EMOTION REGULATION AND MATERNAL NURTURANCE AMONG PREGNANT WOMEN WHO ARE OPIOID DEPENDENT

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Bachelor of Science in Psychology with Distinction

Spring 2021

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ACKNOWLEDGMENTS

I would like to thank Dr. Mary Dozier and Alexandra Tabachnick for their endless support and guidance. Additionally, I would like to thank the entire team of the Attachment and Biobehavioral Catch-up Lab at the University of Delaware for assistance in data collection, cleaning, and coding. Finally, I would like to thank my family and friends for being so supportive during my college career and throughout this process. Without all of your encouragement, I would not have been able to pursue or accomplish my goals.

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ABSTRACT

Effective emotion regulation is important for parenting, but substance-using parents such as opioid-dependent mothers may have poor emotion regulation that interferes with parenting (Rutherford et al., 2015). The current study examined associations between emotion dysregulation, maternal nurturance, and respiratory sinus arrhythmia (RSA) among mothers with opioid dependence. Compared with stronger self-reported emotion regulation, weaker emotion regulation was associated with lower resting state RSA ($r = -0.32$, $p = 0.03$). Correlations among other variables of interest were not significant. Future studies should explore associations between other physiological measures such as cardiac pre-ejection period and parenting outcomes and consider different predictors such as adult attachment states of mind.

Chapter 1

INTRODUCTION

The opioid crisis has become an epidemic in the United States such that opioid dependence is a significant public health concern (Terplan, 2017). Women, specifically white reproductive-age women, increasingly bear the brunt of the opioid crisis (Terplan, 2017). Since 1999, more women have died by overdose than men, and reproductive-age women have been more likely than younger or older women to need emergency care assistance related to opioid misuse (Kozhimannil et al., 2017). In addition, about 45% of all US pregnancies are unintended; the rate of unintended pregnancies is 86% among women with opioid use disorders (Heil et al., 2011; Kozhimannil et al., 2017). Over the last decade, non-medical use of prescription opioids during pregnancy has almost doubled, leaving both women and infants at risk (Kozhimannil et al., 2017).

Opioid dependency and substance misuse can disrupt parenting outcomes (Peisch et al. 2018; Spehr et al., 2017). Parental substance misuse and suboptimal parenting increase the risk for insecure attachment, maltreatment, and foster care placement (Berlin et al., 2014). Parents who are dependent on substances such as opioids are likely to have experienced early adverse experiences such as childhood maltreatment themselves, which may impact their later parenting behaviors and attachment relationships with their own children (Berlin et al., 2008; Berlin et al., 2014).

Parent Responses to Infant Cries

Responsive parenting is crucial for healthy child development. The quality of parenting during the first several years of a child's life impacts the parent-child attachment relationship, the child's ability to regulate their behaviors and emotions, and academic achievement (Ainsworth, 1979; Berlin et al., 2014). In particular, the way in which a caregiver responds to child distress affects the development of the parent-child relationship (Bernard et al., 2013). When a caregiver responds to child distress with nurturing behaviors like comforting and soothing, they serve a protective role and increase the likelihood of developing a secure attachment relationship (Pruitt et al., 2019).

To provide optimal care that promotes healthy early development and self-regulation, parents must first manage their own physiological and emotional responses to their infants' cues (Ablow et al., 2013). Some parents may react internally to infant cries such that they find it difficult to behave in ways that serve to regulate their babies. Infant distress can be dysregulating, especially when cries are persistent and intense. For some mothers, infant cries can be aversive and emotionally upsetting, and can induce a physiological response (Ablow et al., 2013). Parents who report that they are more prone to insensitive and abusive behavior respond to infant cry stimuli with greater accelerations in heart rate and higher rates of respiration than parents who are not prone to insensitive and abusive parenting (Ablow et al., 2013). When heart rate accelerates and rate of respiration increases, parents appear to respond to their infant's actions without reflective consideration and draw upon their own relationships (Ablow et al., 2013). Parents with insecure working models of attachment perceive a narrower range of emotions from their infants, are less accurate in identifying specific infant emotions, and experience greater difficulty interpreting ambiguous signals than mothers with secure working models (Ablow et al., 2013). Additionally, women with insecure working models may have longer response times and may experience more negative affect when comforting their infant than women who have secure working models.

Regulating Emotions While Parenting

Parents need to manage their own emotions in order to respond sensitively, and to soothe and regulate their distressed children (Rutherford et al., 2015). Emotion regulation is the ability to identify, understand and accept emotional experiences, modulate impulsive behaviors when distressed, and control emotional responses as situationally reasonable and appropriate (Kaufman et al., 2015). Parents who misuse substances including opioids may have difficulties in emotion regulation that interfere with parenting (Rutherford et al., 2015). For example, parents who have difficulty regulating emotions, similar to mothers with insecure working models, may have longer latency and express more negative affect in response to infant cries than parents without emotion regulation problems (Ablow et al., 2013). Parents who are unable to regulate emotions effectively may feel guilty and ruminate when their children are distressed (Rutherford et al., 2015). Similarly, parents may have difficulty focusing their attention and ignoring distractions (Rutherford et al., 2015). Thus, emotion regulation may be a key area for intervention to improve attachment relationships and parenting outcomes among parents who misuse substances (Pruitt et al., 2019).

Respiratory sinus arrhythmia (RSA), an index of the parasympathetic nervous system, is a physiological indicator of emotion regulation in children and adults (Beauchaine, 2001; Beauchaine, 2015). At rest, higher RSA reflects better conservation of bodily resources, flexibility to adapt to stressors, and higher self-regulatory ability than lower RSA (Price et al., 2019). In addition, excessive RSA reactivity to emotional stimuli is associated with psychopathology (Beauchaine, 2015). Therefore, it is important to look at parental physiology as well as parental behavior as a reaction to infant distress (Pruitt et al., 2019). Nurturance may be challenging for parents who misuse substances as such parents may be prone to strong stress responses related to infant cues. The inability to regulate emotions and physiology may lead to poor parenting outcomes.

Present Study

To date, there is limited research on parenting among mothers who are dependent on opioids. There is also minimal research that explores emotion dysregulation and psychophysiological indices, such as RSA, in substance using populations (Price et al., 2019). Few studies have examined associations between maternal emotion regulation, nurturance behaviors, and respiratory sinus arrhythmia, particularly among parents who are dependent on substances such as opioids. The purpose of this study was to generate new knowledge regarding multimethod measures of emotion regulation and parenting outcomes that may be important for substance using populations such as mothers that are dependent upon opioids. The present study aimed to examine the relation between emotion regulation, nurturance, and respiratory sinus arrhythmia among opioid-dependent mothers. I hypothesized that emotion dysregulation, maternal nurturance, and resting state RSA would be associated with each other, with greater problems in regulating emotion associated with lower resting state RSA and lower nurturance. Findings regarding RSA reactivity have been mixed in the literature; my exploratory hypothesis was that more difficulties in emotion regulation and lower nurturance would be associated with greater RSA reactivity.

Chapter 2

METHOD

Participants

Sixty-three women receiving medication-assisted treatment (MAT) for opioid dependence were recruited during their third trimester of pregnancy through local treatment centers in Delaware, Maryland, and Pennsylvania. Participants were recruited as part of a larger randomized clinical trial of a parenting program for opioid-dependent women and their infants. Data for the present study were collected when women came into the research laboratory for a pre-intervention visit during the third trimester of pregnancy or in the first postpartum month. For the current study, 59 participants completed the maternal nurturance assessment. Three participants did not complete the assessment due to the COVID-19 transition to remote data collection and nurturance data for one participant were not available due to technical difficulties.

The participants ranged in age from 21.37 to 38.30 years (*M* = 29.74 years, *SD* = 4.13 years). The majority of the sample identified as White (74.6%), with 17.5% Black or African American, and 7.9% Multiracial. Of those who identified as Multiracial, 4.8% said Black or African American and White, and 3.2% said American Indian or Alaska Native and White. The majority of the sample did not identify as Latina (93.7%). The majority of the sample was pregnant at the time of the pre-intervention visit (79.4%). Of the women included in the sample, the majority had a previous pregnancy before the current one (79.4%). In terms of education, the sample had a high school degree or equivalent (e.g. GED; 44.4%), with 30.2% earning less than a high school diploma, 15.9% attending some college without earning a degree, 7.9% holding a certificate from Technical School, and 1.6% holding an Associate degree (e.g. AA, AS). The socioeconomic status of the sample was mostly low income with the average annual family income of less than $10,000 (50.8%). Table 1 presents participant demographics (Table 1).

Table 1. *Participant Demographics.*

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Characteristic	
Maternal demographics	
Age (years; *M*)	29.74 yrs
Race	
Black/African American (%)	17.50%
White (%)	74.60%
Multiracial (%)	7.90%
American Indian or Alaska Native, White (%)	3.20%
Black/African American, White (%)	4.80%
Ethnicity	
Non-Hispanic or Latina	93.70%
Hispanic or Latina	4.80%
Did Not Report	1.60%
Education	
Less than High School (%)	30.20%
High School Degree/ GED (%)	44.40%
Some College (%)	15.90%
Associate Degree (%)	1.60%
Certificate from Technical School	7.90%
Household Income	
Less than $10,000	50.80%
$10,000 - $19,999	12.70%
$20,000 - $34,999	17.50%
$35,000 - $49,999	7.90%
$50,000 - $74,999	1.60%
$75,000 - $99,999	0.00%
More than $100,000	3.20%
Did Not Report	6.30%
Pregnancy Status	
Pregnant	79.40%
Postpartum	20.60%

Procedure

For this study, we adapted an infant simulator task using a newborn baby doll and a Bluetooth speaker (Rutherford, 2019; Voorthuis et al., 2013). The doll resembled a newborn in appearance and weight, its skin color was racially ambiguous, and it was dressed in gender neutral clothing. The baby's weight was similar to a typical newborn's (4.6 lbs.). We placed a Bluetooth speaker inside of the infant simulator to play an audio track that we created.

Women's autonomic nervous system data were continuously recorded during a three-minute resting baseline, the seven-minute infant simulator task, and a three-minute recovery period. For the baseline and recovery periods, women sat in a comfortable chair and listened to nature sounds while looking at a nature scene. Following the baseline period, participants were given the infant simulator and were told to take care of the baby as if it were their own baby. They were also told they could use any of the items provided (baby bottle, toy rings, swaddling blanket) during the interaction. The audio track consisted of newborn distress sounds beginning with subtle noises and transitioning to hard cries and finally to signals of extreme distress. Throughout the task, the audio track continued to play regardless of what the participants did to soothe the baby. Participants were video-recorded during the task for later behavioral coding.

Measures

RSA. Maternal respiratory sinus arrhythmia (RSA) data were derived from electrocardiogram (ECG) data collected during the infant simulator task. Mindware hardware and Biolab software were used for data collection. Three disposable electrodes were placed in a bipolar configuration to record ECG signals. Maternal ECG data were cleaned using Mindware software. Specifically, ECG signals were cleaned manually by removing artifacts resulting from noise or movement interference. Segments that had more than 10% of total beats removed, or that had less than 30 seconds of continuous clean data, were excluded from analyses. Once ECG data were cleaned, RSA were estimated in each minute-long segment by taking the natural log of the mother's average high frequency heart rate variability in that segment. Average RSA was calculated for each task period and RSA reactivity and recovery scores were calculated. $RSA_{reactivity}$ was calculated by subtracting average RSA during the resting period ($RSA_{baseline}$) from average RSA during the infant simulator episode. $RSA_{recovery}$ was calculated by subtracting the average RSA during the infant simulator episode from the average RSA during the recovery period.

Maternal Nurturance. Maternal nurturance was assessed using the Nurturance Rating Scale (adapted from Bernard, 2012; Dozier, 2017). Coders gave a single global code on a scale from 1 to 5, with half points allowed. Higher scores reflected higher maternal nurturance on three dimensions: proportion of distress signals responded to, latency of response, and appropriateness of response. Each of the ratings of nurturance are based on both quality and quantity of mother behavior. A nurturing mother is one who responds to the infant's distress immediately, appropriately and thoroughly even when the infant is giving subtle cues of distress. A less nurturing mother will miss opportunities to nurture the infant, may not respond appropriately to the distress cues and may only act when the infant is in clear distress. The videos were double coded and disagreements over 1 point were determined by conference with the master coder. The reliability was adequate (ICC = 0.65).

Emotion Regulation. During the pre-intervention visit, mothers completed the Difficulties in Emotion Regulation Scale Short Form (DERS-SF; Kaufman et al., 2015). The DERS-SF is a well validated and widely used self-report measure that assesses difficulties in emotion regulation in adolescents and adults. The short form scale retains the total and subscale scores of the original measure, with 18 items instead of 36. The measure captures six dimensions of emotion regulation: non-acceptance of emotional responses, difficulty in engaging in goal-oriented behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Scales are calculated as sums of the component items. The total score was used for the present study. Internal consistency of this scale was excellent ($\alpha = .85$).

Chapter 3

RESULTS

Analyses, conducted as correlations, addressed associations among difficulties in emotion regulation, maternal nurturance, resting state RSA, and RSA reactivity.

Preliminary Analyses

Forty-nine participants completed the DERS-SF questionnaire, with an average total score of 35.84 (*SD* = 9.97), ranging from 18 to 59. Of the 59 participants who completed the infant simulator task, the mean nurturance score was 2.61, ranging from 1.0 to 5.0 on a 5-point rating scale (*SD* = 0.77). Sixty participants had usable resting RSA, and the average resting RSA value was 6.32 (*SD* = 1.43) ranging from 1.03 to 9.11. Of the 59 participants who completed the infant simulator task, the average RSA reactivity difference score was -0.90, ranging between -3.33 and 2.99 (*SD* = 1.14). Table 2 presents the descriptive statistics for the study variables (Table 2).

Primary Analyses

Associations between the study variables of primary interest were examined using Pearson correlations. There was a significant inverse association between difficulties in emotion regulation and resting RSA (r = -0.32, p = 0.03). Opioid-dependent women who reported greater difficulties in emotion regulation had lower resting RSA than women who had higher resting RSA (Figure 1). Difficulties in emotion regulation were not significantly associated with maternal nurturance (r = -0.06, p = 0.68) or with RSA reactivity (r = 0.10, p = 0.51). Resting state RSA and

RSA reactivity were not associated significantly with nurturance, (r = -0.11, p = 0.93, and r = -0.14, p = 0.29, respectively) (Table 3).

Figure 1. *Emotion Regulation and Respiratory Sinus Arrhythmia Among Pregnant Women Who Are Opioid Dependent*

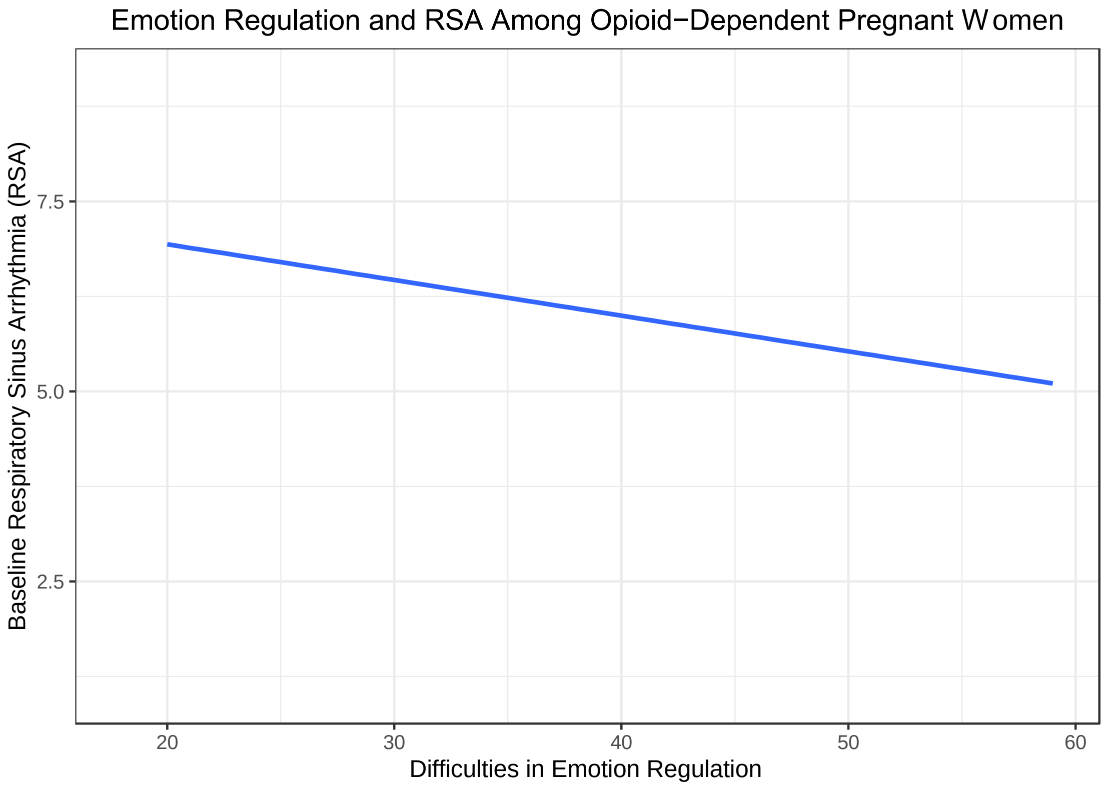

Table 2. *Descriptive statistics of the study variables.*

Table 2. Descriptive statistics of the study variables.

	N	**Min**	**Max**	***M***	***SD***
1. DERS-SF total score	49	18	59	35.84	9.97
2. Resting state RSA	60	1.03	9.11	6.32	1.42
3. RSA reactivity	59	-3.33	2.99	-0.90	1.14
4. Maternal nurturance	59	1.00	5.00	2.61	0.77

Table 3. *Pearson correlation analysis of emotion regulation, RSA and maternal nurturance behaviors.*

Table 3. Correlation between emotion regulation, RSA and maternal nurturance behaviors.

Variable	**1**	**2**	**3**	**4**
1. DERS total score	1	-		
2. Resting state RSA	**-0.32** **(0.03)**	1	-	
3. Reactivity RSA	0.10 (0.51)	-0.45 (0.00)	1	-
4. Maternal nurturance	-0.06 (0.68)	-0.01 (0.93)	-0.14 (0.29)	1

Note. p-values presented in parentheses. Significant findings in bold.

Chapter 4

DISCUSSION

The goal of the present study was to explore associations between emotion dysregulation, nurturance, and respiratory sinus arrhythmia among mothers who are dependent on opioids. Furthermore, the purpose of the study was to generate new information regarding RSA as a psychophysiological marker of emotion regulation and parenting outcomes that may be critical for substance using populations such as mothers that were dependent upon opioids. I hypothesized that greater difficulties in emotion regulation would predict lower resting RSA and lower maternal nurturance than fewer difficulties in emotion regulation. Additionally, I hypothesized that high resting RSA and low RSA reactivity would predict high maternal nurturance. Results from the current study partially supported the hypotheses. As predicted, emotion regulation was associated with resting state RSA. Mothers who reported poorer emotion regulation had lower resting state RSA than mothers who reported stronger emotion regulation. Neither self-reported emotion regulation problems nor RSA were significantly associated with maternal nurturance.

In the present study, there was a significant inverse association between difficulties in emotion regulation and resting RSA. That is, those who reported greater difficulties in emotion regulation had lower resting RSA than those who reported fewer difficulties. This finding extends previous work on emotion regulation and RSA by measuring these constructs with opioid-dependent pregnant women, an understudied population at risk for emotion dysregulation.

RSA is a valid measure of emotion dysregulation that has found low resting RSA to be associated with symptoms of internalizing and externalizing psychopathology (Beauchaine 2001; Beauchaine, 2015). Positive associations between resting state RSA and performance on executive functioning tasks have been reported (Beauchaine 2001; Beauchaine, 2015). Respiratory sinus arrhythmia is a reliable biomarker of emotion regulation, reflecting prefrontal cortex functioning (Beauchaine, 2015). RSA is an index of the vagal system, which reflects attentional and emotional processes (Beauchaine 2001; Beauchaine, 2015).

Previous research also expanded upon different aspects of parenting outcomes and emotion regulation (Pruitt et al., 2019). Pruitt and colleagues used a sample consisting of college-age women to explore individual differences in parenting behavior through the use of the infant simulator paradigm (Pruitt et al., 2019). High attachment avoidance was associated with less infant-oriented beliefs and more parent-oriented beliefs about infant crying, while adult secure attachment was associated with greater physiological reactivity during the infant simulator paradigm, in addition to greater emotion regulation and stronger parenting behaviors (Pruitt et al., 2019). The motivation for the present study was to explore the association between RSA and maternal nurturance using multi-method assessment.

Significant links between maternal nurturance and RSA may not have been found because of the unique characteristics of the sample. The current sample differed in some key ways from those in other samples, including most especially that participants had a number of risk factors. Participants in the current sample had a low socioeconomic status, with a little over half of the sample with an average family income of less than $10,000 (50.8%), and were dependent on substances such as opioids. This was in contrast to prior findings of Pruitt and colleagues (2019) that studied college-age females. The participants in the current study were not typically first-time pregnant women; the majority of the sample had a previous pregnancy (79.4%). Finally, in the present study, nurturance was assessed using a new methodology. It is unclear whether the task elicits the same type of behavioral and physiological response as one's own baby.

Strengths and Limitations

There were several strengths to this study. First, the study involved an understudied population consisting of pregnant women who are dependent on opioids. To date, there is minimal research that considers emotion dysregulation and psychophysiological indices in substance using populations (Price et al., 2019). Additionally, few studies have examined associations between parenting outcomes such as nurturance and maternal emotion regulation and respiratory sinus arrhythmia, especially among parents who are dependent on opioids. Another major strength of this study was its use of multi-method assessment. In particular, the current study's measure of RSA has become a reliable biomarker of emotion regulation and the DERS is a well-validated self-report measure that measures difficulties in emotion regulation in adolescents and adults (Beauchaine 2015; Kaufman et al., 2015).

On the other hand, this study has several limitations. First, the sample size was small, with only sixty-three participants receiving MAT. Not only was the MAT sample size small, group differences could not be assessed between the MAT group and non-opioid-dependent group because the non-opioid-dependent participants were still being recruited, thus not allowing comparisons with this group. Another limitation of this study was its assessment of emotion regulation. Despite the DERS being a valid and widely used measure, it is a self-report measure which makes it susceptible to reporting bias. In addition, RSA and nurturance were assessed simultaneously. To predict from one variable to another, temporal separation is required.

A final limitation of the study is its assessment of maternal nurturance. This study used an infant simulator task, which is in early stages of validation. It is unclear whether the infant simulator elicits the same behavioral and physiological responses that one's own child would elicit. Future studies should be done to test the reliability and validity of this measure.

Future Directions

This study has many exciting future directions to explore. First, an important area of research would be to examine the validity of our assessment of maternal nurturance. Creating a pre- and post-intervention assessment to measure maternal nurturance could be beneficial to explore if participants improve on their quality and quantity of nurturance throughout the intervention. Exploring associations with other physiological measures such as cardiac pre-ejection period and parenting outcomes such as maternal nurturance may be fruitful. The study can be further expanded upon by increasing the sample size and looking at group differences between participants who are opioid dependent and those who are not. Finally, looking at different predictors of maternal nurturance may be beneficial (i.e., looking at parent attachment states of mind).

Conclusion

The current study represents an important step in examining whether respiratory sinus arrhythmia and emotion dysregulation predict maternal nurturance during pregnancy among women who are opioid dependent. This is one of the first studies completed to test effects of emotion regulation and RSA on nurturance, laying the groundwork for other researchers in the future.

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