Examining the Relationship Between Emotional Reactivity and Anxiety and Depressive Disorders in Women During the Perinatal Period

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A thesis presented to McMaster University

in partial fulfilment of the requirements of

PNB4D09: Senior Honours Thesis Course

Hamilton, Ontario, Canada, 2020

Abstract

The perinatal period (i.e., pregnancy and up to 12 months postpartum) is a vulnerable time in which 17.4 % of women develop anxiety disorders and 6.5% develop depression (Fairbrother et al., 2016). Emotion dysregulation is an umbrella term that describes problems in managing emotions, including maladaptive emotional reactivity (ED), and has been implicated in anxiety and depressive disorders (Gross & Jazaieri, 2014). Women in the perinatal period may be more susceptible to experiencing ED due to the biological and physical changes; however, this has not been previously studied. The purpose of the current study is to investigate the role of ED in perinatal anxiety and depression. Perinatal women were recruited from the community and divided into three groups: 1) Experimental group (Exp-peri) for perinatal women with anxiety or depression, 2) Perinatal Healthy Control (HC-peri) group for healthy perinatal women, and 3) Nulliparous Healthy Control (HC-null) group for healthy nulliparous women. Participants' heart rate reactivity was measured using the Polar V800 watch while completing an experimental task including looking at 3 sets (positive, negative, neutral) of pictorial stimuli and comparing reactivity across sets and groups. Data was analyzed on a sample of N= 48 women. We hypothesized that women in the Exp-peri and HC-peri groups would have heightened emotional reactivity compared to HC-null group, and women in the Exp-peri group would have heightened reactivity compared to HC-peri and HC-null. Mixed models of analyses of variance was employed. Results indicated that women in both of the perinatal groups showed a significant heightened emotional reactivity compared to the healthy women who have never been pregnant before, suggesting the perinatal period being a period of vulnerability. The study did not detect any significant difference in heart rate reactivity between the experiment group and the perinatal control group. Future directions and implications are discussed.

Acknowledgements

First and foremost, I would like to express my deepest gratitude to my supervisor Dr. Sheryl Green for giving me this amazing and valuable experience to conduct my senior honours thesis research at her lab. As an undergraduate student who is passionate about clinical psychology, I am more than grateful to have this invaluable opportunity to work on such a terrific project and get hands on experience of clinical research. Dr. Green has provided me countless guidance for my thesis project and a ton of useful advice on both my academic career and life in general. I really appreciate her for being such a supportive, caring, and positive supervisor. Secondly, I would like to say a big thank you to my great mentor Arela Agako for being such an incredible and inspirational role model for me. Arela has provided so much help and support for my thesis throughout the year, and her high conscientiousness and enthusiasm in clinical research really motivate me to keep working harder each time when things get difficult. Also, I would like to express my thanks to Adam Clasky for being such a helpful lab partner. Adam has helped me a lot for the recruitment of my study and provided me a ton of encouragements and feedbacks for my thesis project. Last but not least, I would like to thank Claire Hallett, Eleanor Donegan, Katherine Silang, and the rest of members of the Women's Health and Concern's Lab for their contribution and hard work towards my project and their emotional support from the beginning to the end. Without these amazing people, my thesis project would be impossible. Thank you everyone, for making my thesis project such an unbelievable and enjoyable experience and the highlight of my undergraduate study.

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Mental Health and the Perinatal Period

The perinatal period (pregnancy and up to 12 months postpartum) is a vulnerable period of time in a women's life for mental health difficulties due to the biological, physical, social and cognitive changes that occur. (Brockington, Macdonald & Wainscott, 2006; Green et al., 2015). Childbearing, as one of the most complex events in human life, can put women at greater risk of a wide range of psychiatric disorders and somatic complications. For instance, 44% of women who had anxiety disorders before pregnancy reported an exacerbation of their symptoms (Hertzberg & Wahlbeck, 1996) after giving birth to their children, and accumulating studies have demonstrated that pregnancy does not serve as a protective factor of mental illnesses for women (Giardinelli et al., 2011).

Consequently, 14.1% of pregnant women have met the criterion for one psychiatric diagnosis, and 11.6% have been diagnosed with a mood disorder (Andersson et al., 2003). Amongst the women with depression, fatigue / loss of energy (88.7%), and diminished interest in daily activities (82.4%) were the two most common symptoms based on self-report (Andersson et al., 2003). When comparing the relationship between pregnancy status and postpartum mental disorders, Mota et al (2008) found that women during postpartum were more likely to experience manic episodes (3.5%) and be diagnosed with major depression (13.2%), panic disorder (4.0%), and mood disorders (14.3%) compared to the general population (2.6%, 11.4%, 3.7%, and 13.0%, respectively). Perinatal women who did not have a psychiatric diagnosis also reported experiencing symptoms of fatigue (84.3%), nausea (45.6%), abdominal pain (26.5%), and insomnia (19.1%), indicating that psychiatric and somatic symptoms were common in non-clinical sample of pregnant women as well. As a result, detection and treatment plans for perinatal women are crucial (Andersson et al., 2003).

Thus, perinatal period is a very challenging time for women. Research on perinatal mental disorders are important to further understand the psychiatric disturbances that can occur during pregnancy and postpartum in order to improve healthcare services for perinatal women with mental health issues (O'Hara & Swain, 1996).

An Overview of Perinatal Anxiety and Depression

Perinatal Anxiety and Depression: Prevalence Rates

Previous studies have shown increased incidences of depression and anxiety disorders during the perinatal period compared to the other times in life. However, results for the prevalent rates of perinatal anxiety and depressive disorders are mixed in the literatures. Some studies found that prenatal anxiety disorders were more common than prenatal depression, while anxiety and depression had an almost equal prevalence rate during postpartum (Brockington, Macdonald & Wainscott, 2006). Other research suggested a higher prevalence rate in postpartum anxiety than in postpartum depression (Wenzel et al., 2005). In the study conducted by Fairbrother et al (2016), researchers recruited 310 Canadian women and found a prevalence rate of 15.8% for prenatal anxiety disorders and 17.1% for postpartum anxiety disorders, which were much higher than the prevalence rates of prenatal depression (3.9%) and postpartum depression (4.8%). Interestingly, in other studies, prenatal and postnatal depression had prevalence rates ranging from 12-20%, with common estimates around 13%, which were similar to the prevalence rates of depression in the general population (Bennett et al., 2004; Josefsson et al., 2001; O'Hara et al., 1996).

Notably, anxiety and depression have a high comorbidity rate (10-50%) and share many overlapping symptoms, making it very hard to separate these two categories (Beeghly et al., 2002; Wenzel et al., 2005). A study of Fairbrother and colleagues (2016) demonstrated that 4.2% of

participants met both the criterion for major depression and an anxiety disorder during either pregnancy or postpartum, and 2.3% of participants met the criterion for an anxiety disorder and depressive disorder during both pregnancy and postpartum. Women with perinatal depression were very likely to experience anxiety symptoms that were clinically significant. However, it is possible for women diagnosed with perinatal anxiety disorders to experience no symptoms of depression (Brown, Campbell, Lehman, Grisham & Mancill, 2001). In a meta-analysis conducted by Dave, et al (2010), depression rate was the highest during the first year postpartum, with 13.93% of women being affected. Among women diagnosed with postpartum depression, 27% were comorbid with two or more other mental disorders (Brockington, Macdonald & Wainscott, 2006), and 60% had the diagnosis of generalized anxiety disorder (Wittchen et al., 2000), which was the most common anxiety disorder for pregnant and postpartum women (Wenzel et al., 2005).

Compared to the general population, women during perinatal period were twice as likely to get diagnosed with generalized anxiety disorder (Sutter-Dallay et al., 2004; Wenzel et al., 2005; Adewuya et al., 2006; Vesga-Lopez et al., 2008). The pattern of increased prevalence rates amongst perinatal women were found in other anxiety disorders as well, including obsessive compulsive disorder, social anxiety disorder (Maina et al., 1999; Adewuya et al., 2006), and panic disorder (Bandelow et al., 2006; Sholomaskas et al., 1993). Furthermore, Wenzel et al (2001) found that amongst a sample of women with dysphoria, 11% reported having a panic attack in the previous month during 4-7 months postpartum, and 1.5% were diagnosed with panic disorder. Stress induced by birth complications also had long lasting impacts. The heightened prevalence rates could be associated with childbearing, which was considered as a stressor that was related to anxiety disorders (Sholomskas et al., 1993). According to Ayers and Pickering (2001), the point prevalence of PTSD was 8.1% during pregnancy, 6.9% at six weeks postpartum, and 3.5% at six

months postpartum. Another study discovered that 24.2% of women had clinically significant symptoms in one area (re-experiencing, avoidance, and increased arousal) of PTSD symptoms (Czarnocka & Slade, 2000), and nulliparous women were the most likely to endorse those traumatic stress symptoms (Wijma et al., 1997). It is worth noting that approximately 40-50% of women with prenatal anxiety or depressive disorders experienced another onset of the symptoms during the postpartum period (Wenzel et al., 2005). Thus, perinatal anxiety and depressive disorders are surprisingly common amongst women during the perinatal period. With this, more clinical attention on perinatal mental disorders is warranted to avoid aversive consequences for mother, babies, and family members.

Potential Risk Factors of Perinatal Anxiety and Depression

Previous studies have demonstrated various factors that contribute to the development of perinatal anxiety and depression. During the first trimester, estrogen levels in pregnant women increases rapidly, and the brain heightens its sensitivity in response to the high level of estrogen. The increased sensitivity in the brain due to the reproductive hormonal changes are theorized to trigger the development of mood disorders (Soares, 2010). In addition to this, other studies have presented risk factors that were grounded in the social context. For example, postpartum depression was associated with stressful life events, limited social resources, and poor financial support (O'Hara & Swain, 1996; Beck 1996, 2001). According to a meta-analysis conducted by O'Hara and Swain (1996), past history of psychopathy, psychological disturbance during pregnancy, unhealthy marital relationship, insufficient social support, and stressful life events were the strongest predictors of postpartum depression. Other factors, including lower level of education (Marcus et al., 2003), previous experiences of miscarriage (Rubertsson et al., 2003), low self-

esteem (Ritter et al., 2000), low income (Bolton et al., 1998), and childhood sexual abuse (Rodgers, 2003), could predispose the development of antenatal depression. Leigh and Milgrom (2008) used regression analyses to identify a series of significant risk factors in antenatal depression and postnatal depression, and the results in the study showed that low self-esteem, antenatal anxiety, low society support, negative cognitive style, major life events, low income, and a history of abuse were significant predictors of antenatal depression, with antenatal depression being the strongest predictor of postnatal depression.

In a study conducted by Wenzel et al (2005), lower socioeconomic status, a personal psychiatric history, a family psychiatric history, and the absence of breastfeeding were found to predict depressive and anxiety symptoms. However, all these factors combined could only explain less than 20% of the variance in anxiety and depressive disorders, meaning that there are more important factors still remain undiscovered.

Past studies have demonstrated an overlapping and shared risk factors for perinatal anxiety and depression. It is worth noting that all of those factors tend to cluster and have addictive effect, and none of the factor could be conclusive enough to explain the development of any anxiety or depressive symptoms. Future research is needed to explore the mechanisms of perinatal anxiety and depression and potential etiological factors.

Onset of Perinatal Anxiety and Perinatal Depression

Perinatal anxiety and depression could occur in two different ways: 1) a reoccurrence of a previous episode and 2) the first ‘de novo’ episode, meaning those affected women did not meet the criterion for anxiety or depression before perinatal period (Green et al., 2005; Wenzel et al., 2005). Perinatal anxiety disorders are manifested as a reoccurrence of the previous episodes, and

this is supported by Wenzel, Haugen, Jackson, & Brendle (2005)'s study, which illustrated that individual and family psychiatric histories were the strongest predictors of current anxiety symptoms. Similar findings are shown in a study conducted by Giardinelli et al (2012), which demonstrated that psychiatric disorders before and during pregnancy were strongly associated with the development of pregnant and trait anxiety.

Similar to perinatal anxiety disorders, pregnant and postpartum depression are also more likely to re-occur after previous episodes. This is bolstered by a meta-analysis conducted by O'Hara and Swain (1996), which indicated that past history of psychopathology and psychological disturbance during pregnancy were the strongest predictors of perinatal depression. Also, the strongest predictor of postpartum depression was antenatal depression, suggesting depression as a reoccurrence of previous episodes (Leigh & Milgrom, 2008).

It is worth noting that the mean age of the onset for many anxiety and depressive disorders is in one's 20s, which is the same time period as childbearing age for many women. Thus, the increasing prevalence rate of anxiety disorders amongst pregnant or postpartum women could partially be explained by the fact that many anxiety disorders are the most prevalent among women of childbearing age (Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993). On the other hand, some research suggested that childbirth was a stressor for women, making the incident of anxiety disorders higher during the perinatal period than other times (Sholomaskas et al., 1993). The theory of childbearing as a stressor has been demonstrated in obsessive-compulsive disorder (OCD). Childbearing is the one specific stressful life event that differentiate people with OCD and those who do not (Albert, Maina, & Bogetto, 2000; Maina, Albert, Bogetto, Vaschetto, & Ravizza, 1999). Women with OCD reported experiencing a worsening of symptoms during pregnancy and continued throughout the postpartum period (Altemus, 2001; Diaz, Grush, Sichel, & Cohen, 1997).

Among all the heightened distress, the most predominant distress was the intrusive thoughts of harming the baby (Sichel, Cohen, Dimmock, & Rosenbaum, 1993), making childbearing a more challenging time for women with OCD.

Overall, findings have supported the "window of vulnerability" hypothesis and suggested that perinatal women are very vulnerable towards mental disorders, including anxiety and depressive disorders.

Presentation of Perinatal Anxiety and Depression Symptoms

Although the diagnostic criterion used for anxiety and depressive disorders during the perinatal period are the same as for the general population, the symptoms are more specific and infant-focused around the perinatal context. According to the study conducted by Brockington, Macdonald & Wainscott (2006), the most common fears amongst women with prenatal anxiety were fear of foetal abnormality (43%), fear of foetal death (40%), fear of inadequacy as a mother (32%), tokophobia (28%), and fear of too little support (21%), with fear of foetal loss being the most severe symptom of prenatal anxiety. The infant-related fears experienced by women during pregnancy were normally accompanied by a history of miscarriage and reproductive difficulty. After giving birth to children, the main focus of anxiety shifted toward infant's health and safety (32%), fear of cot death (29%), fear of criticism (19%), and fear of lack of support (16%). Among these fears, the fear of death and the fear of criticism were the two most severe fears during the postpartum period, with the former being called maternal separation anxiety (Hock et al., 1989) and the latter being known as mother-infant relationship disorders. Additionally, 13% of mothers reported excessive worries about their own health. Other worries, including changes in family

dynamics, older children's behaviours, financial problems, employment, were also mentioned in the literature.

For pregnant women with OCD, 11% reported experiencing various obsessive symptoms, which involved obsessive cleaning, housework, and counting foetal movements. Obsession of child abuse was mentioned as well, including throwing the infant out the window, crushing the baby's head, drowning the baby, and sexual abuse (Brockington, Macdonald & Wainscott, 2006). Interestingly, in another study conducted by Wenzel, Gorman, O'Hara, and Stuart (2001), they found that women who endorsed a series of compulsive behaviours did not have aggressive urges to harm their babies. When compared with non-postpartum OCD samples, women during postpartum with OCD reported little distress associated with compulsions (Wisner, Peindl, Gigliotti & Hanusa, 1999).

It is well known that body changes during the perinatal period are very natural amongst pregnant and postpartum women, but these changes could cause distress for a lot of women. In a study by Brockington et al., 2006, 27 % of pregnant women reported that they were ashamed of their body, and 31% were embarrassed by their body changes during postpartum, which was similar to dysmorphophobia (Brockington, Macdonald & Wainscott, 2006).

On the other hand, pregnant and postpartum depressive disorders share many similar symptoms with depressive disorders in the general population. Based on Andersson et al (2003)'s study, fatigue or loss of energy and diminished interest in daily activities were the most commonly reported symptoms by women with perinatal depression (88.7% and 82.4%, respectively). Perinatal women with depression also self-reported the symptoms of insomnia or hypersomnia (57.9%), depressed mood (44.7%), decreased or increased appetite (39.0%), feelings of worthlessness or inappropriate guilt (30.8%), and psychomotor agitation or retardation (29.6%),

which were similar to the depressive symptoms reported by the general population (Andersson et al., 2003). However, the triggers of the depression symptomatology in perinatal period were different from the ones in the general population. According to Cwikel et al (2004), depressive symptoms might be induced by the awareness of infertility, ineffective treatment of infertility, and a long period of infertility. Additionally, perinatal depression could be traced back to a history of miscarriage (Rubertsson et al., 2003) and a younger age of pregnancy (Marcus et al., 2003), which were specifically associated with antenatal depression.

Impacts of Perinatal Anxiety and Depression on Mother and Children

Symptoms of anxiety and depression during perinatal period have long lasting impacts on both the mother and the child, and the global effects persist into childhood, adolescence, and adulthood (Monk, Spicer & Champagne, 2012). The developing fetus is extremely sensitive towards various environmental exposures, and it could easily be a target of epigenetic dysregulation induced by maternal distress (Monk, Spicer & Champagne, 2012). Prenatal anxiety and depressive symptoms, specifically, could induce neurotoxic effects on fetus's brain (Monk, Spicer & Champagne, 2012), double the risk of neurodevelopmental disorders (Susser, Hoek, & Brown, 1998), reduce the gray matter density in the prefrontal cortex (Buss, Davis, Muftuler, Head, & Sandman, 2010; Pruessner et al., 2008), and leads to the malfunctioning of the hypothalamus-pituitary-adrenal (HPA) response to stress (Weinstock, 2005). Also, exposure to antenatal depression and anxiety symptoms is a strong predictor of increased behavioural reactivity and cortisol level in infants when they encounter novel objects (Kaplan, Evans, & Monk, 2007; O'Connor, Heron, Glover, & The ALSPAC Study Team, 2002), and these children are more likely

to have higher than average resting cortisol level, which would continue throughout the childhood and adolescence (Van den Bergh, Van Calster, Smits, Van Huffel, & Lagae, 2008).

It is well known that the development of the relationship between mother and the child is one of the most important psychological processes during the child's development. The mother's mental health conditions could greatly impact the formation of the early mother-child relationship (Brockington, 2004). Further, postpartum depressive symptoms are found to be associated with impaired mother-child bonding, leading to future insecure attachment styles and maladaptation in children (Moehler, Brunner, Wiebel, Reck, & Resch, 2006). Another negative consequence is that the children of the women with antenatal depression are almost four times more likely to be at risk of maltreatment. Additionally, children who were exposed to antenatal depression and maltreatment in their childhood were almost 12 times more likely to develop psychopathology then kids without exposure to antenatal depression or maltreatment (Pawlby et al., 2011). As well, symptoms of anxiety are associated with higher chances of preterm delivery, low birth weight (Orr et al., 2007), negative relationship between the mother and the child (Gondoli & Silverberg, 1997), child neglect (Austin et al., 2005), and poor developmental outcomes (O'Connor et al., 2003; Barnett et al., 1991).

Perinatal anxiety and depression have huge impacts on the offspring's mental health conditions as well. Prenatal anxiety and depression was associated with fearful behaviours in 2-month-old infants (Davis et al., 2007) and greater motor and cry responses to new objects in 4-month-old infants (Davis et al., 2004). Exposure to prenatal anxiety also predicts the likelihood for infants to develop a more negative temperament (Sandman, Davis, Buss, & Glynn, 2011; Blair, Glynn, Sandman, & Davis, 2011), fear behaviours (Bergman, Sarkar, O'Connor, Modi, & Glover, 2007), early signs of ADHD symptoms (O'Connor, Heron, Golding, & Glover, 2003), impulsivity

(Van den Bergh et al., 2005), an increased risk of developing depression (Pawlby et al., 2009), and antisocial behaviours during adolescence (Rice et al., 2009).

Perinatal anxiety and depression have many unfortunate outcomes for both the mother and offspring. Research on factors associated with anxiety and depressive disorders during perinatal period are crucial to gain insights into the development of these psychiatric disorders and more effective treatment plans to help women with perinatal anxiety and depression.

Emotion Dysregulation and Emotional Reactivity

Emotion Dysregulation, Emotional Reactivity, and Mental Health

There are many factors associated with psychiatric disorders during the perinatal period, and emotional dysregulation is one potential factor that might help with how we conceptualize perinatal disorders. Many psychiatric disorders are thought to involve disruption of emotion regulation and problematic patterns of emotional reactivity (Gross & Jazaieri, 2014). However, Dillon et al., 2011 points out that examining the role of emotion in understanding psychiatric distress has been challenging due to the fact that multiple emotions could manifest very similar physiological reactions, such as the change in heart rate reactivity (Dillon et al., 2011, P.75). Also, various psychiatric disorders have shared problems with emotion and emotion regulation, making it difficult to specify the issues with each disorder (Gross & Jazaieri, 2014). Thus, understanding what is emotion and emotion regulation and the associated roles in psychopathology is an important step towards better clinical assessment and intervention.

Emotion, a subtype of affect, arises when an individual draws attention to an internal or external event that is appraised to be relevant to that individual's goal and wellbeing (Gross, 1998; Gross & Jazaieri, 2014). The elicited response sequence is multidimensional, involving

experiential, behavioural, and physiological changes, and these changes refer to emotional reactivity (Lang, 1994; Gross & Jazaieri, 2014). Problems in any of these components of emotional reactivity could lead to interference with emotion regulation. Emotion regulation happens when an individual aims to influence the emotion-generative process (Gross, Sheppes, & Urry, 2011), including situation selection, situation modification, attentional deployment, cognitive change, and response modulation (Gross & Jazaieri, 2014). Many people with psychiatric disorders have shown problematic patterns of emotion regulation, and these problems are mainly due to emotion dysregulation. Emotion dysregulation as an umbrella term, including problematic emotional reactivity, could occur in two ways: 1) emotion regulation failure, meaning an individual fails to engage in regulation when it would be helpful to do so, and 2) emotion misregulation, which refers to failing to use the appropriate regulation strategy that matches to the situation (Gross, 2013). Emotion reactivity is crucial in the research of mental disorders because it could predispose individuals to emotion dysregulation and explains the development and persistence of behavioural problems (Nock, Wedig, Holmberg, & Hooley, 2008).

Emotional Reactivity and Anxiety and/or Depressive Disorders

Emotional reactivity consists of emotional intensity, emotion duration, emotion frequency, and emotion type. Problems in any of these areas could lead to the occurrence of psychopathology (Gross & Jazaieri, 2014).

Problematic emotional intensity refers to either hyperreactivity (overreaction to a situation) or hyporeactivity (underreaction to a situation) (Berenbaum et al., 2003). Emotional intensity consists of experiential, behavioural, and physiological components, and problems with emotional intensity could impact on both positive and negative emotions (Gross & Jazaieri, 2014). For

instance, social anxiety disorder exhibits hyperreactivity to negative emotions, and people with social anxiety disorder tend to experience greater amount intensity of emotion than healthy controls (Gross & Jazaieri, 2014). In an experiment conducted by Goldin, Manber-Ball, Werner, Heimberg, & Gross (2009), after viewing the same social threat stimuli, participants with social anxiety disorder reported greater perceived anxiety than healthy participants. Similar result has also been found in a study by Mauss, Wilhelm, & Gross (2004), where participants with social anxiety disorder reported more anxiety, demonstrated more anxiety behaviours, and exhibited greater physiological activation compared to participants without social anxiety disorder. Sometimes, both hyperreactivity and hyporeactivity are seen in a disorder, such as major depressive disorder. People with major depressive disorder experience an excessive amount of negative emotions while having deficit in perceiving positive emotions. When compared with people without major depressive disorder, those with major depressive disorder reported more daily negative affect, less positive emotions, and fewer happy events in an experience-sampling study conducted by Bylsma, Taylor-Clift, & Rottenberg (2011), indicating problems with emotional intensity problems in those with major depressive disorder, having both hyperreactivity and hyporeactivity.

Another issue regarding emotional reactivity is problematic emotional duration. Problems with emotion duration happens when emotions for a particular situation are either too long or too short (Gross & Jazaieri, 2014). People with mental health problems might experience a too long duration of negative emotion and/ or a too short duration of positive emotion. For instance, people with specific phobia have demonstrated a prolonged duration of negative emotion. Specific phobia involves a persistent and excessive fear when anticipating or facing the feared object, which is normally disproportional to the actual danger. When the feared object cannot be avoided, people

with specific phobia always endure it with intense fear and distress (American Psychiatric Association, 2013). Like many other anxiety disorders, specific phobia is known to have an extended period of negative emotions (Gross & Jazaieri, 2014). Post-Traumatic Stress Disorder (PTSD), on the other hand, is characterized as a shortened duration of experiencing positive emotions. People with PTST have demonstrated a hypoactivation in the brain structures that are associated with emotional experience (Etkin& Wager, 2007), and this hypoactivation is linked to a decrease in the experience of positive emotion with regard to the form of emotional duration (Kashdan, Elhai, & Frueh, 2006).

Problems of emotion frequency occur when individuals experience certain emotions too frequently and/ or too infrequently, and this problem has impacted many individuals with psychopathology, including persistent depressive disorder. According to American Psychiatric Association (2013), individuals with persistent depressive disorder experience a prolonged period of depression for over 2 years, along with low energy and feelings of hopelessness. Research has shown that people with persistent depressive disorder tend to experience positive emotions too infrequently (Gross & Jazaieri, 2014). In a study investigating the anticipation of future affective events (positive, negative and neutral), individuals with persistent depressive disorder anticipated fewer positive events than negative or neutral events while healthy controls expected fewer negative events than neutral or positive events (Casement et al., 2008).

Problematic emotion type refers to the display of inappropriate emotions regarding to the given context (Gross & Jazaieri, 2014). The problems of displaying appropriate emotions are seen in people with schizophrenia, and the odd emotional responses could occur in social interactions and daily life. According to Strauss et al (2011), individuals with schizophrenia often report emotions that mismatch the stimuli. Similar results were found in another study, where people

with schizophrenia reported more positive reactions to negative stimuli and more negative reactions to positive stimuli (Cohen& Minor, 2010). Consequently, people with schizophrenia have difficulties in differentiating stimuli and manifest correct emotion types for the given context.

Taken together, many mental disorders include difficulties with emotional regulation and are demonstrated in problematic emotional reactivity. Past studies have focused on the behavioural and cognitive aspects of emotion dysregulation in women with perinatal anxiety and depressive disorders. To our knowledge, there is no known study has been conducted to specifically examine the role of emotional reactivity and the physiological differences amongst healthy women and women with anxiety or depressive disorders during the perinatal period. To better examine the physiological component of the emotion dysregulation model, a study targeting at the emotional reactivity patterns of perinatal women would be beneficial for this area of research.

The purpose of the current study is to further explore emotional reactivity during the perinatal period in order to understand the role it may have in the development of anxiety and depression symptomology and the detection of emotion dysregulation in perinatal anxiety and depression. The study aims to answer the following questions:

1) Is heart rate reactivity a marker of emotion dysregulation in women with anxiety and depression during pregnancy and the postpartum?
2) Is there a difference in emotional reactivity (as measured by heart rate) between women during the perinatal period with/ without anxiety and/or depression and healthy nulliparous women?
3) Is there a difference in emotional reactivity between 1) women with perinatal anxiety and/ or depression 2) healthy perinatal women and 3) nulliparous women without any mental disorders?

The current study will explore whether there is any significant relationship between emotional reactivity and symptoms of anxiety and depression during the perinatal period. We hypothesize that

1) heart rate reactivity can be used as a marker to detect emotion dysregulation in women with perinatal anxiety and/ or depression;

2) participants in the perinatal period (both Experimental and HC) will have heightened heart rate emotional reactivity compared to Nulliparous HC group, and

3) participants in the experimental group will deminstrate heightened heart rate emotional reactivity compared to perinatal HCs, suggesting that heightened reactivity might be linked to perinatal anxiety and depression.

There are no known studies that have examined the role of emotion reactivity in depression and anxiety disorders during the perinatal period. Exploratory analyses will be used to examine the relationship between emotional reactivity and perinatal anxiety and depression.

Methods

Participants

A sample of N=48 women were recruited from the Women's Health Concerns Clinic at St. Joseph's Healthcare Hamilton and the community through the use of flyers and social media (Facebook & Kijiji). The ages of participants ranged from 19-42 years old, with a mean age of 31. Participants were divided into the three following groups: 1) Experimental Perinatal group (Exp-peri) for perinatal women with anxiety and/ or depression (N=18), 2) Healthy Control Perinatal group (HC-peri) for perinatal women who did not have any mental disorders or take any medications for mental health concerns (N=13), and 3) Healthy Control Nulliparous group (HC-

null) for healthy women who have never been pregnant (N=17). Further demographic information for the three groups are shown in Table 1, Table 2, and Table 3, respectively. In order to meet eligibility of the study, participants were required to be between 18 and 45 years old. All participants went through Mini International Neuropsychiatric Interview (MINI) with a trained assessor before the experiment to further ensure the eligibility. For Exp-peri and HC-peri groups, participants had to be pregnant or up to 12 months postpartum. Women in the Exp-peri group met diagnostic criterion for an anxiety disorder (Generalized Anxiety Disorder, Social Anxiety Disorder, Panic Disorder, or Other-Specified Anxiety Disorder) and/ or a depressive disorder (Major Depressive Disorder, Persistent Depressive Disorder, or Other-Specified Depressive Disorder). Participants who were diagnosed with bipolar disorder, schizophrenia/ other psychotic disorders, substance abuse disorder, or at risk for suicide were excluded from the experiment. Participants were considered eligible if they held a past diagnosis but no longer met the criteria for any current mental disorders based on the assessment of M.I.N.I. and were assigned to either of the HC groups.

Table 1: *Demographic Characteristics for Experimental Group*

	Sample Size (N)	Percentage (%)
Maternal Status		
Pregnant	2	11.11
Postpartum	16	88.89
Employment Status		
Full Time	11	61.11
Part Time	3	16.67
Unemployed	4	22.22
Ethnicity		
African American	1	5.56
Hispanic	1	5.56
White, not of Hispanic Origin	13	72.22
Native American	2	11.11
Other	1	5.56
Marital Status		
Married/ Common Law	15	83.33
Single	3	16.67
Education		
Bachelor’s Degree	7	38.89
Certificate or Professional	5	27.78
Doctorate Degree	1	5.56

High School	1	5.56
Master's Degree	2	11.11
Other	2	11.11

Table 2: *Demographic Characteristics for Perinatal Healthy Control Group*

	Sample Size (N)	Percentage (%)
Maternal Status		
Pregnant	5	38.46
Postpartum	8	61.54
Employment Status		
Full Time	11	84.62
Part Time	2	15.38
Ethnicity		
African American	1	7.69
Asian/ Pacific Islander	1	7.69
White, not of Hispanic Origin	10	76.92
Other	1	7.69
Marital Status		
Married/ Common Law	11	84.62
Single	2	15.38
Education		
Bachelor's Degree	6	46.15
Master's Degree	3	23.08
Doctorate Degree	2	15.38
Certificate or Professional	2	15.38

Table 3: *Demographic Characteristics for Nulliparous Healthy Control Group*

	Sample Size (N)	Percentage (%)
Employment Status		
Full Time	10	58.82
Part Time	6	35.29
Unemployed	1	5.88
Ethnicity		
African American	2	11.76
Asian/ Pacific Islander	3	17.65
White, not of Hispanic Origin	10	58.82
Other	2	11.76
Marital Status		
Married/ Common Law	2	11.76
Single	15	88.24
Education		
High School	1	5.88
Bachelor’s Degree	6	35.29
Certificate or Professional	4	23.53
Doctorate Degree	1	5.88
Master’s Degree	4	23.53
Other	1	5.88

Procedure

The current study was incorpriated within a larger study that obstrained ethics approaval through HiREB (#4055). Participants who expressed interest in the study were contacted by a research assistant at the lab and engaged in a phone screening to ensure the inclusion/exclusion requirements for participating in the experiment were met. Eligible participants were invited to the lab to review the terms and conditions of the experiment with the research assistant. After verbal and written consent was obtained, a trained accessor conducted the Mini International Neuropsychiatric Interview (M.I.N.I.) with the participant to determine final eligibility. If eligible, participants were assigned into a group (Exp-peri, HC-peri, or HC-Null). The task for participants in each group was to perform an emotionally provoking experimental task by looking at three sets (positive, negative, neutral) of stimuli selected from the International Affective Picture System. Participants were asked to wear a heart rate monitor throughout the experiment, and their heart rate reactivity was measured during a ten-minute baseline and throughout the three tasks using the Polar V800 watch. Comparing the differences of heart rate reactivity across the three different conditions among the three different groups allowed us to examine the group (perinatal women with anxiety and/or depression, healthy perinatal women, and healthy nulliparous women) by condition (positive, negative, and neutral) interactions and further explore the specific role of emotional reactivity in perinatal anxiety and depression. The order of the three conditions and the pictures in each set was randomized for all participants to eliminate order effects. A mental health resources sheet and monetary reimbursement were provided for the participants after their completion of the experiment.

Measures

The heart rate reactivity was used as an indicator of emotional reactivity in the experiment (Giles, Draper, & Neil, 2016). To accurately measure the heart rate reactivity of the participants, Polar V800 watch was being selected as a tool due to its high validity (Giles, Draper, & Neil, 2016). This watch also tracks fitness and activity, and it was used to record participants' information, including birthday, age, height, and weight, at the beginning of the experiment. Participants were asked to wear the strap with the heart rate monitor around their chest and the watch on their wrist. The Polar V800 watch recorded participants' heart rates at the ten-minute baseline level and throughout the three experimental tasks that are designed to evoke emotions.

Data Analysis Strategy

The mean heart rate data for each condition in each group was used for comparison across the three conditions and the three groups. Mixed models of analyses of variance were used to look at group (Experimental, Perinatal HC, Nulliparous HC) by condition (positive, negative, and neutral) interactions to explore the possible relationship between emotional reactivity and different mental health conditions. Random forest imputation was used to fill in all missing values through using weighted means to replace the missing data. Shapiro-Walk's test of normality was conducted to test the assumptions of normality. Levene test was used to test for homogeneity of variance to examine the distribution of variance. To check for the group by group, condition by condition, and group by condition differences, mixed models of analyses of variance was used. All data analysis and graphs were conducted and generated through RStudio.

Results

Checking for Assumptions & Main Effects

Random forest imputation was used to replace the three missing values with weighted means, resulting in an increase of 6.25% of the sample size. The results from Shapiro-Walk's test of normality showed that the assumption for ANOVA were met. There was no significant p-value ($p > .05$), suggesting we do not have sufficient evidence to reject the null hypothesis of normality.

Table 4: *Shapiro-Wilk's Test of Normality*

Group	hr_condition	variable	statistic	p-value
1 Exp-peri	Baseline	hr_score	0.971	0.824
2 Exp-peri	Negative	hr_score	0.961	0.629
3 Exp-peri	Neutral	hr_score	0.941	0.297
4 Exp-peri	Positive	hr_score	0.965	0.706
5 HC-null	Baseline	hr_score	0.902	0.0731
6 HC-null	Negative	hr_score	0.869	0.0211
7 HC-null	Neutral	hr_score	0.960	0.639
8 HC-null	Positive	hr_score	0.896	0.0589
9 HC-peri	Baseline	hr_score	0.973	0.924
10 HC-peri	Negative	hr_score	0.899	0.128
11 HC-peri	Neutral	hr_score	0.952	0.623
12 HC-peri	Positive	hr_score	0.968	0.866

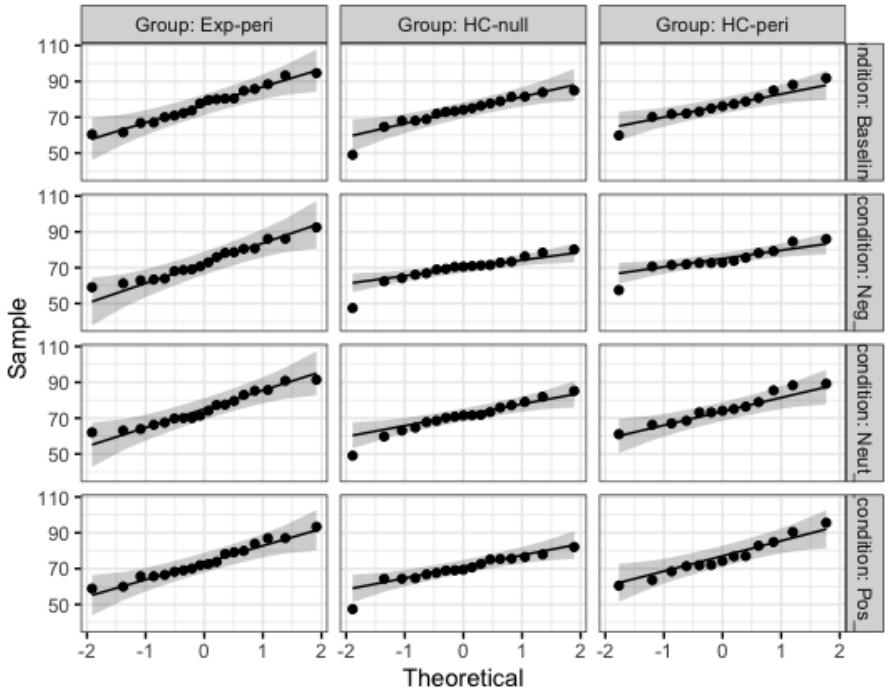

Figure 1 *Shapiro-Wilk's test of normality for the groups by conditions interactions' data (p> .05)*

Levene test was conducted to test the homogeneity of variance. The results demonstrated that the assumption of homoscedasticity has met, and the data have an equal distribution of variance as there was no significant p-value (see Table 5).

Table 5: *Levene Test for Homogeneity*

hr_condition	df1	df2	statistic	p-value
1 Baseline	2	45	0.733	0.486
2 Negative	2	45	2.20	0.123
3 Neutral	2	45	0.481	0.621
4 Positive	2	45	0.793	0.459

Mixed ANOVA was used to examine the main effect between groups, between conditions, and between groups and conditions. Results showed the conditions had significant main effects (p= .021), meaning conditions in this study controlled for a sufficient amount of variation.

Table 6: *ANOVA Table (type III tests)*

Effect	DFn	DFd	F	p p<.05	ges
1 Group	2	45	1.467	2.41e-01	0.055
2 Condition	3	135	8.537	3.12e-05	0.021*
3 Group x Condition	6	135	0.517	7.95e-01	0.003

** p< .05, results based on mixed model ANOVA*

Interactions Within Groups and Conditions

Pairwise t-test was conducted in order to determine whether there was a significant interaction between groups within each condition. Results found that there was no significant difference in heart rate reactivity among the three groups (Exp_peri, HC_null, and HC_peri) in any of the four conditions (baseline, positive, negative, and neutral) indicated in Table 7.

To examine the interaction between conditions within each group, pairwise t-test was used. Results indicated that there were significant changes in heart rates between baseline and positive condition and between baseline and negative condition in both Exp_peri (p= .009 and p= .017,

respectively) and HC_null groups (p= .014 and p= .011, respectively). No other significant heart rate reactivities were found in other condition by condition interactions within any other group (see Table 8).

Table 7: *Group by Group Interactions within Each Condition*

hr_condition	group1	group2	n1	n2	p	p.signif	p.adj	p.adj.signif
1 Baseline	Exp-peri	HC-null	18	17	0.258	ns	0.774	ns
2 Baseline	Exp-peri	HC-peri	18	13	0.956	ns	1	ns
3 Baseline	HC-null	HC-peri	17	13	0.324	ns	0.972	ns
4 Negative	Exp-peri	HC-null	18	17	0.186	ns	0.559	ns
5 Negative	Exp-peri	HC-peri	18	13	0.71	ns	1	ns
6 Negative	HC-null	HC-peri	17	13	0.116	ns	0.349	ns
7 Neutral	Exp-peri	HC-null	18	17	0.162	ns	0.485	ns
8 Neutral	Exp-peri	HC-peri	18	13	0.952	ns	1	ns
9 Neutral	HC-null	HC-peri	17	13	0.179	ns	0.536	ns
10 Positive	Exp-peri	HC-null	18	17	0.204	ns	0.611	ns
11 Positive	Exp-peri	HC-peri	18	13	0.517	ns	1	ns
12 Positive	HC-null	HC-peri	17	13	0.074	ns	0.222	ns

Results based on pairwise t-test

Table 8: *Condition by Condition Interactions within Each Group*

Group	condition1	condition2	n1	n2	statistic	df	p	p.adj	p.adj.signif
1 Exp-peri	Baseline	Negative	18	18	3.49	17	0.003	0.017	*
2 Exp-peri	Baseline	Neutral	18	18	1.44	17	0.168	1	ns
3 Exp-peri	Baseline	Positive	18	18	3.76	17	0.002	0.009	**
4 Exp-peri	Negative	Neutral	18	18	-1.35	17	0.194	1	ns
5 Exp-peri	Negative	Positive	18	18	-0.769	17	0.453	1	ns
6 Exp-peri	Neutral	Positive	18	18	1.04	17	0.314	1	ns
7 HC-null	Baseline	Negative	17	17	3.73	16	0.002	0.011	*
8 HC-null	Baseline	Neutral	17	17	2.92	16	0.01	0.06	ns
9 HC-null	Baseline	Positive	17	17	3.62	16	0.002	0.014	*
10 HC-null	Negative	Neutral	17	17	-1.05	16	0.308	1	ns
11 HC-null	Negative	Positive	17	17	-0.525	16	0.606	1	ns
12 HC-null	Neutral	Positive	17	17	0.665	16	0.516	1	ns
13 HC-peri	Baseline	Negative	13	13	2.60	12	0.023	0.139	ns
14 HC-peri	Baseline	Neutral	13	13	2.02	12	0.067	0.4	ns
15 HC-peri	Baseline	Positive	13	13	0.367	12	0.72	1	ns
16 HC-peri	Negative	Neutral	13	13	-0.720	12	0.485	1	ns
17 HC-peri	Negative	Positive	13	13	-0.810	12	0.434	1	ns
18 HC-peri	Neutral	Positive	13	13	-0.513	12	0.617	1	ns

** p< .05, ** p<.01; results based on pairwise t-test*

Mixed ANOVA was used to examine whether there was an overall significant condition by condition interaction in any of the three groups. Results demonstrated that there were significant physiological change in heart rate reactivities among different conditions in Exp_peri and HC_null group (p= .0016, and p= .000994, respectively). There was no significant change in heart rates among the three conditions and the baseline in HC_peri group (p= .389). These findings (see Table 9) further supported the results indicated in Table 8.

Table 9: *Overall Interactions within Each Group*

Group	Effect	DFn	DFd	F	p	`p<.05`	ges	p.adj
1 Exp-peri	hr_condition	2.16	36.7	4.52	0.016	"*"	0.023	0.048
2 HC-null	hr_condition	3	48	6.38	0.000994	"*"	0.039	0.00298
3 HC-peri	hr_condition	1.61	19.3	0.938	0.389	""	0.013	1

** p< .05, results based on pairwise t-test*

Interactions between Conditions, Groups, and Groups by Conditions

Pairwise t-test was conducted to examine whether there was a significant interaction between conditions and between baseline and each condition. Results found that there were significant interactions between baseline and positive condition, negative condition, and neutral condition (p= 8.62e-4, p= 5.90e-7, and p= 2.00e-3, respectively). No significant interactions were found between the three conditions (see Table 10).

Table 10: *Condition by Condition Interactions*

	condition1	condition2	n1	n2	statistic	df	p	p.adj	p.adj.signif
1	Baseline	Negative	48	48	5.77	47	5.90e-7	3.54e-6	****
2	Baseline	Neutral	48	48	3.34	47	2.00e-3	1.00e-2	**
3	Baseline	Positive	48	48	3.56	47	8.62e-4	5.00e-3	**
4	Negative	Neutral	48	48	-1.89	47	6.50e-2	3.91e-1	ns
5	Negative	Positive	48	48	-1.23	47	2.26e-1	1.00e+0	ns
6	Neutral	Positive	48	48	0.519	47	6.06e-1	1.00e+0	ns

*** p< .01, **** p< .0001; results based on pairwise t-test*

Pairwise t-test was conducted to examine whether there was a significant interaction between the three groups (Exp_peri, HC_peri, and HC_null). Results revealed that there were significant interactions between Exp_peri & HC_null group and between HC_null & HC_peri group (p= .00939 and p= .0039, respectively). The significant differences between the nulliparous group and the two perinatal groups supported the hypothesis of participants in the perinatal period (both Experimental and HC) would have heightened emotional reactivity compared to Nulliparous HC group. No significant difference was found between Exp_peri & HC_peri group (p= .604).

Table 11: *Group by Group Interactions*

group1	group2	n1	n2	p	p.signif	p.adj	p.adj.signif
1 Exp-peri	HC-null	72	68	0.00939	**	0.0282	*
2 Exp-peri	HC-peri	72	52	0.604	ns	1	ns
3 HC-null	HC-peri	68	52	0.0039	**	0.0117	*

** p< .05, ** p< .01; results based on pairwise t-test*

Group by Condition Interactions

Mixed models of analyses of variance was conducted to examine the group by condition interactions. Results have found no significant interactions between group and condition (p=.83) and no significant interactions between group and condition including baseline (p=.79).

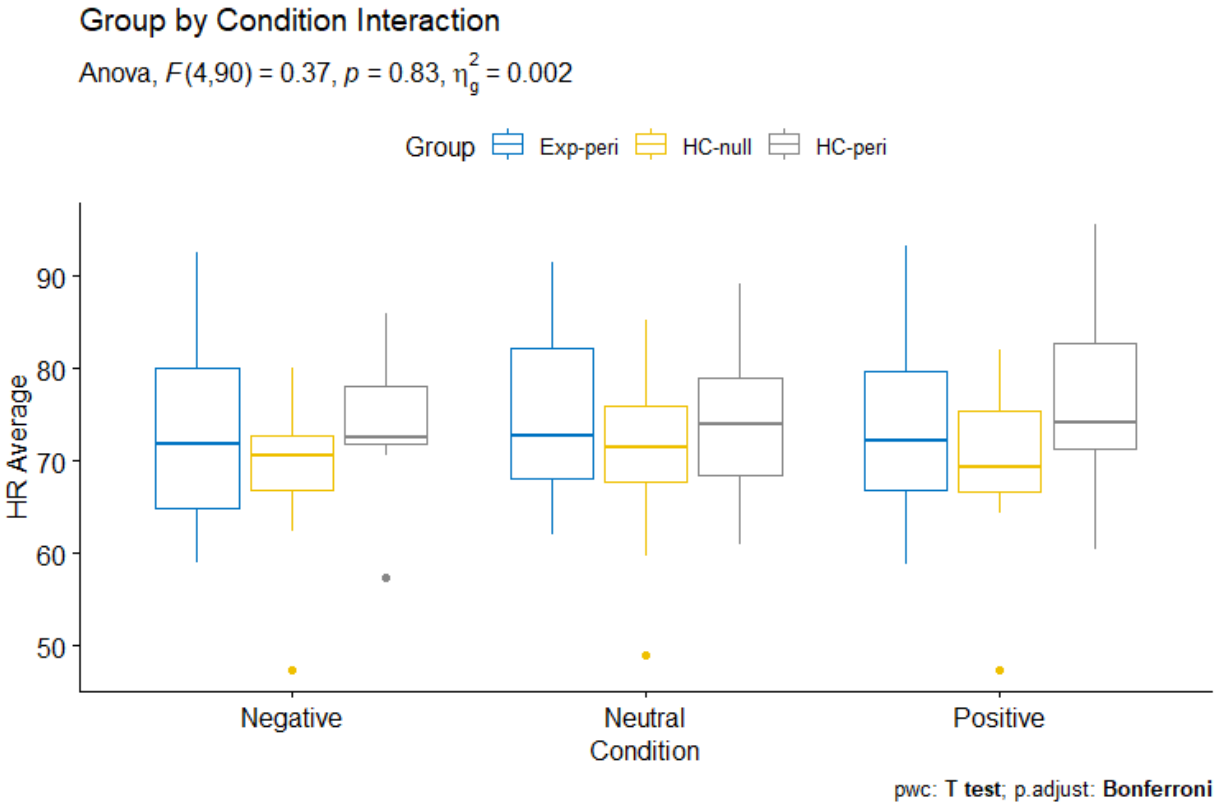

Figure 2 *Interactions between group and condition (p=.83)*

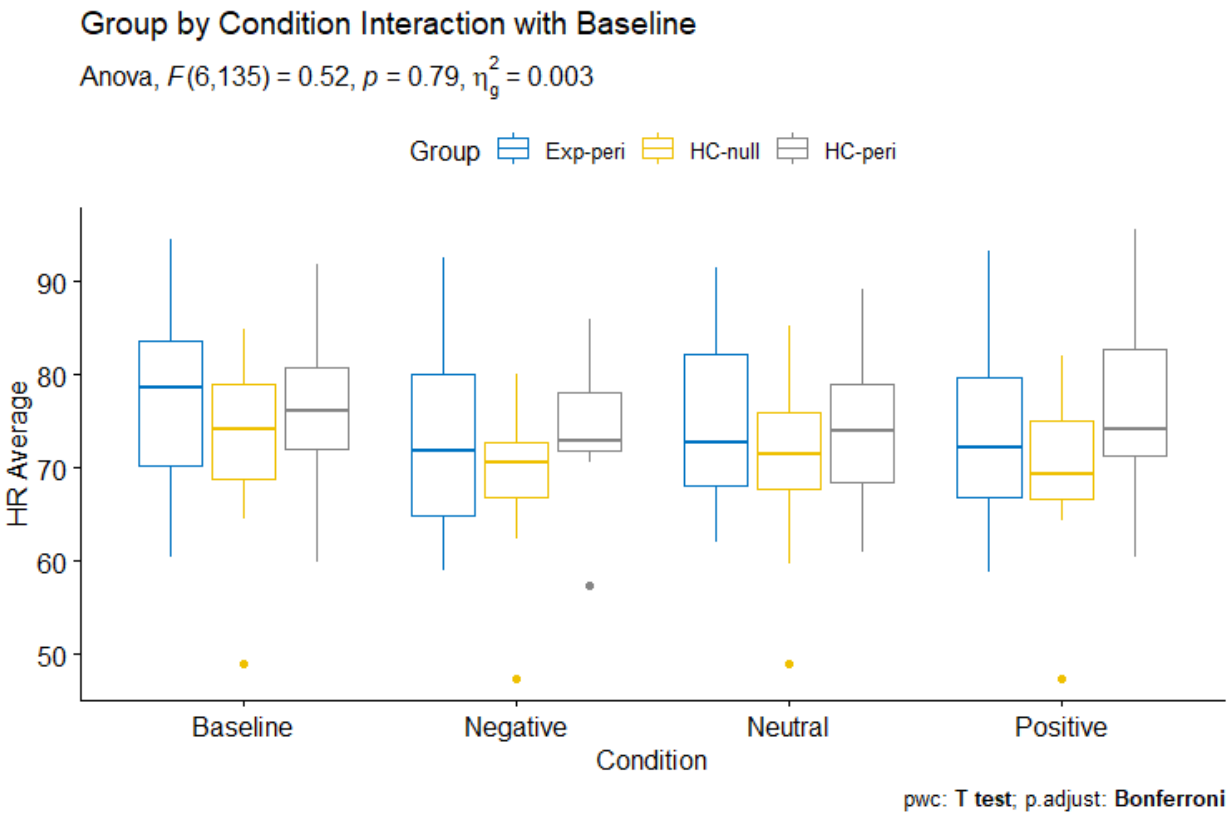

Figure 3 *Interactions between group and condition with baseline (p=.79)*

Discussion

The three main purposes for the current study were to 1) examine whether heart rate reactivity could be a marker of emotion dysregulation in women with anxiety and depression during pregnancy and the postpartum, 2) test whether there is a difference in emotional reactivity between women during the perinatal period with/ without anxiety and/or depression (Exp-peri group & HC-peri group) and healthy nulliparous women (HC-null group), and 3) determine whether there is a difference in emotional reactivity across the three groups. We hypothesized that participants in the perinatal period (both Experimental and HC) would have heightened emotional reactivity compared to Nulliparous HC group due to the perinatal period being a period of vulnerability. We also predicted that participants in the experimental group would demonstrate heightened emotional reactivity compared to perinatal HCs, suggesting that heightened reactivity might be linked to perinatal anxiety and depression.

We did not find any significant changes in physiological reactivities between the experimental group and the perinatal control group. Thus, we do not have enough evidence to support the hypothesis that the experimental group has greater emotional reactivity compared to the perinatal control group, at least as measured through heart rate reactivity. Also, we failed to detect any significant group by condition interactions or any significant physiological changes among the three conditions.

Limitations

When analyzing the findings about the results of the current study, it is worth noting that there are some limitations that could potentially impact the results. First, we had a small sample size in the study (n=48), with 18 participants in the experimental group,13 in the perinatal control

group, and 17 in the nulliparous group. The power analysis indicated that this study required 108 participants (36 participants in each group) to have enough statistical power. The lack of participants in each group decreased the statistical power, making it impossible to detect all the significant physiological changes in the experiment.

Also, the manipulations used in the study did not generate any significant physiological changes. The results demonstrated that there was no significant condition by condition interactions, meaning there was no significant heart rate reactivity changes among the three conditions (positive, negative, and neutral) in any of the three groups. Thus, the manipulations did not induce any significant changes in this study. Stronger stimuli may be needed for the emotionally provoking experimental task to fully capture the physiological changes. As well, the Polar V800 watch is not a sophisticated way to capture heart rate and that using other more powerful systems may have captured more nuances in the results.

Additionally, the physiological component of emotion dysregulation is the only component included in this study, and it did not provide insights for other components. The design of the experiment specifically focused on measuring the physiological component of emotion dysregulation in women with perinatal anxiety and/or depression, and the only assessment we used in this study was the Polar V800 watch to record heart rate. As women can experience a broad range of changes, including physiological, social, cognitive, and biological changes, during the perinatal period, it is possible that the main differences among the three groups are not in the physiological component. As well, emotion dysregulation is a very broad term, and it requires different measures to capture different aspects. Thus, more assessment tools should be used to achieve a more comprehensive conceptualization of emotion dysregulation and detect the

components that are responsible for the heightened number of anxiety and depressive disorders during the perinatal period.

Future Directions

Given that no known study has explored the relationship between emotional reactivity and perinatal anxiety and depressive disorders, further research is required to replicate and validate the findings in the study. It is necessary to determine whether the same results would be found through increasing the sample size to have enough statistical power and using different physiological measures to detect the physiological changes. The current study did not find a significant difference in heart rate reactivity on any of the groups. Thus, future research could specifically look into the difference between these two groups to further understand the role of emotional reactivity during the perinatal period. Also, future research could use more potent stimuli for the emotionally provoking experimental task to induce more emotional changes and to better detect the heart rate reactivities under the different conditions.

Additionally, future studies should use different measures to assess emotional reactivity. Emotion dysregulation, as an umbrella term, could be conceptualized in different ways. Thus, a multimethod approach is necessary to capture the broad aspects of emotion dysregulation and provide more accurate information. Future research should consider use of self-report questionnaires, cognitive measures, brain activity measures, and behaviour measures to examine different components of emotion dysregulation and to achieve a more intact picture of perinatal anxiety and depression.

Summary

To our knowledge, this is the first study to examine the role of emotional reactivity in women with perinatal anxiety and/ or depression. The results demonstrate a significant difference in emotional reactivity between women in the perinatal period and women who have never been pregnant before, suggesting both healthy women and women with anxiety and depression face a significant amount of mental health challenges during the perinatal period. These results may be used to inform future research examining emotional reactivity as a marker to detect early signs of mental health difficulties in perinatal women while advancing research to understand the increased rates of anxiety and depressive disorders during the perinatal period.

References

Adewuya, A. O., Ola, B. A., Aloba, O. O., & Mapayi, B. M. (2006). Anxiety disorders among Nigerian women in late pregnancy: a controlled study. *Archives of Womens Mental Health*, *9*(6), 325–328. doi: 10.1007/s00737-006-0157-5

Albert, U., Maina, G., & Bogetto, F. (2000). Obsessive compulsive disorder (OCD) and triggering life events. *European Journal of Psychiatry, 14*, 180–188.

Allen, M. T., Matthews, K. A., & Kenyon, K. L. (2000). The relationships of resting baroreflex sensitivity, heart rate variability and measures of impulse control in children and adolescents. *International Journal of Psychophysiology*, *37*(2), 185–194. doi: 10.1016/s0167-8760(00)00089-1

Altemus, M., Redwine, L. S., Leong, Y.-M., Frye, C. A., Porges, S. W., & Carter, C. S. (2001). Responses to Laboratory Psychosocial Stress in Postpartum Women. *Psychosomatic Medicine*, *63*(5), 814–821. doi: 10.1097/00006842-200109000-00015

Amstadter, A. (2008). Emotion regulation and anxiety disorders. *Journal of Anxiety Disorders*, *22*(2), 211–221. doi: 10.1016/j.janxdis.2007.02.004

Andersson, L., Sundström-Poromaa, I., Bixo, M., Wulff, M., Bondestam, K., & Åström, M. (2003). Point prevalence of psychiatric disorders during the second trimester of pregnancy: A population-based study. *American Journal of Obstetrics and Gynecology*, *189*(1), 148–154. doi: 10.1067/mob.2003.336

Appelhans, B. M., & Luecken, L. J. (2006). Heart Rate Variability as an Index of Regulated Emotional Responding. *Review of General Psychology*, *10*(3), 229–240. doi: 10.1037/1089-2680.10.3.229

Austin, M.-P., Hadzi-Pavlovic, D., Leader, L., Saint, K., & Parker, G. (2005). Maternal trait anxiety, depression and life event stress in pregnancy: relationships with infant temperament. *Early Human Development*, *81*(2), 183–190. doi: 10.1016/j.earlhumdev.2004.07.001

Ayers, S., & Pickering, A. D. (2001). Do Women Get Posttraumatic Stress Disorder as a Result of Childbirth? A Prospective Study of Incidence. *Birth*, *28*(2), 111–118. doi: 10.1046/j.1523-536x.2001.00111.x

Bale, T. L., Baram, T. Z., Brown, A. S., Goldstein, J. M., Insel, T. R., Mccarthy, M. M., … Nestler, E. J. (2010). Early Life Programming and Neurodevelopmental Disorders. *Biological Psychiatry*, *68*(4), 314–319. doi: 10.1016/j.biopsych.2010.05.028

Bandelow, B., Sojka, F., Broocks, A., Hajak, G., Bleich, S., & Rüther, E. (2006). Panic disorder during pregnancy and postpartum period. *European Psychiatry*, *21*(7), 495–500. doi: 10.1016/j.eurpsy.2005.11.005

Barnett, B., Schaafsma, M. F., Guzman, A.-M., & Parker, G. B. (1991). Maternal Anxiety: a 5 Year Review of an Intervention Study. *Journal of Child Psychology and Psychiatry*, *32*(3), 423–438. doi: 10.1111/j.1469-7610.1991.tb00321.x

Baxter, A. J., Scott, K. M., Vos, T., & Whiteford, H. A. (2012). Global prevalence of anxiety disorders: a systematic review and meta-regression. *Psychological Medicine*, *43*(5), 897 910. doi: 10.1017/s003329171200147x

Beeghly, M., Weinberg, M., Olson, K. L., Kernan, H., Riley, J., & Tronick, E. Z. (2002). Stability and change in level of maternal depressive symptomatology during the first postpartum year. *Journal of Affective Disorders*, *71*(1-3), 169–180. doi: 10.1016/s0165 0327(01)00409-8

Bergman, K., Sarkar, P., Oconnor, T. G., Modi, N., & Glover, V. (2007). Maternal Stress During Pregnancy Predicts Cognitive Ability and Fearfulness in Infancy. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*(11), 1454–1463. doi: 10.1097/chi.0b013e31814a62f6

Blair, M. M., Glynn, L. M., Sandman, C. A., & Davis, E. P. (2011). Prenatal maternal anxiety and early childhood temperament. *Stress*, *14*(6), 644–651. doi: 10.3109/10253890.2011.594121

Bolton, H. L., Hughes, P. M., Turton, P., & Sedgwick, P. (1998). Incidence and demographic correlates of depressive symptoms during pregnancy in an inner London population. *Journal of Psychosomatic Obstetrics & Gynecology*, *19*(4), 202–209. doi: 10.3109/01674829809025698

Brockington, I. F., Macdonald, E., & Wainscott, G. (2006). Anxiety, obsessions and morbid preoccupations in pregnancy and the puerperium. *Archives of Womens Mental Health*, *9*(5), 253–263. doi: 10.1007/s00737-006-0134-z

Brockington, I. (2004). Postpartum psychiatric disorders. *The Lancet*, *363*(9414), 303–310. doi: 10.1016/s0140-6736(04)15858-3

Brown, T. A., Campbell, L. A., Lehman, C. L., Grisham, J. R., & Mancill, R. B. (2001). Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. *Journal of Abnormal Psychology*, *110*(4), 49–58. doi: 10.1037/0021 843x.110.4.585

Buss, C., Davis, E. P., Muftuler, L. T., Head, K., & Sandman, C. A. (2010). High pregnancy anxiety during mid-gestation is associated with decreased gray matter density in 6–9

year-old children. *Psychoneuroendocrinology*, *35*(1), 141–153. doi: 10.1016/j.psyneuen.2009.07.010

Bylsma, L. M., Taylor-Clift, A., & Rottenberg, J. (2011). Emotional reactivity to daily events in major and minor depression. *Journal of Abnormal Psychology*, *120*(1), 155–167. doi: 10.1037/a0021662

Casement, M. D., Shestyuk, A. Y., Best, J. L., Casas, B. R., Glezer, A., Segundo, M. A., & Deldin, P. J. (2008). Anticipation of affect in dysthymia: Behavioral and neurophysiological indicators. *Biological Psychology*, *77*(2), 197–204. doi: 10.1016/j.biopsycho.2007.10.007

Cohen, A. S., & Minor, K. S. (2010). Emotional Experience in Patients With Schizophrenia Revisited: Meta-analysis of Laboratory Studies. *Schizophrenia Bulletin*, *36*(1), 143–150. doi: 10.1093/schbul/sbn061

Csatordai, S., Kozinszky, Z., Devosa, I., Tóth, É., Krajcsi, A., Sefcsik, T., & Pál, A. (2007). Obstetric and sociodemographic risk of vulnerability to postnatal depression. *Patient Education and Counseling*, *67*(1-2), 84–92. doi: 10.1016/j.pec.2007.02.004

Cwikel, J., Gidron, Y., & Sheiner, E. (2004). Psychological interactions with infertility among women. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *117*(2), 126–131. doi: 10.1016/j.ejogrb.2004.05.004

Czarnocka, J., & Slade, P. (2000). Prevalence and predictors of post-traumatic stress symptoms following childbirth. *British Journal of Clinical Psychology*, *39*(1), 35–51. doi: 10.1348/014466500163095

Darwin, C. (1872). The expression of the emotions in man and animals. doi: 10.1037/10001-000

Davidson, R. J. (1998). Affective Style and Affective Disorders: Perspectives from Affective Neuroscience. *Cognition & Emotion*, *12*(3), 307–330. doi: 10.1080/026999398379628

Davis, E. P., Glynn, L. M., Schetter, C. D., Hobel, C., Chicz-Demet, A., & Sandman, C. A. (2007). Prenatal Exposure to Maternal Depression and Cortisol Influences Infant Temperament. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*(6), 737–746. doi: 10.1097/chi.0b013e318047b775

Davis, E. P., & Sandman, C. A. (2010). The Timing of Prenatal Exposure to Maternal Cortisol and Psychosocial Stress Is Associated With Human Infant Cognitive Development. *Child Development*, *81*(1), 131–148. doi: 10.1111/j.1467-8624.2009.01385.x

Davis, E. P., Snidman, N., Wadhwa, P. D., Glynn, L. M., Schetter, C. D., & Sandman, C. A. (2004). Prenatal Maternal Anxiety and Depression Predict Negative Behavioral Reactivity in Infancy. *Infancy*, *6*(3), 319–331. doi: 10.1207/s15327078in0603_1

Davé, S., Petersen, I., Sherr, L., & Nazareth, I. (2010). Incidence of Maternal and Paternal Depression in Primary Care. *Archives of Pediatrics & Adolescent Medicine*, *164*(11), 1038–1044. doi: 10.1001/archpediatrics.2010.184

Diaz, S. F., Grush, L. R., Sichel, D. A., & Cohen, L. S. (1997). Obsessive-compulsive disorder in pregnancy and the puerprium. In: M. T. Pato & G. Steketee (Eds.), *OCD across the life cycle* (pp. 97–112). Washington, DC: American Psychiatric Association Press.

Dillon, D. G., Deveney, C. M., & Pizzagalli, D. A. (2011). From Basic Processes to Real-World Problems: How Research on Emotion and Emotion Regulation Can Inform Understanding of Psychopathology, and Vice Versa. *Emotion Review*, *3*(1), 74–82. doi: 10.1177/1754073910380973

Etkin, A., & Wager, T. D. (2007). Functional Neuroimaging of Anxiety: A Meta-Analysis of Emotional Processing in PTSD, Social Anxiety Disorder, and Specific Phobia. *American Journal of Psychiatry*, *164*(10), 1476–1488. doi: 10.1176/appi.ajp.2007.07030504

Fabes, R. A., Eisenberg, N., & Eisenbud, L. (1993). Behavioral and physiological correlates of childrens reactions to others in distress. *Developmental Psychology*, *29*(4), 655–663. doi: 10.1037/0012-1649.29.4.655

Fabes, R. A., Eisenberg, N., Karbon, M., Troyer, D., & Switzer, G. (1994). The Relations of Childrens Emotion Regulation to Their Vicarious Emotional Responses and Comforting Behaviors. *Child Development*, *65*(6), 1678. doi: 10.2307/1131287

Fabes, R. A., & Eisenberg, N. (1997). Regulatory control and adults stress-related responses to daily life events. *Journal of Personality and Social Psychology*, *73*(5), 1107–1117. doi: 10.1037/0022-3514.73.5.1107

Fairbrother, N., Janssen, P., Antony, M. M., Tucker, E., & Young, A. H. (2016). Perinatal anxiety disorder prevalence and incidence. *Journal of Affective Disorders*, *200*, 148–155. doi: 10.1016/j.jad.2015.12.082

Fairclough, S.H., & Houston, K. (2004). A metabolic measure of mental effort. *Biological Psychology, 66,* 177–190.

Fuller, B. (1992). The effects of stress-anxiety and coping styles on heart rate variability. *International Journal of Psychophysiology*, *12*(1), 81–86. doi: 10.1016/0167 8760(92)90045-d

Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal Depression. *Obstetrics & Gynecology*, *106*(5, Part 1), 1071–1083. doi: 10.1097/01.aog.0000183597.31630.db

Gaynes, B. N., Gavin, N., Meltzer-Brody, S., Lohr, K. N., Swinson, T., Gartlehner, G., … Miller, W. C. (2005). Perinatal Depression: Prevalence, Screening Accuracy, and Screening Outcomes: Evidence Report/Technology Assessment, Number 119. *PsycEXTRA Dataset*, 1–8. doi: 10.1037/e439372005-001

Giardinelli, L., Innocenti, A., Benni, L., Stefanini, M. C., Lino, G., Lunardi, C., … Faravelli, C. (2011). Depression and anxiety in perinatal period: prevalence and risk factors in an Italian sample. *Archives of Womens Mental Health*, *15*(1), 21–30. doi: 10.1007/s00737 011-0249-8

Giles, D., Draper, N., & Neil, W. (2015). Validity of the Polar V800 heart rate monitor to measure RR intervals at rest. *European Journal of Applied Physiology*, *116*(3), 563–571. doi: 10.1007/s00421-015-3303-9

Gondoli, D. M., & Silverberg, S. B. (1997). Maternal emotional distress and diminished responsiveness: The mediating role of parenting efficacy and parental perspective taking. *Developmental Psychology*, *33*(5), 861–868. doi: 10.1037/0012-1649.33.5.861

Goodman, J. H., & Tyer-Viola, L. (2010). Detection, Treatment, and Referral of Perinatal Depression and Anxiety by Obstetrical Providers. *Journal of Womens Health*, *19*(3), 477–490. doi: 10.1089/jwh.2008.1352

Green, S. M., Haber, E., Frey, B. N., & Mccabe, R. E. (2015). Cognitive-behavioral group treatment for perinatal anxiety: a pilot study. *Archives of Womens Mental Health*, *18*(4), 631–638. doi: 10.1007/s00737-015-0498-z

Gross, H. S., & Damasio, A. (2004). Looking for Spinoza: Joy, Sorrow, and the Feeling Brain. *The Journal of Nervous and Mental Disease*, *192*(6), 450–451. doi: 10.1097/01.nmd.0000130139.70393.da

Gross, J. J., & Muñoz, R. F. (1995). Emotion Regulation and Mental Health. *Clinical Psychology: Science and Practice, 2*(2), 151–164. doi: 10.1111/j.1468 2850.1995.tb00036.x

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*(1), 224–237. doi: 10.1037/0022-3514.74.1.224

Gross, J. J. (2013). Emotion regulation: Taking stock and moving forward. *Emotion, 13*(3), 359 365. doi: 10.1037/a0032135

Gross, J. J., & Jazaieri, H. (2014). Emotion, Emotion Regulation, and Psychopathology. *Clinical Psychological Science*, *2*(4), 387–401. doi: 10.1177/2167702614536164

Gross, J. J. (1998). The Emerging Field of Emotion Regulation: An Integrative Review. *Review of General Psychology*, *2*(3), 271–299. doi: 10.1037/1089-2680.2.3.271

Gross, J. J., Sheppes, G., & Urry, H. L. (2011). Emotion generation and emotion regulation: A distinction we should make (carefully). *Cognition & Emotion*, *25*(5), 765–781. doi: 10.1080/02699931.2011.555753

Hansen, A. L., Johnsen, B. H., & Thayer, J. F. (2003). Vagal influence on working memory and attention. *International Journal of Psychophysiology*, *48*(3), 263–274. doi: 10.1016/s0167-8760(03)00073-4

Heron, J., Oconnor, T. G., Evans, J., Golding, J., & Glover, V. (2004). The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of Affective Disorders, 80*(1), 65–73. doi: 10.1016/j.jad.2003.08.004

Hertzberg, T., & Wahlbeck, K. (1996). The impact of pregnancy and puerperium on panic disorder: A review. *Journal of Psychosomatic Obstetrics & Gynecology*, *20*(2), 59–64. doi: 10.3109/01674829909075578

Hock, E., Mcbride, S., & Gnezda, M. T. (1989). Maternal Separation Anxiety: Mother-Infant Separation from the Maternal Perspective. *Child Development*, *60*(4), 793–802. doi: 10.2307/1131019

Ingjaldsson, J. T., Laberg, J. C., & Thayer, J. F. (2003). Reduced heart rate variability in chronic alcohol abuse: relationship with negative mood, chronic thought suppression, and compulsive drinking. *Biological Psychiatry*, *54*(12), 1427–1436. doi: 10.1016/s0006 3223(02)01926-1

Jazaieri, H., Urry, H. L., & Gross, J. J. (2013). Affective Disturbance and Psychopathology: An Emotion Regulation Perspective. *Journal of Experimental Psychopathology*, *4*(5), 584 599. doi: 10.5127/jep.030312

Johnsen, B. H., Thayer, J. F., Laberg, J. C., Wormnes, B., Raadal, M., Skaret, E., … Berg, E.(2003). Attentional and physiological characteristics of patients with dental anxiety. *Journal of Anxiety Disorders*, *17*(1), 75–87. doi: 10.1016/s0887-6185(02)00178-0

Kaplan, L. A., Evans, L., & Monk, C. (2007). Effects of mothers prenatal psychiatric status and postnatal caregiving on infant biobehavioral regulation: Can prenatal programming be modified? *Early Human Development*, *84*(4), 249–256. doi: 10.1016/j.earlhumdev.2007.06.004

Kashdan, T. B., Elhai, J. D., & Frueh, B. C. (2006). Anhedonia and emotional numbing in combat veterans with PTSD. *Behaviour Research and Therapy*, *44*(3), 457–467. doi: 10.1016/j.brat.2005.03.001

Keltner, D., & Kring, A. M. (1998). Emotion, Social Function, and Psychopathology. *Review of General Psychology*, *2*(3), 320–342. doi: 10.1037/1089-2680.2.3.320

Kessler, R. (1993). Sex and depression in the National Comorbidity Survey I: Lifetime prevalence, chronicity and recurrence. *Journal of Affective Disorders*, *29*(2-3), 85–96. doi: 10.1016/0165-0327(93)90026-g

Lang, P. J., Greenwald, M. K., Bradley, M. M., & Hamm, A. O. (1993). Looking at pictures: Affective, facial, visceral, and behavioral reactions. *Psychophysiology*, *30*(3), 261–273. doi: 10.1111/j.1469-8986.1993.tb03352.x

Lang, P. J. (1994). The varieties of emotional experience: A meditation on James-Lange theory. *Psychological Review*, *101*(2), 211–221. doi: 10.1037/0033-295x.101.2.211

Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC Psychiatry*, *8*(1). doi: 10.1186/1471-244x-8-24

Levenson, R. W. (2006). Blood, Sweat, and Fears. *Annals of the New York Academy of Sciences*, *1000*(1), 348–366. doi: 10.1196/annals.1280.016

Macleod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology*, *95*(1), 15–20. doi: 10.1037/0021-843x.95.1.15

Maina, G., Albert, U., Bogetto, F., Vaschetto, P., & Ravizza, L. (1999). Recent life events and obsessive–compulsive disorder (OCD): the role of pregnancy/delivery. *Psychiatry Research*, *89*(1), 49–58. doi: 10.1016/s0165-1781(99)00090-6

Marcus, S. M., Flynn, H. A., Blow, F. C., & Barry, K. L. (2003). Depressive Symptoms among Pregnant Women Screened in Obstetrics Settings. *Journal of Womens Health*, *12*(4), 373–380. doi: 10.1089/154099903765448880

Martijn, C., Tenbult, P., Merckelbach, H., Dreezens, E., & de Vries, N.K. (2002). Getting a grip on ourselves: Challenging expectan- cies about loss of energy after self-control. *Social Cognition, 20,* 441–460.

Mathews, A., & Macleod, C. (1994). Cognitive Approaches to Emotion and Emotional Disorders. *Annual Review of Psychology*, *45*(1), 25–50. doi: 10.1146/annurev.ps.45.020194.000325

Matthey, S., Barnett, B., Howie, P., & Kavanagh, D. J. (2003). Diagnosing postpartum depression in mothers and fathers: whatever happened to anxiety? *Journal of Affective Disorders*, *74*(2), 139–147. doi: 10.1016/s0165-0327(02)00012-5

Mauss, I., Wilhelm, F., & Gross, J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression, and bodily responding. *Cognition & Emotion*, *18*(5), 631–642. doi: 10.1080/02699930341000112

Mineka, S., & Sutton, S. K. (1992). Cognitive Biases and the Emotional Disorders. *Psychological Science*, *3*(1), 65–69. doi: 10.1111/j.1467-9280.1992.tb00260.x

Moehler, E., Brunner, R., Wiebel, A., Reck, C., & Resch, F. (2006). Maternal depressive symptoms in the postnatal period are associated with long-term impairment of mother child bonding. *Archives of Womens Mental Health*, *9*(5), 273–278. doi: 10.1007/s00737 006-0149-5

Monk, C., Spicer, J., & Champagne, F. A. (2012). Linking prenatal maternal adversity to developmental outcomes in infants: The role of epigenetic pathways. *Development and Psychopathology, 24*(4), 1361–1376. doi: 10.1017/s0954579412000764

Mota, N., Cox, B. J., Enns, M. W., Calhoun, L., & Sareen, J. (2008). The relationship between mental disorders, quality of life, and pregnancy: Findings from a nationally representative sample. *Journal of Affective Disorders*, *109*(3), 300–304. doi: 10.1016/j.jad.2007.12.002

Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin, 29,* 894–906.

Nock, M. K., Wedig, M. M., Holmberg, E. B., & Hooley, J. M. (2008). The Emotion Reactivity Scale: Development, Evaluation, and Relation to Self-Injurious Thoughts and Behaviors. *Behavior Therapy*, *39*(2), 107–116. doi: 10.1016/j.beth.2007.05.005

O'Connor, M.-F., Allen, J. J., & Kaszniak, A. W. (2002). Autonomic and emotion regulation in bereavement and depression. *Journal of Psychosomatic Research*, *52*(4), 183–185. doi: 10.1016/s0022-3999(02)00292-1

O'Connor, T. G., Heron, J., & Glover, V. (2002). Antenatal Anxiety Predicts Child Behavioral/Emotional Problems Independently of Postnatal Depression. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(12), 1470–1477. doi: 10.1097/00004583-200212000-00019

O'Connor, T. G., Heron, J., Golding, J., & Glover, V. (2003). Maternal antenatal anxiety and behavioural/emotional problems in children: a test of a programming hypothesis. *Journal of Child Psychology and Psychiatry, 44*(7), 1025–1036. doi: 10.1111/1469-7610.00187

Ohara, M. W., & Swain, A. M. (1996). Rates and risk of postpartum depression—a meta-analysis. *International Review of Psychiatry*, *8*(1), 37–54. doi: 10.3109/09540269609037816

Orr, S. T., Reiter, J. P., Blazer, D. G., & James, S. A. (2007). Maternal Prenatal Pregnancy Related Anxiety and Spontaneous Preterm Birth in Baltimore, Maryland. *Psychosomatic Medicine*, *69*(6), 566–570. doi: 10.1097/psy.0b013e3180cac25d

Pawlby, S., Hay, D. F., Sharp, D., Waters, C. S., & Okeane, V. (2009). Antenatal depression predicts depression in adolescent offspring: Prospective longitudinal community-based study. *Journal of Affective Disorders*, *113*(3), 236–243. doi: 10.1016/j.jad.2008.05.018

Pawlby, S., Hay, D., Sharp, D., Waters, C. S., & Pariante, C. M. (2011). Antenatal depression and offspring psychopathology: the influence of childhood maltreatment. *British Journal of Psychiatry*, *199*(2), 106–112. doi: 10.1192/bjp.bp.110.087734

Pitt, B. (1968). "Atypical" Depression Following Childbirth. *British Journal of Psychiatry*, *114*(516), 1325–1335. doi: 10.1192/bjp.114.516.1325

Pruessner, J. C., Dedovic, K., Khalili-Mahani, N., Engert, V., Pruessner, M., Buss, C., … Lupien, S. (2008). Deactivation of the Limbic System During Acute Psychosocial Stress: Evidence from Positron Emission Tomography and Functional Magnetic Resonance Imaging Studies. *Biological Psychiatry*, *63*(2), 234–240. doi: 10.1016/j.biopsych.2007.04.041

Reck, C., Klier, C. M., Pabst, K., Stehle, E., Steffenelli, U., Struben, K., & Backenstrass, M. (2006). The German version of the Postpartum Bonding Instrument: Psychometric properties and association with postpartum depression. *Archives of Womens Mental Health*, *9*(5), 265–271. doi: 10.1007/s00737-006-0144-x

Rice, F., Harold, G. T., Boivin, J., Bree, M. V. D., Hay, D. F., & Thapar, A. (2009). The links between prenatal stress and offspring development and psychopathology: disentangling

environmental and inherited influences. *Psychological Medicine*, *40*(2), 335–345. doi: 10.1017/s0033291709005911

Ritter, C., Hobfoll, S. E., Lavin, J., Cameron, R. P., & Hulsizer, M. R. (2000). Stress, psychosocial resources, and depressive symptomatology during pregnancy in low income, inner-city women. *Health Psychology*, *19*(6), 576–585. doi: 10.1037/0278 6133.19.6.576

Rodgers, C. S., Lang, A. J., Twamley, E. W., & Stein, M. B. (2003). Sexual Trauma and Pregnancy: A Conceptual Framework. *Journal of Womens Health*, *12*(10), 961–970. doi: 10.1089/154099903322643884

Rottenberg, J., Kasch, K. L., Gross, J. J., & Gotlib, I. H. (2002). Sadness and amusement reactivity differentially predict concurrent and prospective functioning in major depressive disorder. *Emotion*, *2*(2), 135–146. doi: 10.1037/1528-3542.2.2.135

Rubertsson, C., Waldenström, U., & Wickberg, B. (2003). Depressive mood in early pregnancy: Prevalence and women at risk in a national Swedish sample. *Journal of Reproductive and Infant Psychology*, *21*(2), 113–123. doi: 10.1080/0264683031000124073

Sandman, C. A., Davis, E. P., Buss, C., & Glynn, L. M. (2011). Exposure to Prenatal Psychobiological Stress Exerts Programming Influences on the Mother and Her Fetus. *Neuroendocrinology*, *95*(1), 8–21. doi: 10.1159/000327017

Sartorius, N., Üstün, T. B., Lecrubier, Y., & Wittchen, H.-U. (1996). Depression Comorbid with Anxiety: Results from the WHO Study on Psychological Disorders in Primary Health Care. *British Journal of Psychiatry*, *168*(S30), 38–43. doi: 10.1192/s0007125000298395

Schmeichel, B.J., Vohs, K.D., & Baumeister, R.F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85,* 33–46.

Segerstrom, S. C., & Nes, L. S. (2007). Heart Rate Variability Reflects Self-Regulatory Strength, Effort, and Fatigue. *Psychological Science, 18*(3), 275–281. doi: 10.1111/j.1467 9280.2007.01888.x

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion Regulation and Psychopathology. *Annual Review of Clinical Psychology, 11*(1), 379–405. doi: 10.1146/annurev-clinpsy-032814 112739

Sholomskas, D. E., Wickamaratne, P. J., Dogolo, L., O'Brien, D. W., Leaf, P. J., & Woods, S. W. (1993). Postpartum onset of panic disorder: a coincidental event? *Journal of Clinical Psychiatry, 54,* 476–480.

Small, D.M., Zatorre, R.J., Dagher, A., Evans, A.C., & Jones-Gotman, M. (2001). Changes in brain activity related to eating chocolate: From pleasure to aversion. *Brain, 124,* 1720–1733.

Sichel, D. A., Cohen, L. S., Dimmock, J. A., & Rosenbaum, J. F. (1993). Postpartum obsessive compulsive disorder: a case series. *Journal of Clinical Psychiatry, 54,* 156–159.

Strauss, G. P., Robinson, B. M., Waltz, J. A., Frank, M. J., Kasanova, Z., Herbener, E. S., & Gold, J. M. (2011). Patients With Schizophrenia Demonstrate Inconsistent Preference Judgments for Affective and Nonaffective Stimuli. *Schizophrenia Bulletin, 37*(6), 1295 1304. doi: 10.1093/schbul/sbq047

Susser, E., Hoek, H. W., & Brown, A. (1998). Neurodevelopmental Disorders after Prenatal Famine: The Story of the Dutch Famine Study. *American Journal of Epidemiology*, *147*(3), 213–216. doi: 10.1093/oxfordjournals.aje.a009439

Sutterdallay, A., Giaconnemarcesche, V., Glatignydallay, E., & Verdoux, H. (2004). Women with anxiety disorders during pregnancy are at increased risk of intense postnatal depressive symptoms: a prospective survey of the MATQUID cohort. *European Psychiatry*, *19*(8), 459–463. doi: 10.1016/j.eurpsy.2004.09.025

Tietz, A., Zietlow, A.-L., & Reck, C. (2014). Maternal bonding in mothers with postpartum anxiety disorder: the crucial role of subclinical depressive symptoms and maternal avoidance behaviour. *Archives of Womens Mental Health*, *17*(5), 433–442. doi: 10.1007/s00737-014-0423-x

Van Den Bergh, B. R., Calster, B. V., Smits, T., Huffel, S. V., & Lagae, L. (2008). Antenatal Maternal Anxiety is Related to HPA-Axis Dysregulation and Self-Reported Depressive Symptoms in Adolescence: A Prospective Study on the Fetal Origins of Depressed Mood. *Neuropsychopharmacology*, *33*(9), 536–545. doi: 10.1038/sj.npp.1301540

Van den Bergh, B. R., Mennes, M., Oosterlaan, J., Stevens, V., Stiers, P., Marcoen, A., & Lagae, L. (2005). High antenatal maternal anxiety is related to impulsivity during performance on cognitive tasks in 14- and 15-year-olds. *Neuroscience & Biobehavioral Reviews*, *29*(2), 259–269. doi: 10.1016/j.neubiorev.2004.10.010

Weinstock, M. (2005). The potential influence of maternal stress hormones on development and mental health of the offspring. *Brain, Behavior, and Immunity*, *19*(4), 296–308. doi: 10.1016/j.bbi.2004.09.006

Wenzel, A., Gorman, L. L., Ohara, M. W., & Stuart, S. (2001). The occurrence of panic and obsessive compulsive symptoms in women with postpartum dysphoria: a prospective study. *Archives of Womens Mental Health*, *4*(1), 5–12. doi: 10.1007/s007370170002

Wenzel, A., Haugen, E. N., Jackson, L. C., & Brendle, J. R. (2005). Anxiety symptoms and disorders at eight weeks postpartum. *Journal of Anxiety Disorders*, *19*(3), 295–311. doi: 10.1016/j.janxdis.2004.04.001

Wijma, K., Söderquist, J., & Wijma, B. (1997). Posttraumatic stress disorder after childbirth: A cross sectional study. *Journal of Anxiety Disorders*, *11*(6), 587–597. doi: 10.1016/s0887 6185(97)00041-8

Wittchen, H.-U., Carter, R. M., Pfister, H., Montgomery, S. A., & Kessler, R. C. (2000). Disabilities and quality of life in pure and comorbid generalized anxiety disorder and major depression in a national survey. *International Clinical Psychopharmacology*, *15*(6), 319–328. doi: 10.1097/00004850-200015060-00002