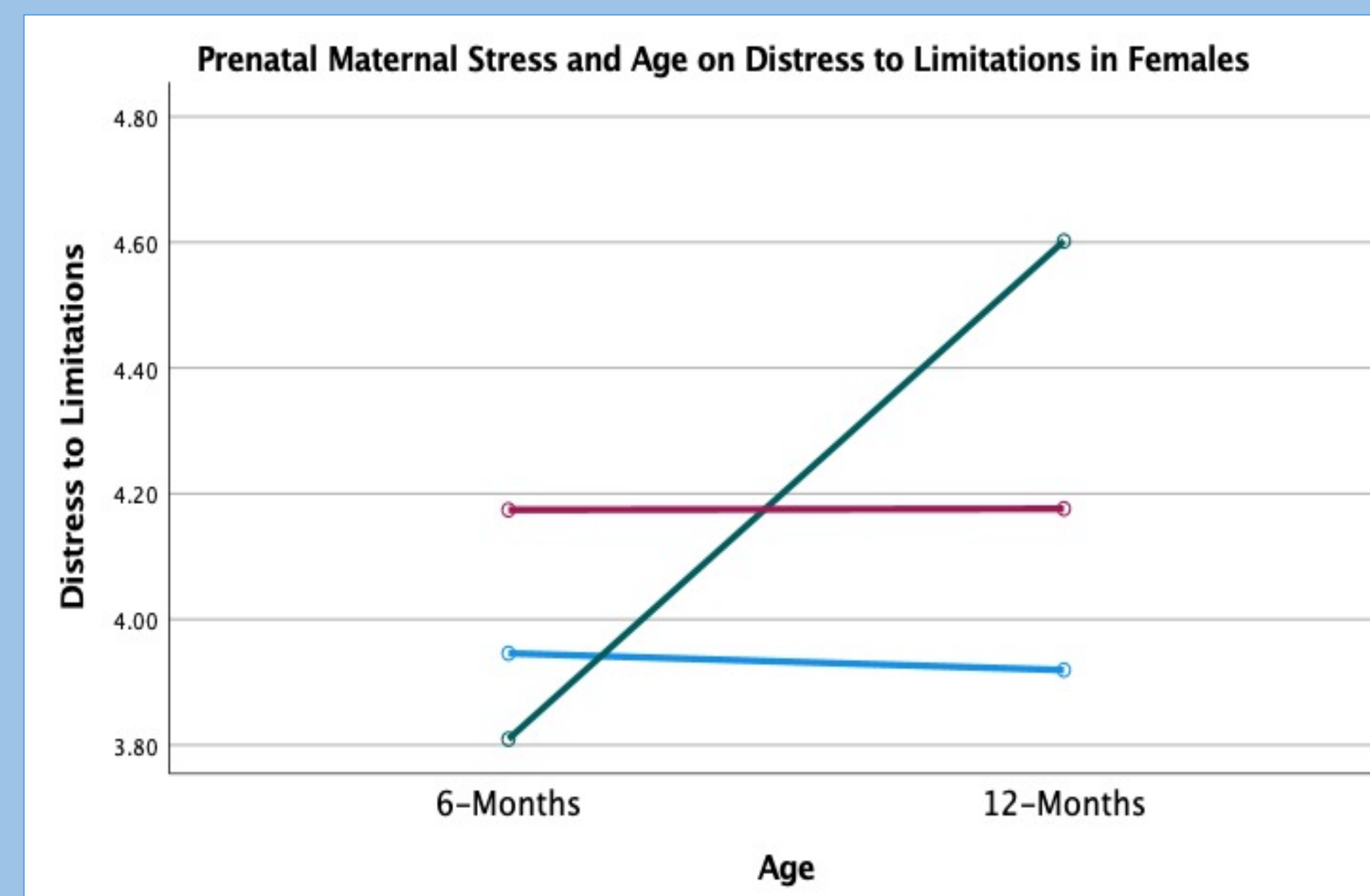
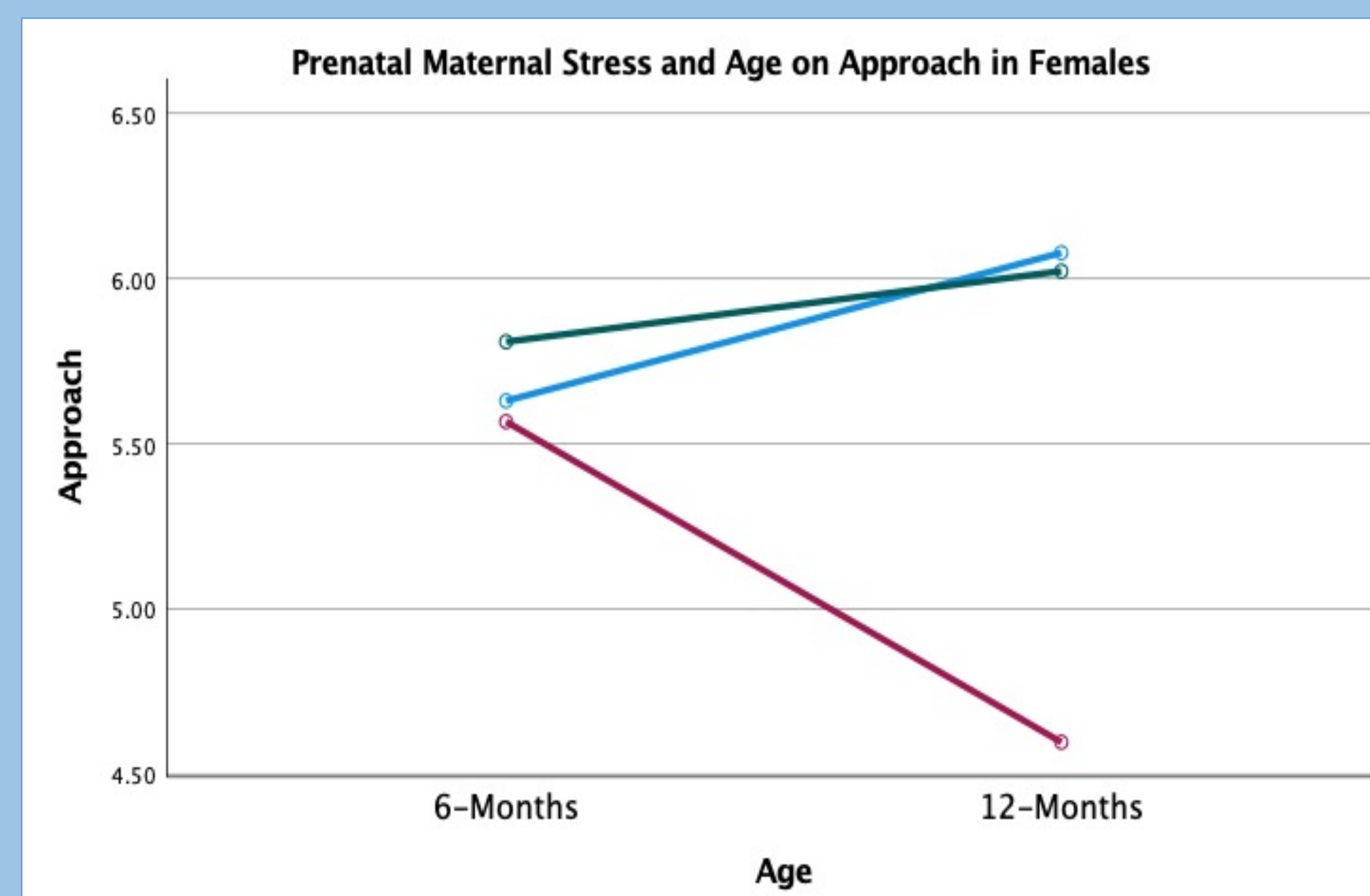
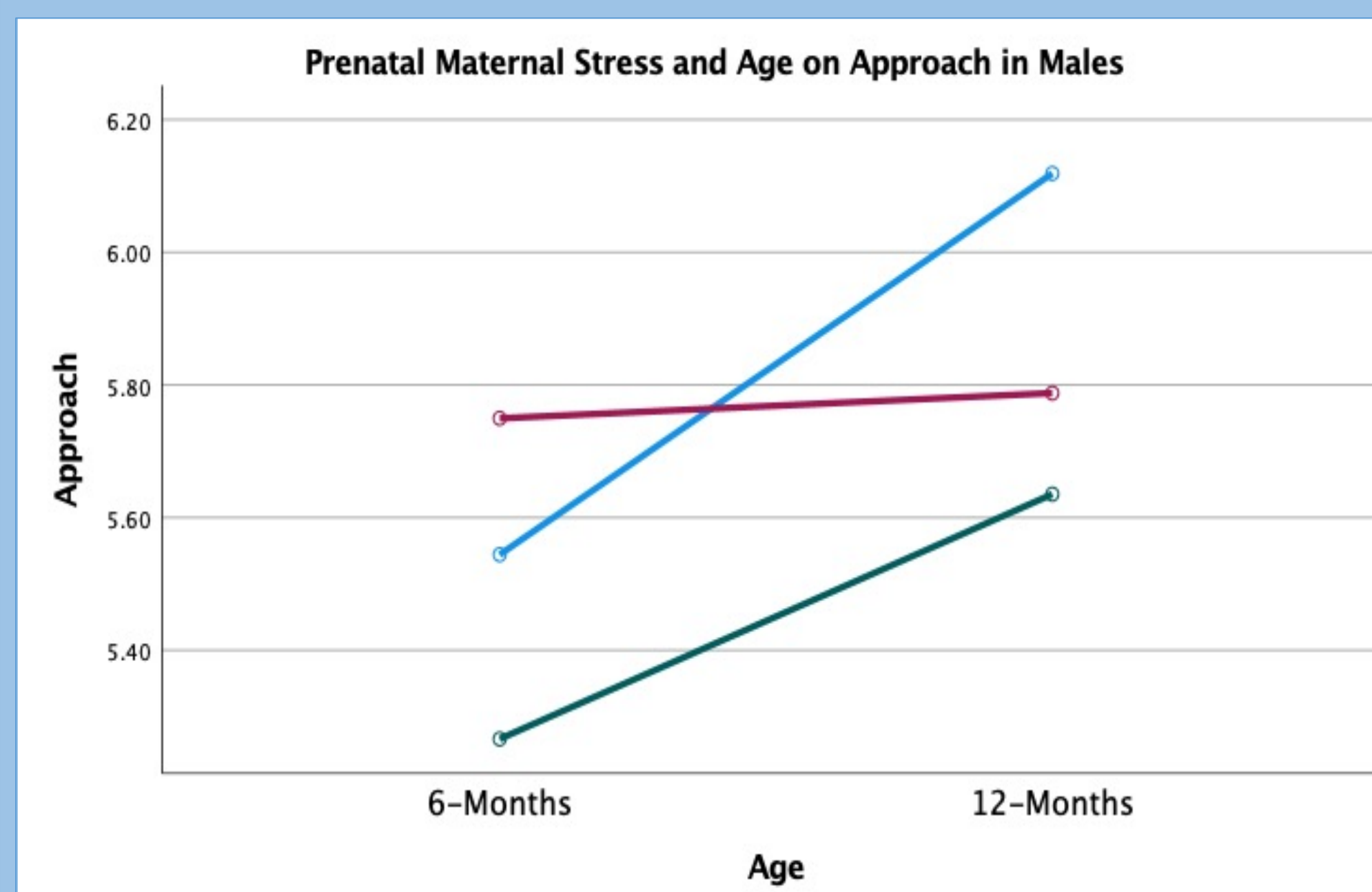
- Only female infants demonstrated significant interaction effects for between maternal prenatal stress and age for temperaments of Approach ($p = .016$) and Distress to Limitations ($p = .012$).

Discussion

- A longitudinal analysis concluded that there were no sex difference in temperament among 3- to 6-month-old children.⁷ However, this analysis did not follow the temperament of mother-child dyads exposed to events of natural disasters.
- As such, consistent with established findings on disaster-related PNMS, both male and female infants in this Superstorm Sandy cohort are demonstrating poor emotionality and self-regulation overall.
- These findings demonstrate PNMS and age contribute differently to the temperament profiles of males and females. Still, studies are needed to further investigate the effects of sexual dimorphism related to PNMS and how it relates to differences in temperament development.

References

1. Wadhwa, Sandman, & Garite (2001) *Prog Brain Res* 133:131-142.
2. Huizink et al. (2002). *Child & Adolescent Psychiatry*, 41(9), 1078-1085.
3. Gutteling et al (2005). *European child & adolescent psychiatry*, 14(1), 41-51.
4. Nomura et al (2019). *Infant mental health journal*, 40(2), 204-216.
5. Laplante, Brunet, & King (2016). *Pediatric Research*, 79(1), 107-113.
6. Rosenfeld (2015). *Endocrinology*, 156(10), 3422-3434.
7. Rothbart (1986). *Developmental Psychology*, 22(3), 356.



Prenatal Maternal Stress — Low — Moderate — High