

A Protocol to Acquire Neonate and Infant Physiology in the Rohingya Refugee Camps and Surrounding Host Communities of Cox's Bazar, Bangladesh

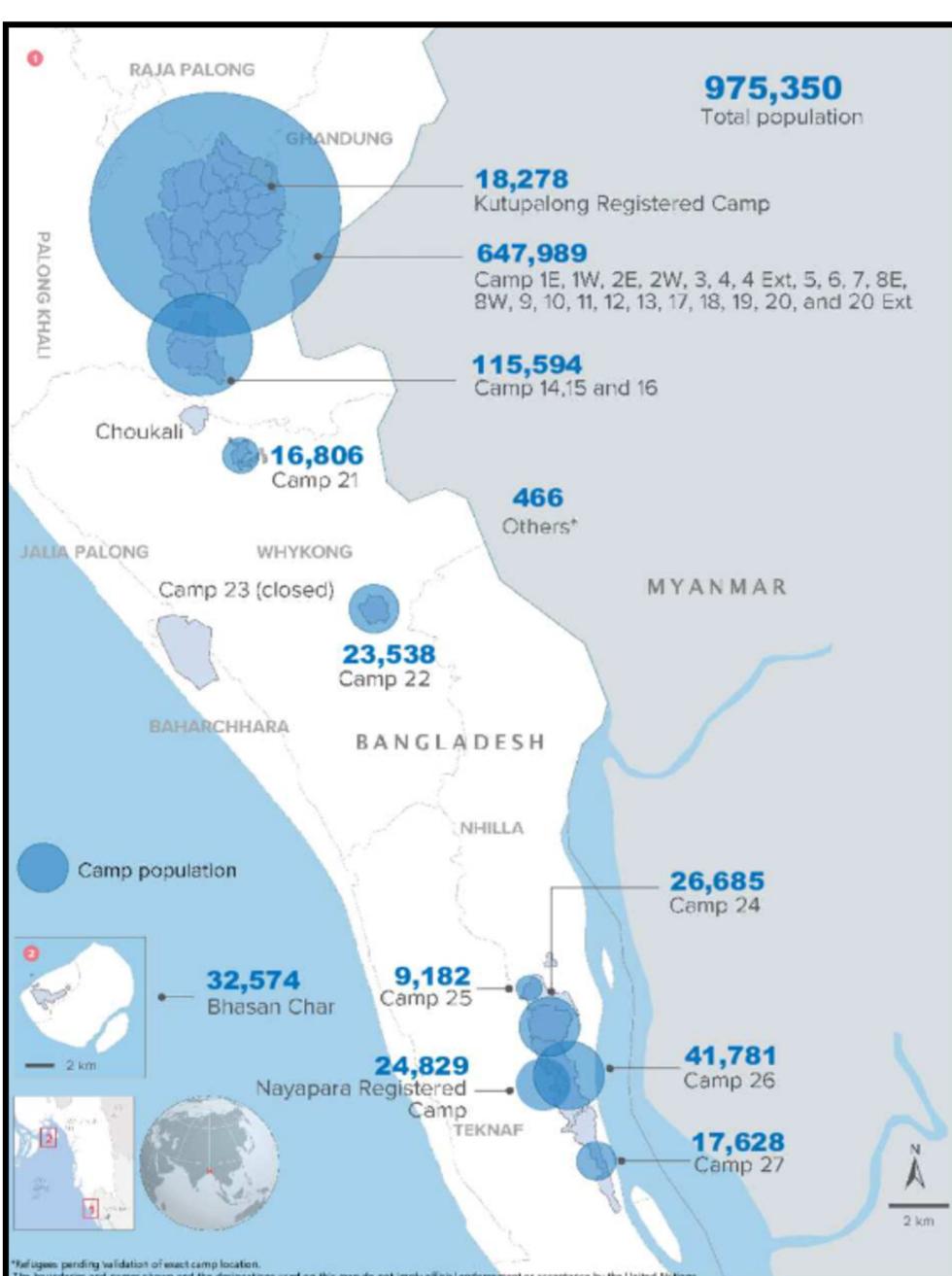
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Introduction

- Respiratory sinus arrhythmia (RSA) is an indicator of **parasympathetic activity**, key for stress regulation and social engagement (Beauchaine, 2015; Porges, 2007). In infants, the vagus nerve matures **between 30 weeks gestation and 6 months postpartum** (Cerritelli et al., 2021), supporting autonomic regulation and caregiver-child interactions.
- RSA is typically measured in **controlled lab settings** using electrocardiogram (ECG) sensors to track heart rate variability during tasks designed to assess autonomic function (Maitha et al., 2020).
- Current RSA collection methods aren't feasible in low-resource settings, highlighting the **need for adapted protocols for "real-world" environments** (Mishra et al., 2023; Troller-Renfree et al., 2021).
- This study develops and tests a home-based protocol for collecting RSA data from infants and mothers in the **Rohingya refugee camps and surrounding host communities** to assess its feasibility in low-resource settings.

Participants & Study Setting

- Data for this research comes from iRRRd (**Intergenerational Risk and Resilience of Rohingya in Displacement**), an ongoing longitudinal birth cohort study in Cox's Bazar, Bangladesh.
- The Rohingya have **fled persecution** over several decades, with the largest wave beginning in **2017**.
- The study sample (**n=2889**) includes **Rohingya refugees** (**n=2323**) and **host community members** (**n=566**).
- HRV data is collected during pregnancy, 1-month after birth and 6-months after birth.
- In this subsample **mothers** were on average **19 years** old (78% Rohingya) and **infants** were **43 days** old (58 % male).



Challenges and Adaptations

- No WiFi or electricity
- Homes are crowded and there is a lot of noise and movement within and out of households
- Steep terrain and extreme weather conditions
- Limited accessibility to study participants: authorized time-window in the camps often not aligned with participants' daily routines.
- Infants are almost always in physical contact with the mothers or other caregivers.

Table 1: Strategies to adapt the HRV protocol

Goal	Strategies
1. Develop Field-Friendly Methods	Pre-pilot methods through community engagement, establish low-maintenance HRV device.
2. Ensure Data Quality and Synchronization	Test device and data synchronization across independent devices, optimize electrode placement, extensive training.
3. Adapt to Cultural and Contextual Constraints	Define baseline conditions, adapt to local materials, consider environmental constraints, identify behavioral indicators potentially influencing RSA.

Our field-friendly protocol enables RSA data collection in resource-limited settings with modest impact on data quality. While RSA was linked to risk factors at birth during solo baseline, this association disappeared when infants were held by their mothers.



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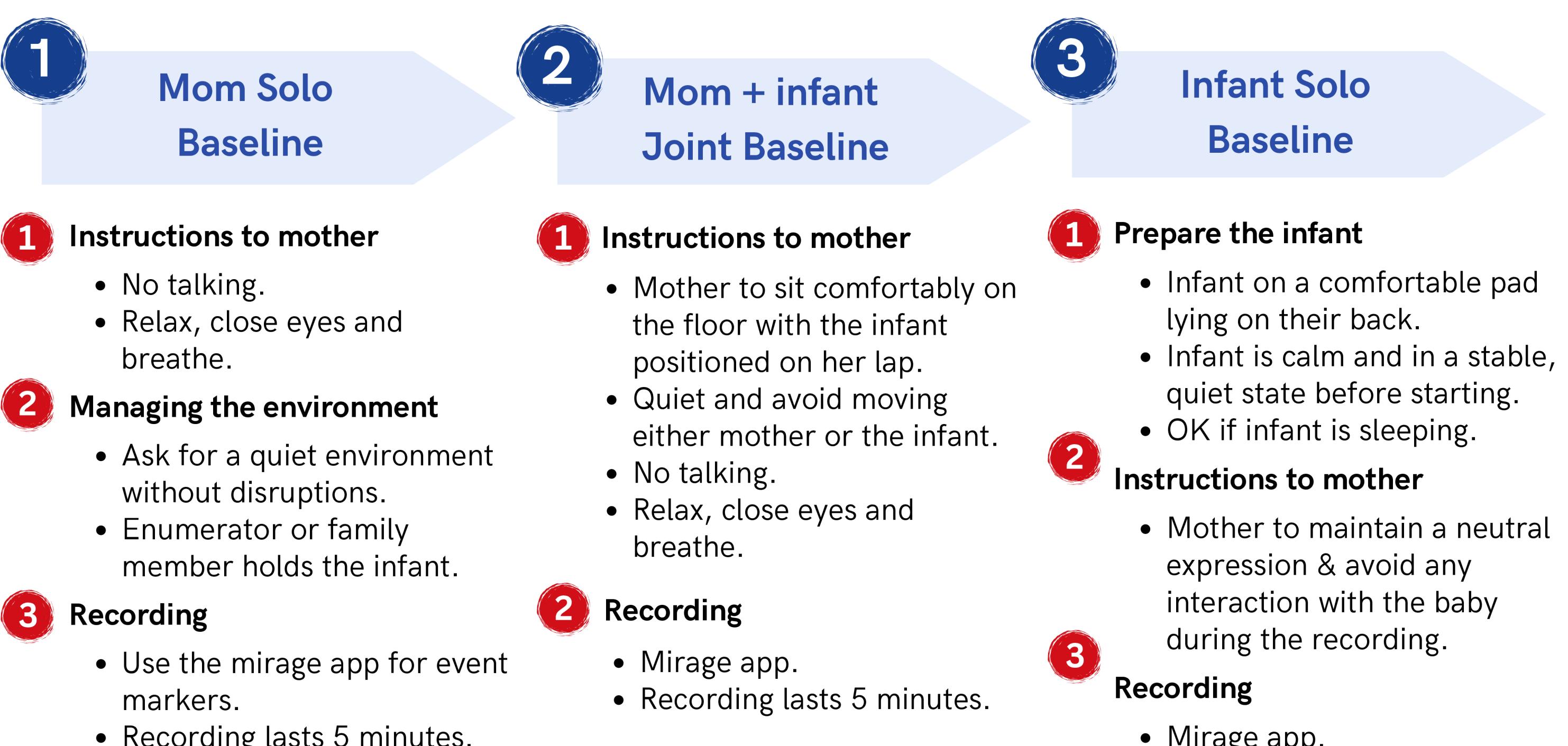
Take a picture of this QR code to check references, details about our study, R scripts and R output. Please contact me for questions or suggestions: eu2082@nyu.edu



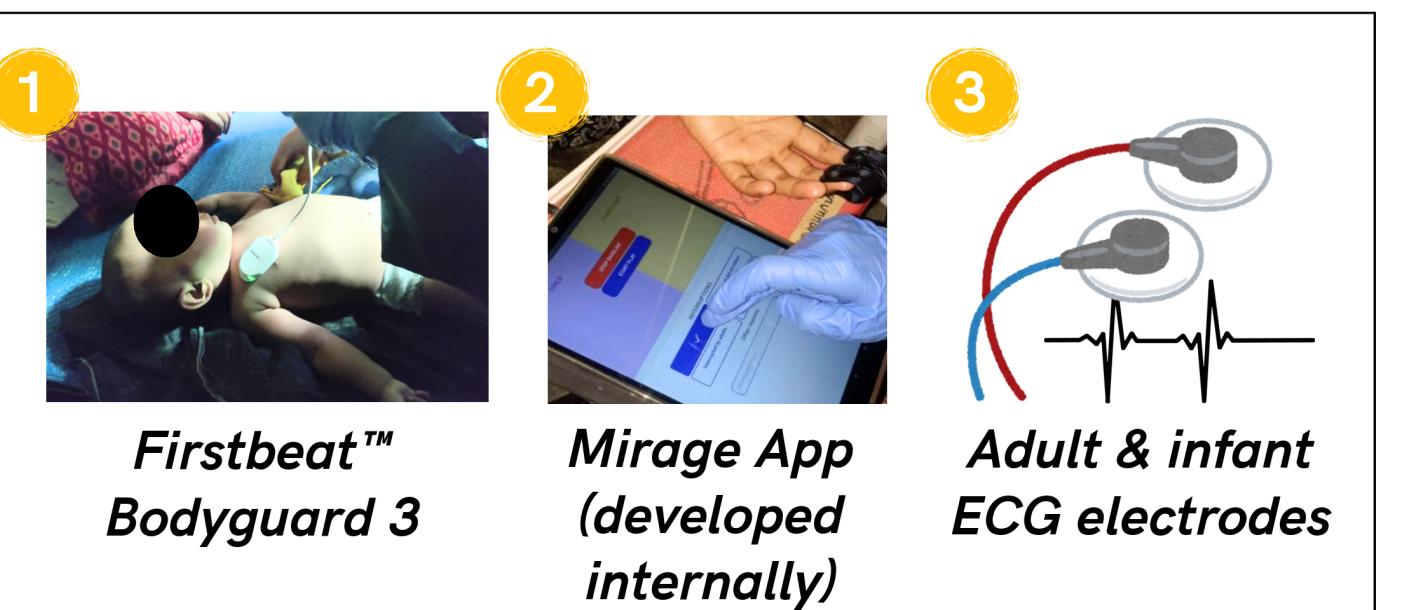
Heart Rate Variability Acquisition Procedure

Protocol Adjustments

- Scheduled visits during calm periods of the baby's day, typically after naps.
- Adjusted task order: Before, solo baseline was acquired simultaneously from mother and infant, wrapping up with a joint baseline.
- Reinforced the importance of maintaining a calm environment during visits.
- Extended length of visits to allow enumerators to follow the natural pace of mother and infant, ensuring the procedure isn't rushed.



What we used:



At the end of each baseline:

- Assess infant arousal states
- Annotate mother activities such as rocking, face-to-face contact, kissing, etc

Data Usability

Table 2: File Usability for the two baseline conditions

Baseline condition	Usable	Unusable	Missing*	Edited	RSA (M, SD)
Joint	122 (88%)	12 (9%)	5 (3%)	105 (75%)	2.58 (1.03)
Alone	90 (83%)	6(6%)	12 (11%)	83 (77%)	2.61 (1.21)

*Missing due to refusal or technical errors

Usability was significantly associated with arousal levels (T solo baseline = 2.22, p = .029; T joint baseline = 2.69, p = .01).

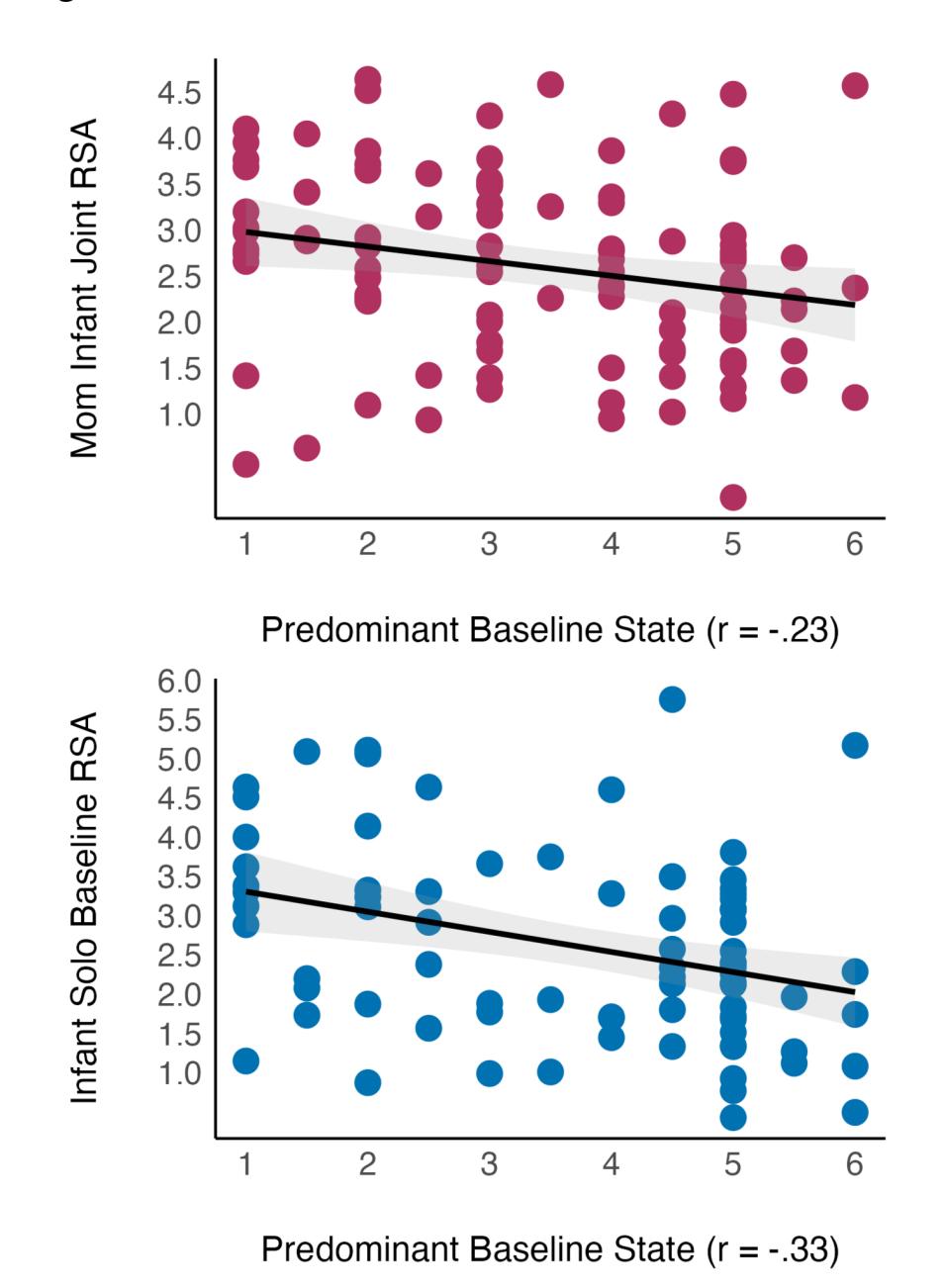
Usability was not associated with acquisition date, location, and mothers' activities (rocking, face-to-face placement, breastfeeding, etc).

Behavioral Indicators & RSA

Figure 1: Changes in arousal levels after we adjusted the protocol*



Figure 2: Association between baseline behavioral indicators & infant RSA. Higher scores denote more arousal



*No direct associations between RSA and date of protocol changes

Anthropometrics & RSA

Table 3: Descriptive Statistics for Infant Anthropometrics

	Length (cm)		MUAC (cm)		Weight (kgs)	
	mean	SD	mean	SD	mean	SD
Birth	49.05	2.27	9.88	0.90	2.96	0.49
1 mth after birth	55.34	2.80	11.89	0.99	4.33	0.67

Adjusting for gestational age, gender, and current weight-for-length, **weight at birth** was associated with **higher RSA** only on **infants who were alert or aroused** (states 4-6).

In contrast, **in infants who were sleeping** (state 1), **weight at birth** was associated with **lower RSA**.

Similarly, **MUAC at birth**, an indicator of nutritional status, was associated with **higher RSA**, only on **infants who were alert or aroused** (states 4-6).

No associations between anthropometrics & baseline RSA when **mothers were holding their infants** (joint).

Figure 3: Infant RSA & Anthropometrics by Arousal State

