Brain & Behavior Foundation
Meet the Scientist Webinar
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Changes in Infant Emotion Regulation Following Maternal Treatment for Postpartum Depression

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Overview

- Postpartum Depression: Effects on Infant ER
- BBRF Study 1: Infant ER
- BBRF Study 2: Mother-Infant Dyad
- Implications & Next Steps

Postpartum Depression

- 8% of individuals experience perinatal MDE[1]
- Up to 20-30% of mothers/BPs will experience ↑ symptoms[2]

- Associated with costs of $100K (USD) over the lifespan[3]
  - **Up to 2/3rd of these costs are due to offspring difficulties**

Impact on Offspring

- Increased risk of:[4]
  - Cognitive
  - Emotional
  - Behavioral problems in offspring
- Childhood: ↑5x in behavioral problems[5]
- Adolescence/Adulthood: ↑4x in major depressive disorder[6]

Infant Emotion Regulation

- Emotion Regulation: the ability to modify emotions in the service of future goals
  - Can be reliably measured in pre-verbal infants
    - Assessed using a combination of parent-report, observational, and physiological measures[7]
  - It is poorer in the infants of mothers with PPD[8,9]

Long-Term Effects of Poor ER

- Early problems with ER are associated with 3x ↑risk of:
  - School failure
  - Substance dependence
  - Income below the poverty line[10]
- Involved in the development of almost all forms of psychopathology[11]

How Does PPD Affect Infant ER?

- Mothers/infants form a dyadic regulatory system[12]
  - Infants signal mothers and mothers provide regulatory support
- PPD is associated with:
  - Increased anxiety in response to infant distress[13]
  - Maladaptive reactions to infant distress[14]
  - Fewer caregiving behaviors[15]
- It is not known if or how these maternal behaviors are affected by treating mothers

Maternal PPD Treatment

- Relatively few studies of the impact of PPD treatment on infant offspring
  - Some suggest it helps[16,17] while others do not[18,19]
  - Just two have examined infant ER
    - Used maternal report alone[20,21]

Objectives

1. To determine if treating maternal PPD can improve infant ER
2. To examine the impact of maternal CBT for PPD on the mother-infant (dyadic) regulation system

Sample

- PPD Group - 40 mothers with:
  - Current major depressive disorder
  - Infants <12 months-old
- Healthy Control Group - 40 mothers:
  - Free of mental health problems
  - Matched on:
    - Infant Age
    - Infant Sex
    - Family SES

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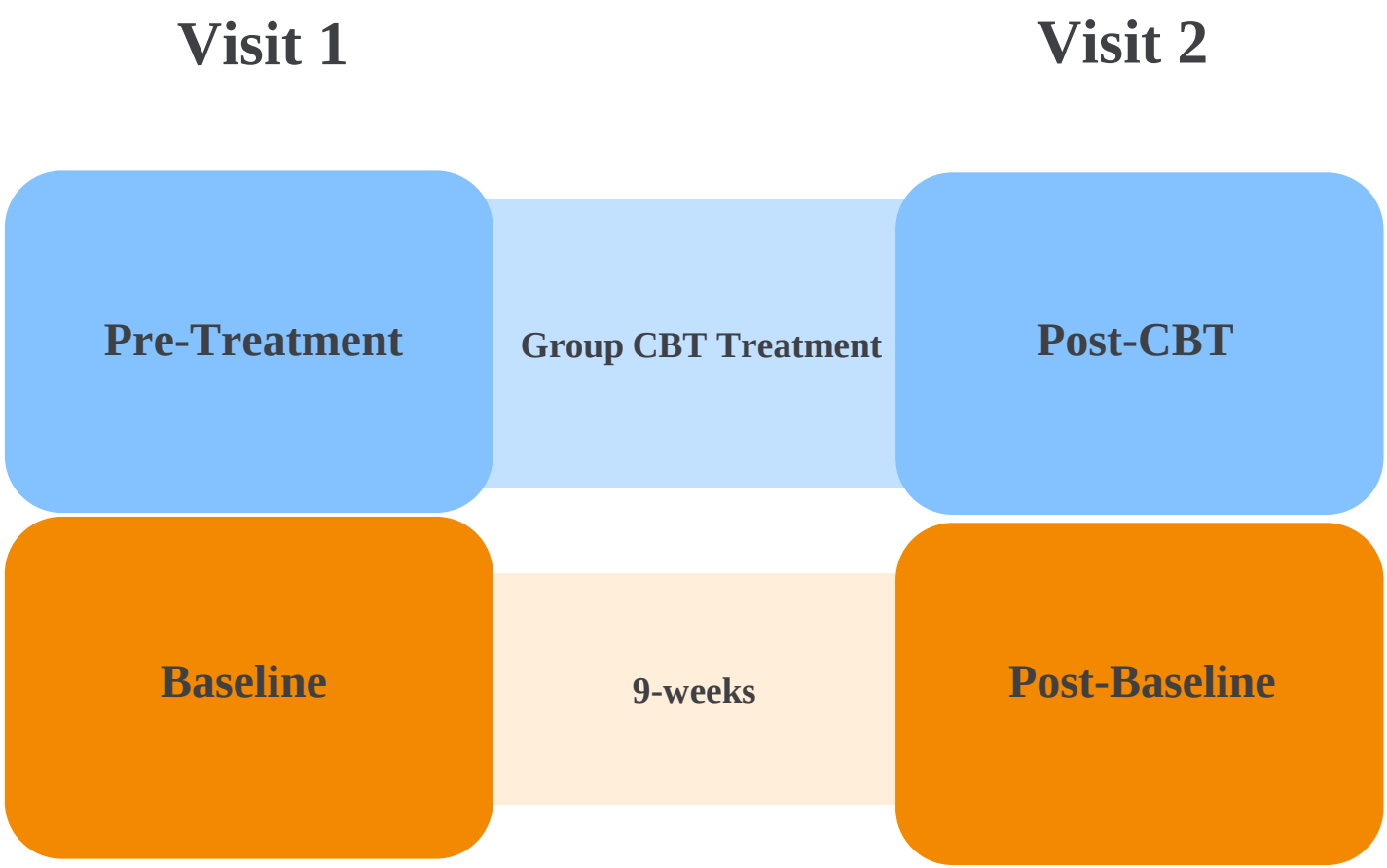
Intervention

- 9-week group CBT for PPD intervention
  - Nine weekly two-hour sessions
    - Delivered by a perinatal psychiatrist and social worker or nurse
  - Hour 1: Core CBT skills (cognitive restructuring, behavioral activation)
  - Hour 2: Discussion topic (supports, transitions, sleep, etc.)

Study Design



Measures

- **Infant:**
  - Emotion Regulation
    - Parent-Report: Infant temperament (IBQ-R)
    - Observational: Face-to-Face Stillface Task
    - Physiology: EEG, ECG: At rest and during FFSF
- **Maternal:**
  - Demographic characteristics
  - Clinical measures (EPDS, GAD-7, NEO-FFI)
  - Resting state and FFSF EEG, ECG

Sample Characteristics

TABLE 1 Sample characteristics

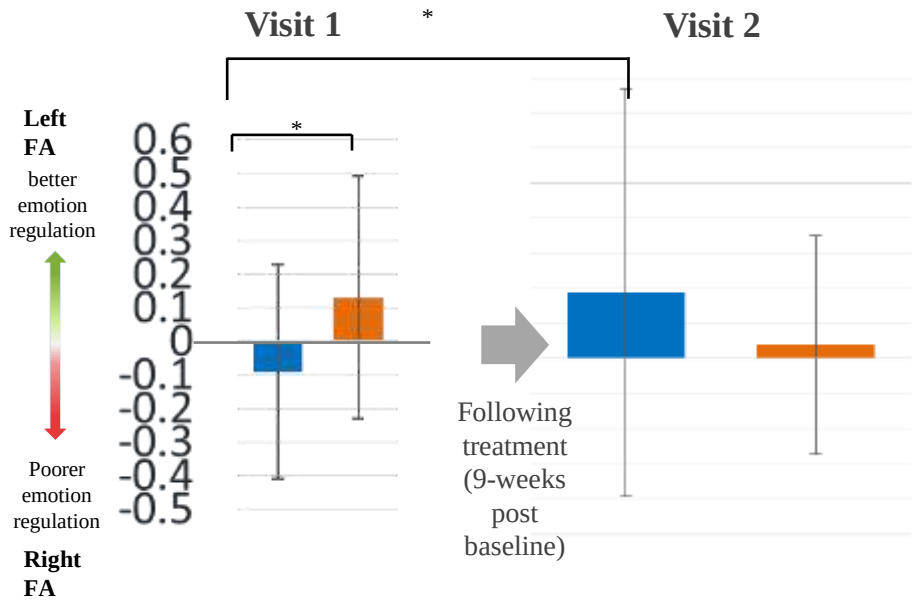
	Case ($n = 40$)		Control ($n = 40$)		p Value
Infant age, m (*SD*) months					
Visit 1	5.6	(2.7)	5.9	(2.6)	0.55
Visit 2	7.7	(2.7)	8.2	(2.7)	0.55
Infant sex, no (%) male	16	(40)	16	(40)	>0.99
Total household income[a] m (*SD*)					
<49,999	8	(20)	5	(12)	0.66
50,000–79,999	10	(25)	11	(28)	
>80,000	22	(55)	24	(60)	
EPDS score m (*SD*)					
Visit 1	14.7	(5.4)	4.6	(3.4)	<0.001
Visit 2	10.6	(5.3)	4.3	(4.2)	<0.001
Maternal age, m (*SD*) years	32.3	(4.1)	32.7	(5.1)	0.68
Parity, no (%)					
Primiparous	21	(53)	22	(55)	>0.99
Multiparous	19	(47)	18	(45)	
Marital status, no (%)					
Single	3	(8)	2	(5)	0.70
Separated	1	(2)	0	(0)	
Common-law	9	(22)	8	(20)	
Married	26	(68)	30	(75)	
Education, no (%)					
High school or less	5	(12)	3	(7)	0.70
College or certificate program	12	(30)	11	(28)	
University or higher	23	(58)	26	(65)	
Birthweight m (*SD*), grams	3329.5	(448.4)	3374.	9(475.2)	0.66
Gestational age m (*SD*) weeks	39.5	(2.2)	39.2	(1.1)	0.38

[a]Canadian Dollars, median household income in Ontario is $62,700.

Results: BBRF Study 1 (Infant ER)

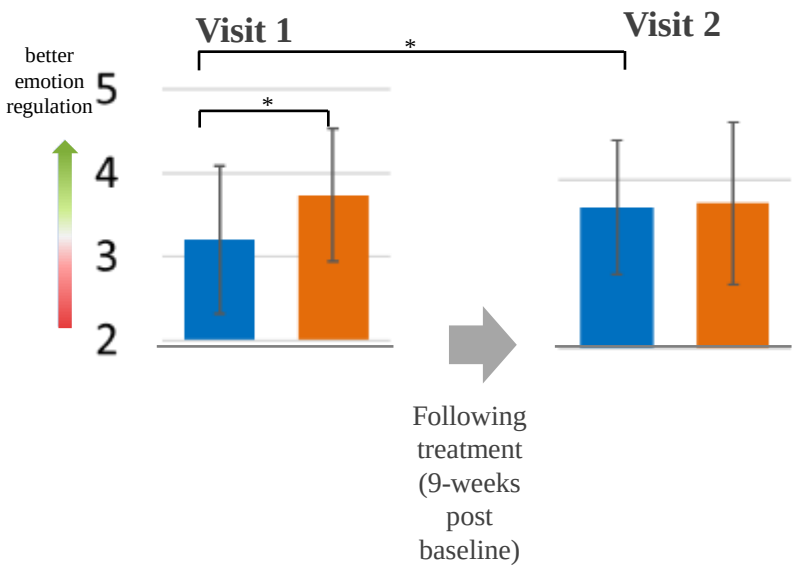
PPD infants Control infants

Frontal EEG Asymmetry (Resting FA)



Hedges g = 0.60

Heart Rate Variability (Resting)



Hedges g = 0.56

***Maternal and paternal ratings of regulation behaviors also increased from Visit 1 to Visit 2 (*d*=0.29 and 0.35, respectively)[22]**

BBRF Study 2 (Mother-Infant Dyads)

- Infants rely on mothers to soothe them when distressed
- Mothers with PPD can struggle to do this

The Stillface Paradigm

Play
(2 minutes)

Stillface
(2 minutes)

Reunion
(2 minutes)

HRV underlies emotion regulation in mothers and children[23]

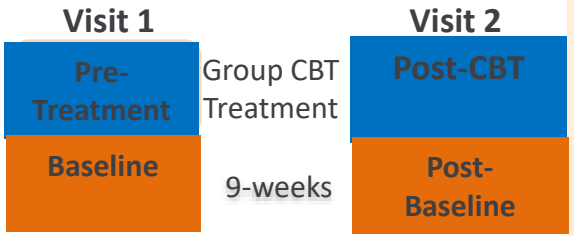
a) **Does mother-infant HRV synchrony play a role in how mothers soothe their infants**
b) **Does this improve following PPD treatment?**

Method

Sample and Design

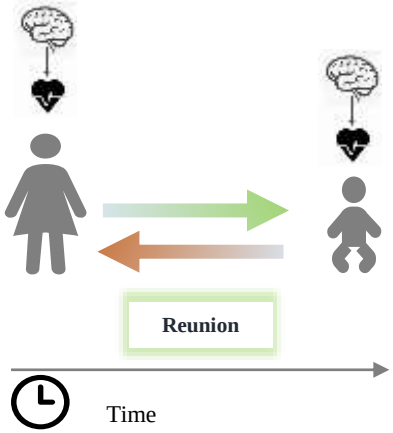
- **Cases:** n=40 dyads diagnosed with maternal PPD
- **Controls:** n=40 healthy controls without PPD

Matched on age, sex, SES



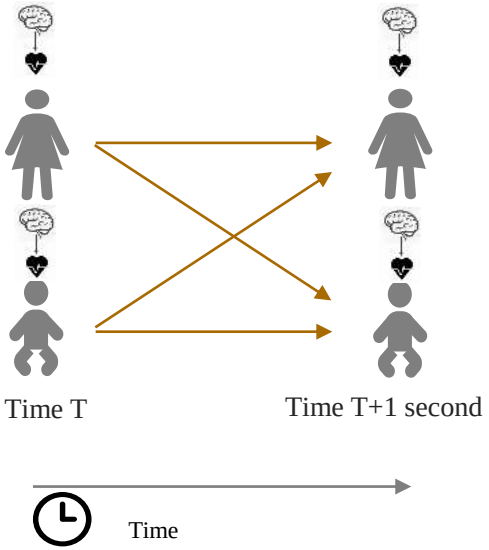
Variables

Reunion

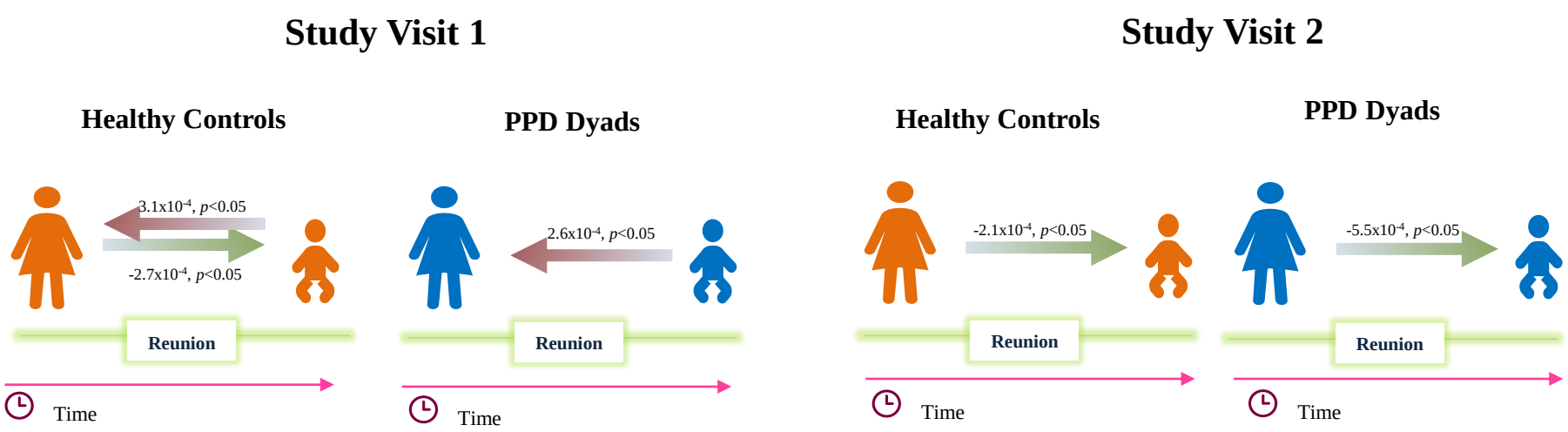


Statistical analyses

Stability and Influence Model



Results



Interpretation

- Adaptive changes in a mechanism though which mothers may actively regulate infant distress in real time
- Treating PPD may enable the mother to better respond to infant cues and provide support[24]

Discussion

- Treating maternal PPD with CBT is associated with:
  - Improvements in infant ER
  - Improved dyadic regulation under stress
  - These may improve to levels seen in healthy control dyads in just 2 months
- CBT, a brief, cost-effective, preferred treatment for PPD could disrupt transmission of psychiatric risk

BBRF Study 1 (Infant ER)

- ER Improvements were of medium effect size
  - Consistent with previous infant ER studies using maternal self-report
- Mechanisms unclear
  - NOT due to changes in PPD symptoms, mother-infant bonding, maternal ER
  - ?↑ quality of maternal signals and/or contingent responsiveness

BBRF Study 2 (Mother-Infant Dyad)

- Baseline:
  - Healthy control mothers influenced their infants
  - PPD mothers influenced by their infants
- After treatment, PPD mothers influenced their infants (similar to healthy control mothers)
  - Mothers transmit regulatory inputs to distressed infants on a second-by-second basis
- This mechanism is malleable with treatment

Limitations

- Small sample
- Short duration of follow-up
- Observational study design
- Unknown mechanisms
- Uncertain brain changes

Future Research Directions

- Larger RCT
- Brain region/circuit changes (e.g., fNIRS)
- Further exploration of mechanisms
  - Maternal regulatory parenting (FFSF, PCERA)
  - Maternal mood variability or emotion regulation (Shannon's Entropy)
  - Physiological synchrony

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