INTERGENERATIONAL EFFECTS OF MATERNAL ANXIETY DURING PREGNANCY

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BRIEF REPORT

Prenatal programming theory predicts that maternal stress during pregnancy increases the likelihood that infants will exhibit altered behavioral and emotional states after birth (O'Connor et al., 2002), which may be adaptive in stressful environments. Additional research (Glover, 2015) has shown that there is ample reason to suspect that maternal psychobiological factors, such as the stress hormone cortisol, can have wide-ranging effects on infant development. One method of measuring those effects on infants is by observing the sympathetic nervous system, the control center of the "fight or flight" startle response, during stress. Sympathetic nervous system activity is perceptible through electrodermal activity (EDA), a measure of eccrine sweat gland activation that has been used to indicate emotion arousal in adults and children (Dawson, Schell, & Filion, 2016) as well as general arousal in infants (Hellerud & Storm, 2002; Mammen et al., 2017). Including EDA in analyses along with other established measures of infant reactivity could allow for a more holistic understanding of the infant stress response system (Ham & Tronick, 2008). Additionally, measuring infant EDA enables researchers to further test prenatal programming theories.

Data for this study is part of the BABY Project, an intergenerational, longitudinal study on emotion dysregulation. Participants included 162 mothers in the Salt Lake City Area who were enrolled in the study during their third trimester of pregnancy. Of those 162 mothers, 110 returned to the laboratory seven months postpartum with their infants (53 females) and completed the measures used in this analysis. Race was reported as follows: White/Caucasian 78.2%, Asian 10.9%, American Indian/Alaskan Native 1.8%, Hawaiian or Pacific Islander 0.9%, Black/African American 0.9%, and Multiracial 7.3%. Mothers were between 18-40 years old with a mean of 28.7 years old during the third trimester of pregnancy.

During the prenatal phase of data collection, the mothers completed a battery of questionnaires that included the State-Trait Anxiety Inventory (Spielberger et al., 1983). This questionnaire calculates scores of trait (general) anxiety and state (in-the-moment) anxiety. Twenty-six mother/infant dyads were excluded from trait anxiety analyses and forty-five dyads were excluded from state anxiety analyses due to missing data. At the 7-month data collection session, participants first watched a 2-minute clip of a *Baby Einstein* film (The Baby Einstein Company, LLC, Rose Bay North, Australia), then completed the Still-Face Paradigm (Haley & Stansbury, 2003). During the Still-Face Paradigm, mothers played with their infants as they normally would at home for two minutes. Next, the mothers stopped all interaction and maintained a flat affect for two minutes, then finally resumed normal play for two minutes. This short period of maternal unavailability allows researchers to observe infants' self-regulatory ability. Throughout the paradigm, EDA data was collected via two electrodes on the plantar surface of infants' feet using MindWare software and hardware (MindWare Technologies Ltd., Gahanna, OH). The obtained signal was then processed and analyzed by research assistants using

the same company's EDA Analysis software (version 3.1), extracting the total number of electrodermal responses per 2-minute segment of data. Reactivity to the flat affect episode of the Still-Face Paradigm was calculated as $EDA_{\text{still-face episode}} - EDA_{\text{baseline}}$. Using data from this experiment, it was hypothesized that high levels of prenatal maternal anxiety would (1) be related to high infant baseline EDA, and (2) be related to high infant EDA reactivity.

We found no correlation between maternal prenatal anxiety and infant baseline EDA; however, there was a significant *negative* correlation between maternal prenatal anxiety (both trait and state) and infants' electrodermal reactivity to the Still-Face Paradigm (Table 1). This association indicates that mothers who reported higher prenatal anxiety had infants who were *less* reactive to the stressor (see Figures 1 & 2). Once these correlations were established, the authors re-analyzed the relationships using multiple linear regression with the addition of infant sex, household income, and maternal race and age as independent control variables in the model. The regressions did not yield statistically significant results in the case of trait or state anxiety after controlling for the demographic variables (Table 2).

The results of these analyses provide a snapshot into the complexities of both prenatal psychobiological influences and how demographic variables may significantly influence maternal stress and the infant sympathetic nervous system. The initial correlations lend credence to the idea that the prenatal environment prepares infants for their postnatal experience. For example, a pregnant mother's body may signal to her developing infant that it will be born into a stressful environment. As an adaptive response, it should therefore be less reactive to the abundant stressors that it will experience. If this was not the case, the infant would be more likely to feel constantly overwhelmed. However, after controlling for demographic variables with multiple regression, those effects disappeared. This indicates that in conjunction with each other, infants' sex, mothers' race and age, and household income have a greater effect on infants' response to stress than does prenatal maternal anxiety. Additional research should be completed to tease apart the intricate effects of the prenatal environment on infants' stress response systems.

Works Cited

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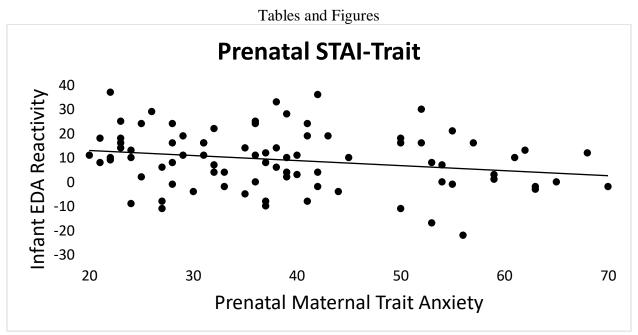
Figure 1. Significant association between maternal anxiety prenatally and infant stress reactivity at 7 months including the line of best fit.
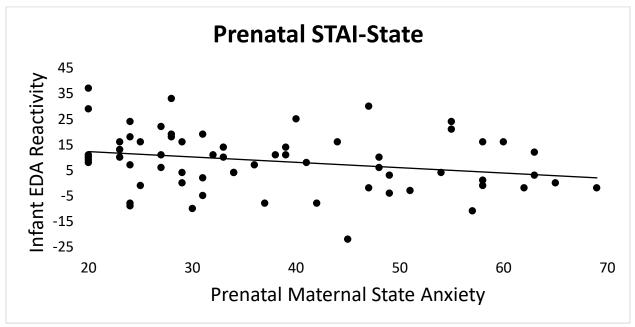

Figure 2. Significant association between maternal anxiety prenatally and infant stress reactivity at 7 months including the line of best fit.

Table 1. Correlation matrix of infant EDA reactivity to the Still-Face Paradigm and maternal state and trait anxiety.

	Infant reactivity	Maternal trait anxiety	Maternal state anxiety
Infant reactivity	-		
Maternal trait anxiety	-.252*	-	
Maternal state anxiety	-.286*	.804**	-

*p < .05, **p<.001

Table 2. Regression model summary with infant EDA reactivity as the depended variable and maternal anxiety (STAI-Trait or STAI-State) and infant sex, household income, and maternal race and age as independent variables.

	β	r^2	r^2 change	*p*
Prenatal STAI-Trait	-0.2478	0.117	0.117	0.200
Prenatal STAI-State	-0.233	0.105	0.105	0.262