

Atypical ERP responses to dynamically changing facial expressions correlate with behavioral risk in toddlers born preterm



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Introduction

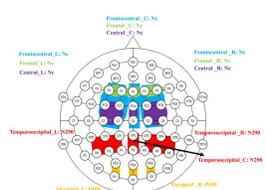
- Premature birth increases lifelong risk for emotional dysregulation and mental health problems.
- Identifying alterations in neural pathways that subserve social cognitive development may help identify variability of prospective risk on behavioral levels.
- Leveraging EEG as a developmentally sensitive neuroimaging tool, we examined associations between premature birth status and event related potentials (ERPs; N290, P400 and NC) elicited while toddlers (between 15 to 30 months corrected age) passively viewed dynamically changing facial emotion expressions.

Sample Demographics

- The sample was composed of 48 toddlers with histories of extremely/very pre-term E/VPT birth (52% male (n = 25), mean age of 21.96 months, SD = 5.16 months, range 14.27 to 30.05 age adjusted for prematurity).
- 46% (n = 22): extremely premature (<28 weeks),
- 31% (n = 13): very premature (<33 weeks)
- 24% (n = 13): late premature.

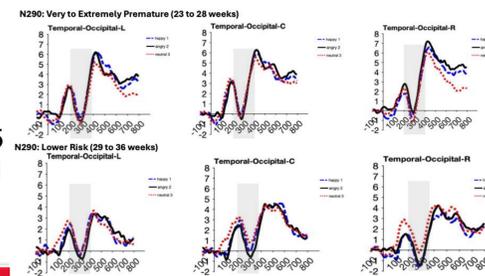
Methods

- ERP Task: Passive Viewing of Dynamic Facial Expressions
 - Happy, Angry, Neutral
- ERPs of Interest: N290, P400, NC
 - Mean Amplitude, Peak Latency
 - Processed with Happe and ERP-lab pipelines
- Source Localization: Fronto-temporal regions of interest
 - Established pipeline: <https://osf.io/knf9t/>
- Brain – Behavior/Functional Significance
 - BITSEA: Examined ERPs in association with parent report on total problem behaviors, competence, internalizing and externalizing.

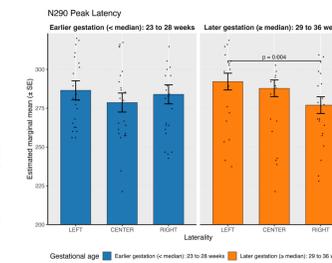


Results

N290 Component: Effects of Gestation



Peak Lat: Laterality * Gestation
 $F(2, 332) = 4.284$
 $p = 0.015$
 partial $\eta^2 = 0.025$



Source Localization Effects of Gestation

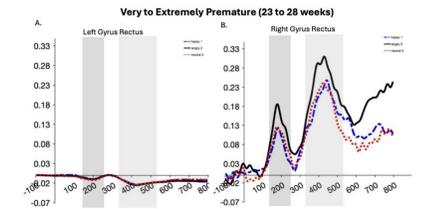
N290/P400 Source

Right gyrus rectus/mid frontal

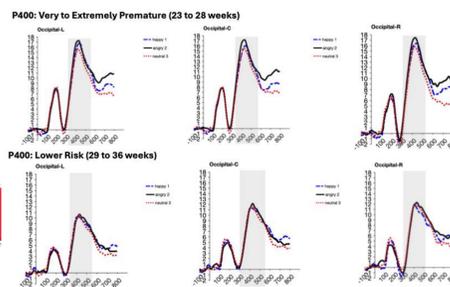
NC Source:

Frontal temporal

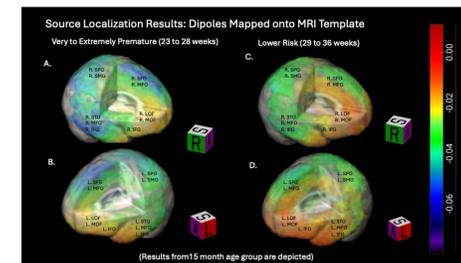
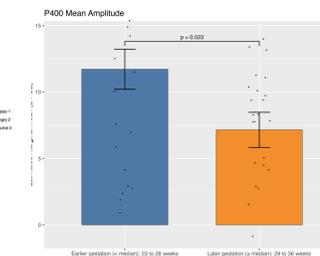
Reduced activation in babies born at early vs later gestational stages



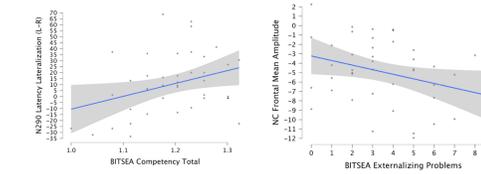
P400 Component: Effects of Gestation



Mean Amp: Gestation
 $F(1, 41) = 5.342$
 $p = 0.026$
 partial $\eta^2 = 0.115$



Brain Behavioral Associations

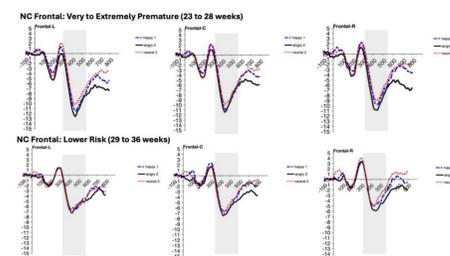


N290 (R minus L) and BITSEA competency
 $(rho = 0.252, p = 0.053)$

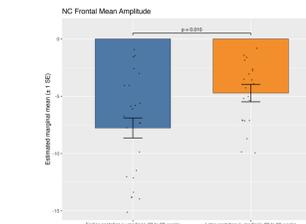
Frontal NC and BITSEA externalizing problems
 $(rho = -0.299, p = 0.046)$

NC Component: Effects of Gestation

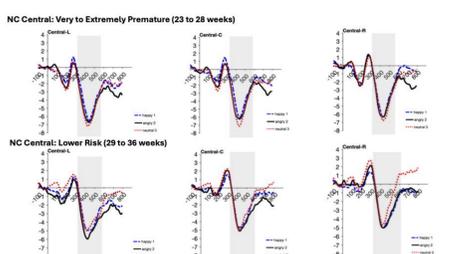
Frontal



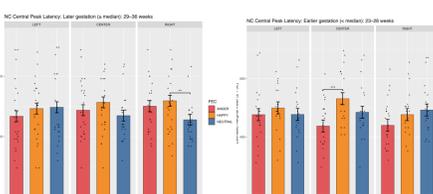
Mean Amp: Gestation
 $F(1, 41) = 6.732$
 $p = 0.013$
 partial $\eta^2 = 0.141$



Central



Peak Lat: Age * Cond * Gestation
 $F(2, 332) = 4.123$
 $p = 0.017$
 partial $\eta^2 = 0.020$



Summary and Discussion

- Very to early preterm birth was associated with atypically larger P400 and frontal NC amplitudes and reduced right hemispheric lateralization in N290, P400 and NC latencies, relative to late preterm birth.
- The ERP differences point to a more immature profile of social brain development that varies as a function of gestational risk. Source localization techniques pointed to frontal and temporal cortical regions as neural generators of ERP components, which is consistent with prior work showing heightened vulnerability of these circuitries to effect of prematurity.
- Brain-behavioral correlations support preliminary associations between ERPs and early childhood psychopathology risk, highlighting the potential to leverage neural markers to inform prevention and intervention.

Acknowledgements

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