

Nonlinear Relations between Early Stress and Vagal Tone in Children with Prenatal Cocaine Exposure

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BACKGROUND

- Prenatal cocaine exposure (PCE) may affect the biological systems underlying arousal and regulation
- Vagal tone (VT) is a physiologic index of regulation & reactivity. But past research on VT in PCE has been inconsistent
- Research on PCE has controlled for postnatal factors (to isolate effects of PCE).
- Research has not modeled the impact of risk and adversity on biological reactivity and regulation in PCE
- A “conditional adaptation” model (Boyce & Ellis, 2005) predicts that high and low environmental stress in early life will be related to high reactivity (curvilinear relations)

AIMS & HYPOTHESIS

- **Aim:** To model the impact of early stress on physiologic reactivity in PCE
- **Hypothesis:** Cumulative risk (stress) in infancy will predict VT reactivity during environmental challenge. Relations between stress and VT predicted to be curvilinear

METHODS

PARTICIPANTS

- We selected 683 children from the Maternal Lifestyle Study
 - PCE: n=281
 - NonCE: n = 402
- Race/Ethnicity: 77% Black; 16% White; 6% Hispanic

	NonCE N = 402		CE N=281		p
	Mean	sd	Mean	sd	
Cumulative Risk					
Full Risk	3.69	2.27	6.56	2.02	< .001
Environmental Risk	2.81	1.94	3.50	1.83	< .001
Birth Weight (g)	2,651	861	2,557	759	ns
VT (36 Months)	5.16	1.21	5.24	1.18	ns
Gender (%male)	51%		48%		ns
SES (% Low SES) ¹	32%		47%		< .001

¹ percent low SES by Hollingshead classification
VT = vagal tone during 36 month exam (see text)

METHODS, continued

MEASURES

- 1) Cumulative Risk Scale**
 - 15 Items: summed the presence of prenatal substance exposures (cocaine, alcohol, marijuana, tobacco) with postnatal psychosocial risks in the first year of life
 - **Full Risk Score (with drug exposures):**
 - Range_(observed): 0 – 12. Median = 5. Alpha = 0.69
 - **Environmental Risk Score (without drug exposures):**
 - Range_(observed): 0 – 10. Median = 3. Alpha = 0.67
- 2) Physiologic Reactivity – Data Acquisition**
 - Heart rate data was acquired by ECG
 - ECG recorded during mildly stressful Mastery Motivation procedure at 36 months (9 minutes of play with somewhat challenging toys)
- 3) Physiologic Reactivity – VT Calculation**
 - ECG signals processed with a series of automated algorithms, including artifact rejection
 - VT calculations utilized method developed by Porges
 - Lower VT was used as our measure of physiologic reactivity. The inverse of VT represented this construct of reactivity (VT has been shown to be lower during environmental challenge and mild stress)

ANALYSIS

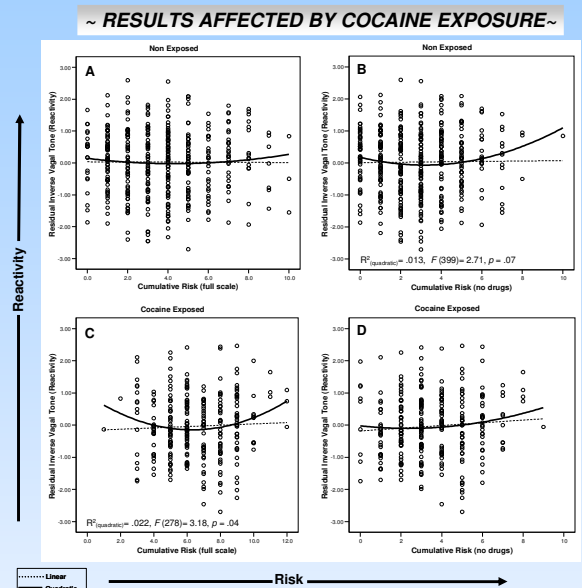
- Hypothesis Testing:**
- Tested linear and nonlinear fit between risk and VT
 - Analyses were run for full sample and separately for PCE and nonCE groups
 - Covariates: birth weight, gender, and MLS study site (residual VT controlling for covariates)

RESULTS

Across Groups:
Quadratic relations between risk and VT reactivity was observed for PCE and nonCE combined sample

- 1) Full Risk:** $R^2 = .007$, $F[680]$, $p = .10$
- 2) Environmental Risk:** $R^2 = .011$, $F[680]$, $p = .02$

RESULTS, continued



- Within Groups:**
- 1) NonCE Group:** Quadratic relationship between cumulative risk (environmental only) and reactivity, $p < .10$ (Fig. B)
 - 2) CE Group:** Significant quadratic relationship between cumulative risk (full risk score) and reactivity (Fig. C)

SUMMARY & CONCLUSIONS

- High and low cumulative risk was associated with high reactivity as compared to moderate stress.
- Findings affected by the presence of PCE:
 - **NonCE Group:** Context dependent reactivity related to environmental risk
 - **PCE Group:** Context dependent reactivity related to combined bio-environmental risks
- PCE may affect regulatory systems. But modeling the impact of stress on reactivity may better account for individual differences.
- Results consistent with conditional adaptation model (Boyce & Ellis)