Infant Temperament as an Indicator of Patterns in Heart Activity During Arm Restraint

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Introduction

Background: Cardiac functioning is a critical aspect of autonomic functioning and can be assessed using multiple measures, including heart rate (HR) and heart rate variability (HRV). Previous research has demonstrated associations between typically developing (TD) children’s HR/HRV and their current behaviors, temperament, and psychopathology later in life (Buss et al., 2005). Yet, few studies have examined the relationship between infants’ momentary cardiac function and temperament at the domain/subdomain level.

Objective: This study examined HR/HRV patterns during arm restraint and their relationship to the infant temperament domain of Negative Affect and subdomains of Distress to Limitations and Falling Reactivity.

Hypotheses: We predicted that (1) the degree of HR/HRV increase at onset of arm restraint will be positively associated with Negative Affect and Distress to Limitations, and (2) the degree of HR/HRV decrease after arm restraint will be negatively associated with Negative Affect and positively associated with Falling Reactivity.

Methods

Sample: Participants consisted of 23 TD infants recruited through the Neurodevelopmental Family Lab (M = 12.0 months; SD = 0.82 months; Range = 10.5-13.5 months). The sample was 56.5% male.

Arm Restraint Task: Infants played with a toy while seated in a high chair. After 30 seconds of play, infants’ mothers held down their arms for 30 seconds to prevent toy access. After, the infant resumed play for 30 seconds. This study compared heart activity between the three phases.

Heart Activity: Heart activity was monitored throughout the arm restraint task using Actiwave Cardio HR monitors. Post-processing included identification of R-spikes using QRSTool software to compute interbeat intervals (IBIs) as the duration between two consecutive heartbeats. HR was operationalized as the average HR for each of the three phases (Shaffer & Ginsberg, 2017). HRV was operationalized as the standard deviation of R-R intervals (SDRR) for each of the three phases (Shaffer & Ginsberg, 2017).

Temperament: Temperament was assessed using the Infant Behavior Questionnaire-Revised (IBQ-R; Putnam et al., 2014). This study was specifically interested in the IBQ-R’s temperament domain score of Negative Affect (tendency to experience negative emotions) and sub-domain scores of Distress to Limitations (fussing or crying in restricting situations) and Falling Reactivity (rate of recovery from peak distress) (see Figure 1).

Results

Figure 7. A significant negative correlation was found between Negative Affect scores and SDRR from before to during arm restraint, (r = -0.62, p < 0.01).

Figure 8. A significant positive correlation was found between Falling Reactivity scores and SDRR from before to during arm restraint, (r = 0.63, p < 0.01).

Conclusions

Hypothesis 1: Contrary to our hypothesis, degree of HR/HRV increase at onset of arm restraint was not positively associated with either Negative Affect or Distress to Limitations. Instead, Negative Affect was negatively associated with change in HRV due to arm restraint (see Figure 7).

Hypothesis 2: Contrary to our hypothesis, there was no association between degree of HR/HRV decrease after arm restraint and either Negative Affect or Falling Reactivity (see Figure 6).

Exploratory Analyses: We also found a significant positive association between degree of HRV increase and Falling Reactivity at onset of arm restraint (see Figure 8).

Interpretations & Future Directions: Our findings raise the possibility that HRV is associated with certain aspects of infant temperament, although more research will be necessary to fully understand these intricate relationships and contextualize the preliminary findings of our study. Future research should include an expanded sample of infants, incorporate more sophisticated statistical techniques such as repeated measures analyses, and integrate behavioral coding with physiological measurements of HR/HRV.

Limitations: Post-hoc power analyses suggested our sample size did not limit our ability to detect larger effects (post-hoc power = 80% for an effect size of .4 at α = 0.05). However, power to detect smaller effects was limited necessitating the need for future research with larger sample sizes.

References


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