CORRELATIONS BETWEEN PRIMARY MATERNAL PREOCCUPATION, MATERNAL DEPRESSION AND ANXIETY, AND INFANT PAIN BEHAVIOUR SELF-REGULATION

by

Brianne Juella Bourdon

BSN, Thompson Rivers University, 2007

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Abstract

Identifying mechanisms that may underlie alteration in infant pain behaviour is important for preventing the adverse impacts of routine infant pain. While it is known that prenatal maternal depression and anxiety (MDA) predicts postnatal alteration in infant pain behaviour self-regulation, the contribution of prenatal primary maternal preoccupation (PMP) on infant pain behaviour remains unknown. The twofold aims of this secondary analysis study were to compare measures of PMP between mothers with and without MDA during the second trimester of pregnancy and relationships between and amongst prenatal MDA and PMP and postnatal infant pain behaviour self-regulation in a matched sample of 21 mother-infant dyads.

Analyses of MDA were based on data from the EPDS, HAM-D, and HAM-A tools that mothers completed at second trimester and the analysis of three measures of alteration in infant pain behaviour self-regulation (strained/erratic limb movement, immobility, and weak/exhausted cry) from the original study. The analysis of PMP measures were based on the sum of PMP scale scores for each of the seven PMP behaviours and a total PMP score calculated across the seven behaviours.

As hypothesized, mothers with MDA had significantly higher PMP scores at second trimester and excessive PMP predicted strained/erratic limb movement and immobility in infants with prenatal MDA exposure. These findings support and extend findings of the original study. They suggest that PMP and MDA are comorbid during pregnancy and that both may contribute to infant pain behaviour dysregulation and delay in recovery from pain.

More research is required to help validate the preliminary PMP study findings. Future studies should include concurrent analysis of prenatal data from mothers (MDA, PMP) and
postnatal data from mothers (caregiving behaviour, salivary cortisol) and infant (changes in heart rate, salivary cortisol, facial action, behavioural self-regulation). This will further understanding of the underlying role that MDA and PMP play on infant pain response and will help inform targeted development of infant pain interventions sensitive to the needs of mothers with prenatal mental health conditions and their infants as appropriate.
Preface

This thesis is an original, unpublished, independent work by Brianne Bourdon.

Ethical approval for this study involving analysis of secondary data was obtained from the UBC Research Ethics Board, Children's and Women's Research Ethics Board certificate number H15-01167.
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<tr>
<td>BL</td>
<td>Baseline</td>
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<tr>
<td>EPDS</td>
<td>Edinburgh Postnatal Depression Scale</td>
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<td>HAM-A</td>
<td>Hamilton Anxiety Scale</td>
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<td>HAM-D</td>
<td>Hamilton Depression Scale</td>
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<tr>
<td>HL</td>
<td>Heel lance</td>
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<td>HPA</td>
<td>Hypothalamic-Pituitary Adrenal</td>
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<tr>
<td>MDA</td>
<td>Prenatal Maternal Depression and Anxiety</td>
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<td>MFA</td>
<td>Maternal fetal attachment theory</td>
</tr>
<tr>
<td>MLA</td>
<td>Medical Laboratory Assistant</td>
</tr>
<tr>
<td>ND-BCS</td>
<td>Newborn Distress Pain Related Behaviour Coding System</td>
</tr>
<tr>
<td>NFCS</td>
<td>Neonatal Facial Coding System</td>
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<tr>
<td>Post-HL</td>
<td>Post-heel lance</td>
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<tr>
<td>PMP</td>
<td>Prenatal Primary Maternal Preoccupation</td>
</tr>
<tr>
<td>SSRI</td>
<td>Selective serotonin reuptake inhibitor</td>
</tr>
<tr>
<td>YIPTA</td>
<td>Yale Inventory of Parental Thoughts and Actions</td>
</tr>
<tr>
<td>YIPTA-R</td>
<td>Yale Inventory of Parental Thoughts and Actions Revised</td>
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Dedication

To my husband Paul, thank you for enduring this process with me but, most especially, thank you for your love and support of every crazy new adventure I embark on. I know I have been impossible at times but you have kept me grounded and helped me in whatever way possible throughout my education and career. I could not have done this without you.

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Chapter 1: Introduction

This proposed thesis study is a secondary analysis of data from an original study conducted by Warnock, Craig, Bakeman, and Castral (2014). Secondary data analysis refers to the analysis of data collected and or analyzed previously by other researchers for another purpose (Smith et al., 2011). The approach is time and cost effective, since data are available, and provides opportunity to ask high impact questions of the existing data (Garmon Bibb, 2007; Smith et al., 2011).

In their study, Warnock et al. (2014) collected measures of prenatal maternal depression and anxiety (MDA), prenatal primary maternal preoccupation (PMP) and postnatal measures of infant pain behaviour self-regulation post-heel lance (Post-HL). The study aimed to determine whether MDA would be associated with infant pain measures. Findings showed MDA predicted altered infant pain behaviour self-regulation Post-HL, but the authors had not included analysis of the PMP measures. In this thesis study, I extended the analysis of data from the Warnock et al. (2014) study by including the analysis of PMP measures. The two-fold aims were to examine if self-reports of PMP would differ between mothers with and without MDA and to examine the relationship and contribution of PMP and infant pain behaviour self-regulation in this dynamic.

In this chapter, I provide an introduction of the issues and background that formed the basis for me to pursue this secondary analysis. I also provide a discussion of the significance of the thesis study and a statement of purpose. I conclude with several hypotheses that I undertook to address my thesis study.
1.1 Background

Prenatal primary maternal preoccupation is a psychological state experienced by a woman during pregnancy in which the woman is intensely absorbed and engrossed, or preoccupied, with thoughts about the development, safety, and well-being of the infant even before the infant is born (Leckman et al., 1999; Leckman, Mayes, & Cohen, 2002; Winnicott, 1956). Defined as a normative psychological state during pregnancy, PMP functions to prepare the mother to create a safe and nurturing caregiving environment to meet the prenatal and postnatal developmental, physical, and psychological needs of the infant, and to establish a strong sense of attachment to her infant (Leckman et al., 2002; Winnicott, 1956, 1960).

However, a growing body of evidence suggests that excessive PMP can predict symptoms of MDA and the quality of a mother’s prenatal attachment to her infant (Ambrosini, Donzelli, & Stanghellini, 2012; Field, Diego, & Hernandez-Reif, 2010; Goecke et al., 2012; Priel & Besser, 1999). In this thesis study, excessive PMP is defined as PMP scale scores that were statistically higher in one group of mothers as compared to the second group of study mothers. Findings of other studies also suggest that current and past history of pregnancy complications and maternal exposure to high levels of self-perceived stress during pregnancy can adversely impact maternal psychological state; thereby, increasing a woman’s risk for prenatal and postnatal mental health disorders such as morbid preoccupations, MDA, Obsessive Compulsive Disorder, and post-traumatic stress disorder (Ambrosini et al., 2012; Brockington, Macdonald, & Wainscott, 2006).

The preceding findings suggest patterns of association between co-occurrence of vulnerabilities (such as poor socioeconomic status, marital satisfaction, and social supports) during pregnancy and prenatal maternal factors including self-perceived stress, mental health
disorders, and excessive PMP. However, evidence about any such patterning is weak due to lack of study and methodological reasons. For example, the factors have largely been investigated independent of each other (Warnock, Bakeman, Shearer, Misri, & Oberlander, 2009). As well, there is unclear understanding of if and how these factors may be significantly associated with infant outcomes, or even with each other throughout the trajectory of the prenatal and postnatal periods and particularly during the neonatal period (Kinsella and Monk, 2009; Monk, 2001; Oberlander & DiPietro, 2003; Yonkers et al., 2009). While there is established evidence that has linked alterations in maternal mental health to infant cognitive and psychosocial outcomes in later childhood, there is a lack of understanding of the impact of these maternal factors on infant pain outcomes during the newborn period. This gap in knowledge is relevant because it is during the neonatal period, that the immature brain is especially vulnerable to the neurodevelopmental effects of noxious sensory stimuli such as from routine painful procedures (Anand et al., 2006; Findlay, 2004; Grunau et al., 2005). The infant’s mother normally serves as a powerful buffer helping to optimize the infant’s own ability to self-regulate to everyday stressors. It would be important to know if and how MDA and excessive PMP may hamper the maternal role or act to mediate infant pain self-regulation outcomes.

Within the larger fields of maternal mental health, there has been a historical focus on the study of maternal mental health during the postnatal period (Bergink et al., 2011; Gavin et al., 2005) and within the infant pain field, these maternal factors have rarely been considered or investigated (Warnock et al., 2014). Growing awareness of the negative and long-term impact of prenatal maternal mental illness on pregnancy and on maternal and infant health outcomes has stimulated a growth of research on maternal mental health
throughout the trajectory of the prenatal and postnatal periods (Kinsella and Monk, 2009; Monk, 2001; Oberlander & DiPietro, 2003; Yonkers et al., 2009; Warnock et al., 2014). For example, while it has long been understood that prenatal depression predicts postnatal depression, it is only recently that clinical and epidemiological studies have documented that depression and other maternal mental health concerns often begin during pregnancy or that history of postpartum depression increases risk for prenatal depression in subsequent pregnancies (Beck 2001; Gavin et al., 2005).

These findings call for prenatal and early postnatal screening of maternal mental health conditions for prevention and for implementation of early treatments such as nurse family partnership programs (Leckman et al., 2002). These kinds of prenatal programs have been found to be highly effective in strengthening the mental health of mothers at high risk for major depression and anxiety and for improving cognitive and attachment outcomes of infants (Feldman, Weller, Leckman, Kuint, & Eidelman, 1999; Leckman et al., 2002). However, there are still too few studies that have examined maternal mental health conditions concurrent with infant pain outcomes (Warnock et al., 2009). Even fewer studies include PMP as a distinct study variable. What remains unclear is the contribution and directional nature of these pathways of risk association and whether some or all contribute to altered infant outcomes including pain outcomes. This adds to a further lack of clarity given the inherent pre and postnatal link between mothers and infants.

Of the few infant pain studies that have included MDA, the primary aims of most have been to determine the effects of infant prenatal exposure to antidepressant selective serotonin reuptake inhibitor (SSRI) medication on infant pain reactivity, while controlling for MDA (either via the study design or statistically). Findings show that infants with prenatal
exposure to SSRIs exhibit a dampened facial and cry response to routine heel lance (HL) procedures one week after birth (Oberlander et al., 2005; Warnock et al., 2009). Maternal depression and anxiety is prevalent during pregnancy (Bennett, Einarson, Taddio, Koren, & Einarson, 2004) and SSRI medications are currently the most common first line of treatment (Oberlander et al., 2005). Hence, these findings are relevant because they provide mothers with MDA and their physicians with information that may be important for treatment decision making during pregnancy. However, the findings are limited because they do not tell us whether the infant findings were due to infant prenatal exposures to MDA or to SSRI medications or to both and, because MDA was controlled for, the findings cannot inform us of the potential underlying role that MDA can have on infant pain outcomes.

To further clarify the role of MDA on infant pain outcomes, Warnock et al. (2014) recently compared a number of infant pain outcomes including behaviour self-regulation during a routine HL between groups of infants born to mothers with MDA and a control group of infants born to mothers without MDA. In that study, the authors controlled for the confounding effects of prenatal SSRI medication effects statistically to help separate out the distinct effects of MDA. They focused on infant behaviour self-regulation as a main infant study outcome because infant ability to self-regulate behaviour to everyday stressors is reflective of infant neurodevelopment. They did this by obtaining time-based mean measures of the indictor (proportion of time spent in behaviour as it occurs naturally during an observed event) rather than obtaining conventional measures of pain behaviour (mean measures of behaviour over a predefined brief window). The benefit of time-based measures is that they provide detail on the temporal nature of the behaviour type and the ability to distinguish distinct patterning in the often diffuse behaviour responses of newborn infants.
Such behaviour responses have made infant pain assessment and treatment difficult. In the other fields of infant study, findings of altered infant behaviour self-regulation to routine physical exam were observed in infants born to mothers with MDA compared to infants born to mothers without MDA (Salisbury et al., 2011). Authors of that study raised the question if the infant findings were due to the underlying effect of MDA. Accordingly, Warnock et al. (2014) made use of systematic observation methods because these methods are specially designed to help elucidate the mechanisms, such as MDA, that may underlie the time-based measures of infant pain behaviour self-regulation that are generated by the study results.

Findings of the Warnock et al. (2014) study showed that prenatal MDA predicted an increase in the proportion of time Post-HL that infants spent exhibiting strained/erratic limb movement, crying in an exhausted manner, and in behavioural immobility, compared to a control group of infants born to mothers without MDA. The authors concluded that MDA may be an underlying factor that contributed to delays in infant ability to behaviourally self-regulate Post-HL. While these findings help clarify the predictive role of MDA on infant pain behaviour self-regulation, the findings nonetheless provide only partial information on the other maternal factors described in the introduction. The authors also collected measures of PMP during the second trimester of pregnancy from all study mothers but did not analyze the PMP data. Excessive PMP has been linked with MDA in prior studies (Ambrosini et al., 2012; Brockington et al., 2006; Goecke et al., 2012). Hence, it is important to determine whether mothers with MDA in the Warnock et al. (2014) study also had excessive prenatal PMP and if excessive PMP is linked to altered infant pain behaviour self-regulation.
1.2 Significance of the Research

To date, there has been no study that has examined the associations between prenatal mental health measures of MDA and PMP and postnatal infant pain outcomes, such as pain behaviour self-regulation, concurrently. It is important that these relationships be investigated concurrently. Such an investigation may help to clarify any contribution of PMP and to our overall understanding of complex pathways of association between MDA, PMP, and infant pain behaviour self-regulation. Furthermore, the study of these variables taken together will provide foundational information needed to help inform and guide future development of targeted interventions to support mothers with MDA during the prenatal period and to improve postnatal pain assessment of MDA exposed infants as appropriate.

1.3 Statement of Purpose

In this thesis study, I made use of secondary maternal and infant data from the study by Warnock et al. (2014). The primary aim was to examine any group differences in self-reported PMP during the second trimester of pregnancy between women with and without prenatal MDA. A secondary aim was to investigate relationships between and amongst maternal prenatal measures (MDA and PMP) and infant measures (infant pain behaviour self-regulation). Outcomes of this thesis study will help validate and broaden prior findings of the Warnock et al. (2014) study and advance knowledge by examining the relationship between MDA, PMP, and infant pain behaviour self-regulation concurrently.

1.3.1 Hypothesis

1. There will be differences in self-reported prenatal PMP between women with prenatal MDA and women without prenatal MDA during the second trimester of pregnancy.
2. There will be associations between time-based measures of prenatal MDA, prenatal PMP, and postnatal infant pain behaviour self-regulation following an acute pain procedure (heel lance).
Chapter 2: Theoretical Framework

My thesis study is guided by the maternal fetal attachment (MFA) theory (Brandon, Pitts, Denton, Stringer, & Evans, 2009; Cranley, 1981). Stemming from the larger theory of human attachment, the theory of MFA has evolved to further conceptual understanding of a mother’s experience and perception of prenatal attachment to her unborn child. I chose to use MFA theory as a guiding framework to help me interpret the significance of the PMP measures of my study and to determine how excessive PMP may or may not be related to other maternal and infant factors: such as the impact of excessive PMP and MDA on the relationship between the mother and her infant. Maternal fetal attachment can be an important framework for future development of targeted intervention given that strong prenatal and postnatal mother-infant attachment is an acknowledged protective factor to maternal depression (Goecke et al., 2012; Priel & Besser, 1999).

In this chapter, I will present a review of the literature on the evolution of MFA starting with the theory of human attachment which formed the foundations for MFA. Then I will discuss in depth the theory of MFA and how this theoretical framework relates to PMP, MDA, and maternal and fetal/infant well-being.

2.1 Evolution of the Theoretical Roots of Maternal Fetal Attachment

John Bowlby first introduced attachment theory viewed from an ethological-evolutionary stance to understand mothering as a human activity (Ainsworth, 1979; Bowlby, 1988). Bowlby first described attachment as a human need that depended on the formation of close bonds and the earliest bonds. By attachment, Bowlby was primarily referring to the early relationship between the mother and infant (Bretherton, 1985; Goulet, Bell, St-Cyr Tribble, Paul, & Lang, 1998; Swain, Lorberbaum, Kose, & Strathearn, 2007). Mary
Ainsworth, another lead contributor to attachment theory, developed her work in parallel to Bowlby’s work. Ainsworth’s main contribution was to identify the infant’s need of an attachment figure as a secure base from which the infant could explore the world and that a mother’s sensitivity to her infant’s signals formed this secure base (Ainsworth, 1979; Bretherton, 1985; Bretherton, 1992). Together, Bowlby and Ainsworth’s work signify that a secure infant attachment develops when the infant’s social initiatives are harmonized with the mother’s sensitivity to responding to her infant’s cues (Goulet et al., 1998; Bretherton, 1985, 1992; de Wolff & van Ijzendoorn, 1997). These authors viewed a secure attachment relationship between infant and mother to have occurred when the relationship was characterized by reciprocity, synchrony, and maternal sensitivity (Goulet et al., 1998; Bowlby, 1988; Bretherton, 1985, 1992; de Wolff & van Ijzendoorn, 1997).

Maternal sensitivity to the infant shapes infant development through behavioural, neuroendocrine, and autonomic systems (Hofer, 2005; Kim, Mayes, Feldman, Leckman, & Swain, 2013). It is believed that the mother’s role in a secure attachment relationship functions to regulate the still immature infant’s own ability to self-regulate to everyday stressors and his/her behavioural fear reactions (Field, 1994; Hofer, 2005; Kim et al., 2013). Bowlby (1988) explains that an infant’s organization and attachment behaviours can be triggered by exposure to a stressor, such as a routine painful procedure. When an infant experiences a pain event, he/she looks to the mother who will typically respond to her infant pain cues by soothing her infant to promote infant self-regulatory capacity. However, alteration in the maternal patterns of regulatory interactions can interfere in the mother’s ability to regulate her infant (Bowlby, 1988; Hofer, 2005). It is also believed that over time, the patterns and variations in the maternal-infant interactions shape the infant’s development
and influences his/her behavioural reactions into childhood and even adulthood (Bowlby, 1988; Hofer, 2005). The infant’s ability to generate attachments through the lifespan such as spousal and his/her own children, is affected by his/her first attachments in the prenatal and infant periods.

Since the theory of human attachment involves a reciprocal relationship, there are two perspectives that are important to explore: the infant and the mother. Historically, attachment theory, as initially put forth by Bowlby and Ainsworth, primarily examined attachment from the perspective of the infant at about six months when developmentally the infant starts to explore his/her environment (Goulet et al., 1998). In other words, the process of attachment occurs from the child to the parent. However, some authors have argued that to understand attachment as a reciprocal process, it is crucial to consider the mother’s perspective in parallel to her infant because the mother needs to develop maternal role identity to bond and attach to her infant (Goulet et al., 1998; Kennell & Klaus, 1984).

In 1979, Ainsworth built on the original theory of attachment and, in so doing, acknowledged that maternal behaviour influenced infant exploration of their environment and security seeking attachment behaviour (Brandon et al., 2009). She discussed the mother’s level of attachment and degree of engagement to her infant as sensitivity. Ainsworth viewed mothers who were sensitive to their infants as those who were able to attune, interpret and respond appropriately, and react promptly to their infant’s signals. These preliminary descriptions helped formulate maternal sensitivity as an integral concept to the attachment theoretical framework and an essential component to the mother-infant attachment process (Ainsworth, 1979; Brandon et al., 2009; Bretherton, 1992; Leckman et al., 2002; Winnicott, 1956). In this way, maternal sensitivity and synchrony in the maternal-
infant interaction was understood to lead to mutually satisfying behaviours. In addition, Ainsworth developed the “still face” situation which is a clinical research approach that incorporates assessment of maternal and infant interaction behaviour to help distinguish and classify levels of attachment security in the infant. A further development is that researchers have since explored a prenatal focus to attachment, derived from the maternal perspective, to help explain the bonding experienced by mothers and infants immediately following birth (Brandon et al., 2009). The findings of such research contributed to the development of MFA.

2.2 Maternal Fetal Attachment Theory and Prenatal Attachment

The articulation of MFA as a theory first arose in 1967 based on findings from a nursing doctoral study by Rubin (1976) who was investigating maternal role attainment. Although the author did not officially define the concept or process of MFA, Rubin concluded that the immediate bond between the mother and her infant is developed and structured prenatally (Brandon et al., 2009; Rubin, 1967, 1976). It was not until 1981 when Cranley first defined the theoretical construct of MFA as “the extent to which women engage in behaviours that represent an affiliation and interaction with their unborn child” (p. 282).

Several authors have since critiqued Cranley’s concept of MFA as too behaviourally focused. One main criticism considered Cranley’s definition as insufficient because it excluded maternal prenatal thoughts and fantasies (Brandon et al., 2009). In 1997, Condon and Corkindale simply described MFA as the emotional bond that develops between a pregnant woman and her unborn child (Brandon et al., 2009). To date, there is no single conceptual definition of MFA (Brandon et al., 2009).
Despite the lack of a consistent definition of MFA, scholars drew attention to the process of prenatal attachment, which was postulated to begin early in pregnancy, and that fetal and infant attachment behaviours were developed on the basis of fetal sensory reception and modified through experience (Condon, 1985; Hofer, 2005; Honjo et al., 2003). In their review of the prenatal attachment literature, Brandon et al. (2009) reviewed and identified criticisms with MFA. One criticism argued that MFA did not align with the core premises of the theory of human attachment that focus on both a reciprocal relationship and infant security seeking. A further concern was that MFA could not be measured prenatally with any accuracy (Brandon et al., 2009; Laxton-Kane & Slade, 2002).

However, more recent studies refute arguments against accuracy in MFA measurement and infant reciprocity. Findings based on fetal movement and ultrasound imaging suggest MFA begins as early as the first trimester and that the use of techniques such as ultrasound imaging mark an increase in the development of the attachment relationship and reciprocity (Brandon et al., 2009; Condon, 1985; Laxton-Kane & Slade, 2002). The studies explain that reciprocity is evident in newborn infants since they are able to recognize their mother through visual and voice cues and by odour immediately following birth (Brandon et al., 2009; Condon, 1985; Laxton-Kane & Slade, 2002). The literature argues that MFA needs to be viewed from a lens of maternal-infant attachment throughout the pregnancy and postpartum and that this perspective not be conditional on the infant security seeking component (Brandon et al., 2009; Laxton-Kane & Slade, 2002). Because of these distinctions, different yet interrelated conceptual frameworks are required for prenatal attachment and postnatal attachment (Brandon et al., 2009).
Clinically, the concept of MFA draws attention to the emotion experienced by the mother during pregnancy that would influence attachment formation to her unborn child (Brandon et al., 2009; Laxton-Kane & Slade, 2002). Measures of MFA have been reported to be correlated with immediate postnatal maternal attachment feelings and with maternal feelings of competence (Brandon et al., 2009). The relevance of MFA is also supported through acknowledgement of the notion of caregiving capacity, which is thought to be developed during pregnancy to help the mother adapt to the role of motherhood (Brandon et al., 2009). The theory is supported by evidence that links prenatal attachment quality to maternal pregnancy health practices and to maternal mental health outcomes. For example, weak attachment has been found to be associated with fetal and child abuse and maternal symptoms of depression and anxiety (Brandon et al., 2009; Condon & Corkindale, 1997; Goecke et al., 2012; Laxton-Kane & Slade, 2002; Leckman et al., 2002; Sroufe, Carlson, Levy, & Egeland, 1999). Conversely, strong attachment has been found to be associated with positive health practices in pregnancy and to a decrease in vulnerability to maternal depression and depressive symptoms (Brandon et al., 2009; Priel & Besser, 1999).

In their 1984 paper, Kennell and Klaus examined ties between Winnicott’s theory of PMP and the prenatal maternal sensitivity period, a bonding period that starts within a few hours following birth and lasts no longer than 1 month postnatally. Those authors identified PMP to be a factor relevant to attachment. Leckman et al. (1999) further speculated that PMP influences pre and postnatal parental caregiving behaviours. On the basis of their review, Brandon et al. (2009) also concluded that PMP can negatively impact MFA. However, in contrast to Kennell and Klaus and to Leckman et al., Brandon et al. described PMP as a temporary phenomenon that women may experience and that it was not necessarily tied to
attachment. Primary maternal preoccupation will be discussed in further detail later in this thesis proposal (see section 3.1).

In a more recent article, Laxton-Kane and Slade (2002) discuss associations between prenatal attachment and maternal psychological factors which can affect maternal well-being and postnatal attachment. The authors concluded that psychological factors, such as MDA, that influence MFA can, in turn, facilitate or impede the MFA attachment relationship and vice versa. Hence, associations between MFA, PMP, and MDA are important to explore considering MFA has been used to enhance understanding of the importance of PMP in mother-infant attachment and how altered preoccupations can complicate maternal psychological state (Ambrosini et al., 2012; Dunkel Schetter, 2011; Dunkel Schetter & Tanner, 2012; Field et al., 2010). Furthermore, the application of MFA and PMP frameworks have been speculated to be useful for guiding the timing and measurement of early intervention programs, with implementation of the theory based interventions thought to be most effective at as early as 20 weeks gestation. (Coyl, Roggman, & Newland, 2002; Field, Hernandez-Reif, and Diego, 2006a; Goecke et al., 2012; Leckman et al., 2013; Sroufe et al., 1999).

In summary, there has been an evolution in our theoretical understanding of MFA and PMP stemming from attachment theory as put forth by John Bowlby and Mary Ainsworth. Theoretical formulations such as MFA and PMP provide useful frameworks for understanding factors that adversely impact mothers during pregnancy, such as MDA, and that may hamper a mother’s ability to form attachment to her unborn child. There is some reasoning that early interventions theoretically rooted in MFA and PMP would be effective in addressing and influencing prenatal symptoms of MDA (Goecke et al., 2012).
Chapter 3: Literature Review

In this chapter I will present a review of the literature structured around the variables that will be directly examined in this proposed thesis study. These variables include PMP, MDA, and infant pain behaviour self-regulation.

3.1 Primary Maternal Preoccupation

To understand PMP as a theoretical concept and how an excessive PMP can negatively impact maternal mental health and predict MDA, it is important to explore the history and origins of PMP. In 1956, Winnicott drew attention to the term “primary maternal preoccupation” as a distinctive state and psychological condition in which a woman during pregnancy experiences an altered mental state. Primary maternal preoccupation as a theory has origins in psychoanalytic theory (Hollway, 2012; Leckman et al., 1999; Ogden, 2001). Winnicott transformed what was then viewed to be a symbiotic relationship between mother and infant that involves a biological conditioning for motherhood, to a progressive interpretation of the mother-infant relationship in terms of a psychological explanation (Hollway, 2012; Ogden, 2001; Winnicott, 1956). The author did this by likening the difference between the mother’s identification with her infant and the infant’s dependence on the mother to a psycho-pathology that gradually develops over pregnancy, heightens during the last trimester, and lasts a few weeks after the birth of the infant (Hollway, 2012; Winnicott, 1956, 1960). The mother transfers some of her sense of identity to the fetus growing inside of her (Winnicott, 1960). This psychological difference is what Winnicott labeled as PMP and further stated that PMP is a normative psycho-pathology that most mothers experience and that ultimately benefit both mother and child.
Winnicott (1956) relates PMP to a dissociative or schizoid state. Primary maternal preoccupation typically occurs during pregnancy when the preoccupation portion of the woman’s cognitive thoughts take over and excludes all other thoughts temporarily (Leckman et al., 1999; Leckman et al., 2004; Leckman et al., 2002). It is important to understand that, although Winnicott likens the mother’s preoccupied state to an “illness” (p. 302), the mother must be healthy in order to develop and recover from this state. In this state, the mother must consciously lose sense of herself to “feel herself into her infant’s place” (p. 304). The infant’s state is thought to parallel the mother’s state of preoccupation. According to Winnicott, a mother’s preoccupation provides the context for the infant to experience a sense of self and to develop his/her own identity (Ogden, 2004; Winnicott, 1956; Winnicott & Khan, 1965). As the infant needs to separate his/her identity from that of the mother, Winnicott postulated that the mother must also detach from the infant and, in so doing, would gradually recover from her preoccupied state (Winnicott, 1956; Winnicott & Khan, 1965).

Leckman et al. (1999) also examined PMP and pointed out that although some authors refer to PMP to describe disorders of parent-infant interactions and to assess parent engrossment with their infants, PMP has received little research attention as a distinct study variable. In subsequent series of studies, Leckman and colleagues (1999, 2002, 2004) examined PMP from an evolutionary and genetic perspective and they operationalized the concept to link measures of PMP to disorders in maternal mental health.

In line with Winnicott (1956), Leckman and colleagues (1999, 2002, 2004) defined PMP as an intensified sensitivity to environmental and emotive cues during pregnancy, especially towards the end of pregnancy. From an evolutionary perspective, the authors
speculated that poor environmental, food, and health security in the past few centuries has conditioned parental caregiving behaviours to this heightened sensitivity towards the infant. This explanation was extended to prenatal and mother-infant attachment, stating that infant survival needs, distress, or fear would trigger attachment behaviours in the mother and the infant or fetus (Brandon et al., 2009). In their study conducted in 2002, Leckman et al. ascertained that heightened maternal sensitivity and attachment behaviours are essential to maternal attachment and to infant survival. They explained that these conditions help the mother to identify with her infant, to anticipate the needs of the developing infant, and to respond to infant cues and signals (Leckman et al., 2002; Winnicott, 1956). These explanations are consistent with Winnicott (1960) who also stated PMP is important for mother-infant attachment and for infant emotional and self-development.

Concerns about the notion of PMP have been acknowledged by various authors. Winnicott’s (1956, 1960, 1965) main concern related to the mother who cannot risk developing this preoccupied state. That is, she cannot achieve preoccupation in a manner that is normal and temporary (Winnicott, 1956, 1960; Winnicott & Khan, 1965). More recently, Hollway (2012) discussed this concern viewed from a feminist lens. Traditionally, PMP was considered inadmissible from a feminist perspective because it pathologizes women. Hollway re-approached Winnicott’s theory of PMP by making use of the matrixial concept of transsubjectivity. Hollway described the matrixial concept as a prenatal/pre-maternal theory that does not necessarily distinguish the mother from the fetus but identifies the pre-maternal state as neither two nor one (referring to the mother and fetus identities). In her study that involved interviews of 10 mothers, Hollway showed that PMP is in fact complementary to matrixial and feminist thinking. The findings showed that some of the
maternal participants could not embrace the non-reciprocal relationship with their infant, could not identify with the state of the infant, and feared losing themselves. Hollway concluded that mothers who could not submit to the “almost illness of PMP” (p. 21), as described by Winnicott, were those who were most likely suffering from postpartum depression.

One other concern with PMP Winnicott discussed pertains to the mother who is unable to let go of her identification with her infant as the infant requires (Winnicott, 1956). Other authors have suggested that self-perceived stress and vulnerabilities such as poor socioeconomic status, marital satisfaction, and social supports alters normative PMP (Ambrosini et al., 2012; Brockington et al., 2006). It is believed that exposure to such adverse conditions may hamper the mother’s ability to develop the preoccupied state or, alternatively, such conditions may not allow the mother to release her identification with the infant as required (Winnicott, 1956).

In a recent review of preoccupation and parental caretaking behaviours they engender, Leckman et al. (2004) reported that levels of PMP too intense or too diminished can also alter a mother’s psychological state. These findings are consistent with findings of an earlier study by Leckman et al. (1999) who reported that intense PMP can potentially increase maternal risk for obsessive-compulsive disorder and that diminished PMP can lead to abusive or neglectful maternal caregiving behaviour. In the 2004 review, Leckman et al. emphasized that the area of greatest concern was maternal depression since maternal depression is prevalent during pregnancy and that depressed mothers reported lower preoccupations with their infants when compared to mothers of infants who were not depressed. A growing body of evidence has identified diminished PMP and perceived
prenatal attachment as predictors to pre and postnatal symptoms of MDA (Brandon et al., 2009; Goecke et al., 2012; Priel & Besser, 1999). However, all associations between PMP and MDA in mothers have not been fully identified, including differences in measures taken and timing of measures. As well, such factors have not yet been linked to infant outcomes, namely infant pain or non-pain behaviour self-regulation. Most studies examining associations between PMP, MDA, and infant outcomes have reported on maternal factors and infant outcomes independently, that is they have not examined these factors concurrently. Yet, it would be important to know if and how PMP would be associated with infant pain behaviour self-regulation in particular given that alterations in that outcome for the infant may signal alterations in neurodevelopment. This is important to clarify in order to affirm a pre and postnatal link between mothers and infants with such factors. As well, descriptive findings of correlation may be useful in helping to sort out the relevance of PMP for future development of targeted maternal prenatal interventions and postnatal infant pain interventions as appropriate.

3.2 Maternal Depression and Anxiety in Pregnancy

Recent studies report several factors that can negatively impact maternal psychological state which can lead to MDA in pregnancy. Risk factors for MDA include current and past history of pregnancy complications, exposure to stress perceived to be stressful by the mother, and specific vulnerabilities such as marital disruption and low socioeconomic status (Ambrosini et al., 2012; Dunkel Schetter, 2011; Dunkel Schetter & Tanner, 2012; Field et al., 2010). Such factors can increase or heighten a sense of morbid preoccupations and increase the risk for co-morbidities in pregnancy such as MDA,
Obsessive Compulsive Disorder, and post-traumatic stress disorder (Ambrosini et al., 2012; Brockington et al., 2006).

Pregnancy is a vulnerable period in which onset, return, or exacerbation of depressive symptoms can occur (Bennett et al., 2004). In some literature, the prevalence of maternal depression during pregnancy is reported to range from 10 to 17% (Bennett et al., 2004; Dennis & Dowswell, 2013; Le Strat, Dubertret, & Le Foll, 2011). When anxiety is assessed with depression, the range of prevalence increases to 15% to 25% of pregnant women (Alderdice, McNeill, & Lynn, 2013; Bennett et al., 2004). In their review, Bennett et al. (2004) discuss the imprecision of the reported rates of pre and postnatal maternal depression. Their findings indicate that inaccuracy in measurement may be due to lack of examining the trimester of pregnancy in which the symptoms occur, reliance on self-reported clinical signs and symptoms, and making use of objective structured interviews from which a more accurate diagnosis can be drawn. (Bennett et al., 2004; Gavin et al., 2011; Goecke et al., 2012).

Maternal depression and anxiety have an impact on the mother and her infant while in utero and once born. This is especially concerning given that the prevalence of MDA in pregnancy is up to 25% of women, as previously mentioned (Alderdice et al., 2013). Field et al. (2006a), interviewed 810 pregnant women in the second trimester and classified 42% of these women into a depressed group. The contribution of this study is that it targeted assessment of MDA relative to the second trimester of pregnancy with results verifying the suggestion Bennet et al. (2004) made: that MDA may be more prevalent during this trimester.
As noted previously, Brandon et al. (2009) reported that negative mood states such as depression and anxiety and altered PMP can negatively impact MFA. A gap in this line of research is that very few existing studies have examined the linkage between MDA, PMP, and infant pain outcomes such as behaviour self-regulation. This gap is important to address given that early alteration in infant neurobehaviour may signal infant inability to self-regulate to everyday stressors. Alteration in maternal MDA and PMP may underlie these infant alterations and may also hamper the otherwise powerful regulatory role of the mother following birth of the infant. Brandon et al. concluded that the infants would be at risk for biochemical profiles and behaviours that are not optimal.

These conclusions are supported by findings reported by Diego, Field, and Hernandez-Reif (2005) who found that the infants born to mothers with MDA have greater indeterminate sleep, spend more time crying, and display stress-related behaviours than infants born to mothers without MDA. Other studies have found that infants born to mothers with MDA are more irritable, difficult to console, less active, and less attentive and responsive to facial expressions (Lundy, Field, & Pickens, 1996; Whiffen & Gotlib, 1989; Zuckerman, Bauchner, Parker, & Cabral, 1990). However the associations between MDA, PMP, and infant pain outcomes and behaviour self-regulation have not been explored in detail nor studied concurrently; therefore, such maternal psychological factors have not been identified as underlying influences in these altered infant outcomes.

To summarize, there is substantial literature on the negative effects of MDA on pregnancy and on maternal and infant outcomes. Since alterations in PMP and the quality of prenatal attachment can be used as predictors for MDA, mitigating such risk factors are important for this population (Ambrosini et al., 2012; Brandon et al., 2009; Field et al., 2010;
Goecke et al., 2012; Priel & Besser, 1999). Associations between PMP and MDA require further validation and their link to infant behaviour self-regulation is crucial to more clearly understand their potential underlying and overt impact on the infant.

3.3 Maternal Depression and Anxiety Exposed Infants and Altered Pain Outcomes

Normally, infant pain is a response to noxious events, such as exposure to routine HL, which induces complex biochemical, physiological, and behavioural changes. However, these responses can be heightened because the infant nervous system is immature at birth and continues to develop past parturition (Anand et al., 2006; Findlay, 2004). When infants experience pain, a series of sequential neurobiological alterations are triggered which activate and modulate the pain system; prolonged and repetitive pain in this still developing system may cause permanent modifications and altered pain processing (Anand et al., 2006). A study by Grunau et al. (2005), discussed the potential consequences of repeated and prolonged pain exposure in infants which included such changes as altered behavioural and cardiac reactivity and alterations to the hypothalamic-pituitary adrenal (HPA) axis reactivity. Several studies show that infants exposed to pain and stress can result in altered reaction to painful events that can persist into adulthood (Fitzgerald & Walker, 2009; Grunau et al., 2005; Grunau, Holsti, & Peters, 2006; Lucas-Thompson et al., 2008).

Although the majority of infant pain studies do not consider maternal factors, there is an emerging body of literature that discusses the impact of infant prenatal exposure to MDA on infant pain outcomes (Monk, 2001; Oberlander & DiPietro, 2003; Oberlander et al., 2005; Yonkers et al., 2009). Several studies have identified that a system programmed in utero to MDA alters term infant pain outcomes and behaviour self-regulation (Kinsella and Monk, 2009; Monk, 2001; Oberlander & DiPietro, 2003; Yonkers et al., 2009). Once born, the
infant experiences neurobehavioural changes associated with MDA exposure, including inferior orienting and reflex skills, increased irritability and fussiness and decreased activity, robustness, behavioural tone, endurance, attentiveness, and soothability (Monk, 2001; Oberlander & DiPietro, 2003; Yonkers et al., 2009). Warnock et al. examined, in their 2009 study, the percentage duration of infant behaviour dysregulation Post-HL. This study and others, have reported that infants with prenatal exposure to MDA exhibit altered behaviour such as dampened facial and cry responses and behaviour dysregulation in response to HL (Oberlander et al., 2005; Warnock et al., 2009; Warnock et al., 2014).

Lucas-Thompson et al. (2008) discuss premature infants as vulnerable to pain stressors due to a less developed ability to self-regulate; however, full-term infants with prenatal exposure to MDA may be equally vulnerable to altered ability to self-regulate to pain stressors. During the newborn period, all infants are born with immature brains that undergo rapid changes in structure and function. As such, all infants are vulnerable to sensory stressors, although self-regulatory capacities may be more compromised in the infant born ill or premature. A clear understanding of infant pain recovery is a necessary pain assessment to understand if the infant is self-regulating or showing adaptive pain responses.

Most infant pain studies report on mean measures of infant pain response Post-HL but these conventional measures are typically based on a Post-HL event, or recovery timeframe, that lasts no more than 10 seconds. This is problematic because the reported outcomes of recovery are too limited in their ability to inform us of patternning in behaviour and whether the infant is self-regulating or showing adaptive responses to the pain event. There are, however, a handful of studies that have reported infant pain responses for a longer period of time Post-HL and in manner that provides insight into infant behaviour self-
regulation. For example, studies on pain recovery showed that preterm infants continued to exhibit elevated heart rate levels or they continued to exhibit altered pain behaviour even after 10 minutes Post-HL which indicated physiological patterns of arousal and overload (Chimello, Gaspardo, Cugler, Martinez, & Linhares, 2009; Lucas-Thompson et al., 2008). However, few studies have examined pain recovery, such as behaviour self-regulation, in term infants.

One study by Warnock and Sandrin (2004) aimed to draw attention to and expand the knowledge on infant pain recovery in the otherwise healthy full-term infant. The authors applied systematic observation methods and time-based analytic approaches to distinguish infant behaviour self-regulation specific to each phase of an acute infant pain procedure (routine infant male circumcision). While typical pain behaviour measures such as pain cry and change in facial action are informative, pain cry is a non-specific pain measure because it can occur in non-pain situations. As well, change in facial action, which is regarded as the most salient measure of infant pain behaviour, lasts only a second which limits its utility as a meaningful pain recovery measure. Rather, Warnock and Sandrin focused on infant behavioural movement in recognition that infant inability to self-regulate behaviour responses to a stressor is reflective of altered neurobehaviour. The authors identified 14 infant distress related behaviours lasting up to 5 minutes following infant male circumcision.

In a subsequent study, Warnock et al. (2014) further examined linkages between MDA and change in time-based measures of infant behaviour self-regulation during three phases of routine infant HL. The aims were to determine if full-term infants with and without prenatal exposure to MDA would differ in terms of time based measures of pain behaviour self-regulation and to determine if MDA would predict alteration in infant behaviour self-
regulation based on their findings of a 2009 prior study (Warnock et al, 2009). In that prior study, findings showed that infants born to mothers with MDA exhibited altered pain cry and that the mothers of these infants spent more time exhibiting altered caregiving behaviour to their infants during routine HL. Findings of the 2014 Warnock et al. study showed that both study groups of infants (with and without prenatal exposure to MDA) reacted equally to HL but that infants in the MDA exposed group continued to exhibit time-based measures in types of altered pain behaviour self-regulation (time spent in strained/erratic limb movement, crying in an exhausted manner, and in behavioural immobility) Post-HL longer than infants in the non-MDA exposed group. The authors concluded the MDA may be a mechanism underlying the reported infant alterations of behaviour and that it may have contributed to delay in pain recovery in MDA exposed infants. The authors also put forward that behaviour self-regulation could be incorporated clinically as a pain indicator when assessing and treating pain in MDA exposed infants.

As previously discussed (see section 3.2), prenatal exposure to MDA is associated with sub-optimal behavioural and biochemical outcomes in infancy. With findings of increased infant irritability (e.g., crying) and difficulty in consoling, it is not surprising that prenatal exposure to MDA in infants predicts an increase in strained/erratic limb movement, crying in an exhausted manner, and in behavioural immobility following an acute pain inducing procedure (Warnock et al., 2014; Whiffen & Gotlib, 1989; Zuckerman et al., 1990). Although Warnock et al. (2014) concluded that MDA may be the underlying factor causing delay in infant ability to regulate behaviour responses to a HL, associations between prenatal MDA, PMP, and postnatal infant pain outcomes, including behaviour self-regulation and recovery, have yet to be identified. Investigating these larger associations will help determine
whether excessive PMP is associated with alteration in MDA and if an alteration in MDA and/or PMP predicts alteration in the infant outcome. Results will help strengthen theoretical understanding of MFA and substantiate findings of MDA, PMP, and infant pain outcomes and behaviour self-regulation as discussed in the literature review chapter of this thesis. Finally, findings may be useful to future development of appropriate targeted interventions sensitive to the needs of mothers with MDA and to pain assessment and management in MDA exposed infants.
Chapter 4: Methods

In this chapter, I will present details on the research design and instruments and measures used in this secondary data analysis study I conducted, including data collection, data analysis, and ethical considerations. It is to be noted that in this secondary analysis, the study method and procedures that I made use of are based on the original study by Warnock et al. (2014) from which data were drawn. Although Warnock et al. collected several maternal and infant measures, I will only describe the maternal (i.e., MDA and PMP) and infant (i.e., infant pain outcomes and behaviour self-regulation) measures that were directly analyzed in my study.

4.1 Study Design and Study Aims

This thesis study is a descriptive comparative study making use of secondary maternal and infant data previously collected by Warnock et al. (2014). The primary aim was to compare any group differences in maternal self-reported PMP in women with MDA and women without MDA during the second trimester of pregnancy. The secondary aim was to examine relationships between PMP and time-based measures of MDA and infant pain behaviour self-regulation between infants of mothers in the two groups.

A descriptive study is a quantitative method allowing researchers to observe and to gain fundamental understanding of relationships between variables. The strength in using descriptive design lies in the ability to study variables and situations as they naturally occur (Polit & Beck, 2012). Researchers have the ability to examine relationships between variables with realism as opposed to a manipulated or “artificial” situation as experienced in many experimental studies (Polit & Beck, 2012). Therefore, the descriptive design is
conducive to examining the relationships between PMP, MDA, and infant pain behaviour and comparing these variables in women with and without MDA and their infants.

Data on prenatal MDA and postnatal infant pain outcomes of behaviour self-regulation were collected and their comparisons and associations analyzed in the previous study by Warnock et al. (2014), although the authors did not include PMP measures in their analysis. A secondary analysis involves analyzing previously collected data to answer research questions and test hypotheses that are original to a new study (Polit & Beck, 2012). Researchers typically collect more data than will be analyzed which provides opportunity to conduct a secondary analysis of the data which is beneficial and cost effective and that can help answer new questions (Garmon Bibb, 2007; Polit & Beck, 2012).

4.2 Participants

As per the study by Warnock et al. (2014), this study included a total of 30 mothers for the correlational analysis of prenatal maternal measures (PMP and MDA) and a matched sample of 21 maternal infant pairs for correlational analysis of prenatal MDA and PMP, and postnatal infant pain behaviour self-regulation.

As per the original study by Warnock et al. (2014), mothers were recruited during their second trimester of pregnancy using convenience sampling. This was completed through advertisement posted in prenatal classes, newspapers, and health clinics. For the pregnant women with MDA, volunteers were recruited through physician referral from the practitioner who provided the diagnosis of MDA. All pregnant women who volunteered completed an assessment of their mental health at their second trimester of pregnancy. The original study excluded women with bipolar disorder, Axis II disorders, or delivery complications: 30 women completed the assessment and met the study criteria. The original
study also involved infant assessment requirements which included a birth weight of >2500 g and >37 weeks gestational age and excluded infants with congenital heart disease, central nervous system malformation, neonatal abstinence syndrome, and infants requiring admission to a Neonatal Intensive Care Unit.

The population of 30 women, who completed the assessment and study criteria, was used to complete the analysis of the unmatched prenatal health measures. For the matched data analysis of the maternal infant study measures, the population was reduced to 21 mother infant pairs. This is because of the 30 women who met the criteria, 9 mothers and their infants could not be included in the postnatal study analysis due to loss of contact (n=2), infant born at a different facility (n=1), and incomplete behaviour data due to ill-positioning of the video camera (n=6). This resulted in a final sample of 21 maternal infant pairs that formed the basis for the postnatal analysis. In the original study by Warnock et al. (2014) a priori power calculation to examine group differences and change infant behaviour over the sub-phase of Post-HL indicated that 20 infants would yield sufficient power, given a type I error of .05, a power of .80, and an effect size of 0.30 using G-Power 3.1.

4.3 Ethical Considerations

In the original study by Warnock et al. (2014), ethics approval was obtained from the University of British Columbia Research Ethics Board and BC Women’s Hospital and Health Centre with the Provincial Health Services Authority Research Review Committee. Prior to commencing the study, all women provided informed consent to partake in the study and provided consent on behalf of their infant. All participants in the study were notified of their right to refuse or withdraw from the study at any time.
As my study involves the use of secondary data, I received ethics approval from the University of British Columbia Research Ethics Board, Children and Women’s Research Ethics Board. Confidentiality and privacy of the women and infants who participated in the original study was maintained. This was completed by password protecting and encrypting all data stored on a data storage device. All hardcopy materials related to the thesis secondary analysis will be stored for 5 years in a locked filing cabinet in a locked office at the University of British Columbia. At the end of this time, any hardcopy of data will be shredded, the data storage device will be destroyed, and electronic data will be deleted. The raw data used in this secondary analysis were already free of any personal identifiers and participant names do not appear on this and will not appear on any thesis or report resulting from this study.

4.4 Data Collection

In the original study by Warnock et al. (2014), maternal data were collected during the second trimester. Maternal depression and anxiety was assessed using the Edinburgh Postnatal Depression Scale (EPDS), Hamilton Depression Scale (HAM-D), and the Hamilton Anxiety Scale (HAM-A). Measures of PMP were assessed using seven questions from the Yale Inventory of Parental Thoughts and Actions Revised (YIPTA-R) tool. I provide detailed information about the psychometrics and validity of these tools in the next sections. A trained and certified examiner, who was not blinded to the aims of the study, assessed MDA using these three separate scales. The same examiner also assessed the measure of PMP.

Infants were examined on the day of their scheduled infant blood screening and had not experienced any other pain inducing procedures within 12 hours of the blood collection. The blood screening was collected via HL at approximately 37 hours of age.
Pharmacological pain interventions were not provided which aligns with the institution’s routine care practices; however, mothers remained in the room with their infants and provided comfort measures before and after the HLs were performed. A trained Medical Laboratory Assistant (MLA) performed the HL while the infant was awake, dressed in a diaper only, and lying supine in a cot.

One video camera was positioned to capture the full body behaviours of study infants. The infant’s cry was audio-recorded. Both behaviours were recorded second by second (hereafter referred to as continuously) for the full duration of the HL procedure including baseline (BL), lance (HL), and post-lance (Post-HL) and a research staff member depressed a foot pedal to record the beginning and ending of each phase of the HL. The BL phase began with the infant lying quietly in the cot and ended just before the MLA touched the heel; the HL phase began the moment the heel was sliced and ended when the MLA stopped touching the infant; and the Post-HL phase began right after the MLA touched the infant and ended just before the infant was lifted from the cot to be comforted by the mother. Each of the infant body and cry videotapes were encoded with a permanent running time notation at the bottom right side of the image in 1 s intervals. This was to allow for second by second coding of behaviour at a later time to generate time based measures of infant pain behaviour self-regulation.

4.4.1 Prenatal Maternal Measures

As mentioned in the Warnock et al. (2014) study, all study mothers were assessed for MDA during the second trimester of pregnancy making use of EPDS, HAM-D, and HAM-A. Validity of the anxiety and depression tools has been established in the literature and has been used to assess the mental health status of pregnant women and mothers in previous
studies (Bech, 2009; Bergink et al., 2011; Gavin et al., 2005; Hamilton, 1960; Oberlander et al., 2005; Oberlander et al., 2008; Oberlander et al., 2010; Warnock et al., 2009). Results were used to identify mothers and/or infants to either the non-MDA exposed group (control) or to the MDA exposed group using the cut-off scores recognized in previous studies (Oberlander et al., 2005; Oberlander et al., 2008; Oberlander et al., 2010; Warnock et al., 2009). An infant or a mother was considered MDA exposed if the mother’s prenatal score on the EDPS was greater than 10 and if their scores on the HAM-D and HAM-A were greater than 8. These cut off scores indicate mild to severe levels of depression and mild to severe levels of anxiety respectively. Mothers whose scores totaled a mild or higher level of depression and/or anxiety were informed of their scores and provided a referral to a perinatal psychiatrist. The authors also assessed measures of PMP using seven questions from YIPTA-R tool. The psychometrics of each of these measures will be explored in detail in the following sections commencing with the maternal mood measures.

4.4.1.1 Edinburgh Postnatal Depression Scale

The EPDS (see Appendix A) is a 10-item postpartum depression screening instrument that is self-reported by the participant (Bergink et al., 2011; Gavin et al., 2005). The EPDS is a convenient and easily administered tool that has a higher sensitivity for detection of postpartum depression than other tools such as the Beck Depression Inventory.

Although the EPDS was originally designed and validated to screen for postpartum depression, it has since been validated for use in pregnant women (Bergink et al., 2011; Eberhard-Gran, Eskild, Tambs, Opjordsmoen, & Ove Samuelsen, 2001). A 2011 study by Bergink et al. examined the psychometric qualities of the EPDS in pregnancy. In that study, women completed the EPDS in each trimester of their pregnancy: at 12, 24, and 36 weeks of
gestation. The authors concluded that the EPDS is a reliable and valid tool for use in every trimester of pregnancy and recommended that the cut-off scores of 11 in the first trimester and 10 in the second and third trimesters be used. These recommendations align with the EPDS cut-off score of greater than 10 that was used in the original study by Warnock et al. (2014) to indicate depressive symptoms.

4.4.1.2 Hamilton Depression Scale

The HAM-D (see Appendix B) is a clinician rated 21-item instrument that is widely used to assess symptoms and severity of depression in adults (Hamilton, 1960). Hamilton used factor analysis to create the scale items (Bech, 2009; Hamilton, 1960). The tool has established reliability and has been used for assessment and to evaluate effectiveness of treatments for depression (Hamilton, 1960). The instrument’s scores range from 0-63 and scores of 0-7 suggest no or minimal levels of depression, 8-17 mild depression, 18-25 moderate depression, and scores of 26 or higher severe depression. Scores of 8 or higher were used in the study by Warnock et al. (2014) to indicate mild to severe levels of depression.

4.4.1.3 Hamilton Anxiety Scale

The HAM-A (see Appendix C) is a clinician administered 14-item instrument that is widely used to assess symptoms and severity of anxiety in adults diagnosed with anxiety states (Hamilton, 1959). Similarly to the HAM-D, Hamilton used factor analysis to create the scale items (Bech, 2009; Hamilton, 1959). This tool also has established reliability. An advantage of this tool is that it has demonstrated ability as a diagnostic approach rather than only assessing for symptoms of anxiety of patients suffering from other disorders (Hamilton, 1959). The instrument’s scores range from 0-56 and scores of 0-7 suggest no or minimal
levels of anxiety, 8-17 mild anxiety, 18-25 moderate anxiety, and scores of 26 or higher severe anxiety. Scores of 8 or higher were used in the study by Warnock et al. (2014) to indicate mild to severe levels of anxiety.

4.4.1.4 Measures of Primary Maternal Preoccupation

This is a 7 item patient rated instrument imbedded into the demographic questionnaire provided to the mothers in the original study by Warnock et al. (2014). The data were collected and analyzed but they did not report on PMP in their study. This scale was adapted from Leckman et al. (1999) Yale Inventory of Parental Thoughts and Actions (YIPTA) scale which has since been revised to the YIPTA-R (Kim et al., 2013). The YIPTA-R has been validated for use to elicit information concerning the specific nature of new parents’ thoughts and actions (Kim et al., 2013; Leckman et al., 1999). The YIPTA-R scale is administered using semi-structured interviews by an experienced clinician at several time points: usually at around 8 months gestation, two weeks postpartum, and 3 months postpartum (Leckman et al., 1999).

Although developed for use and administered in an interview format, Leckman et al. also used the YIPTA-R to conduct several self- and partner-reported measures. Warnock et al. (2014) made use of 7 questions from the six domains of the YIPTA-R scale to use in the study that was self-reported by each participant at one time point during the second trimester of pregnancy. The questions/statements included from the YIPTA-R asked mothers to rate on a five point scale (0=never, 1=sometimes, 2=often, 3=very often, 4=always) how often they had any of the following thoughts or worries about their babies: 1) how your baby is growing and developing, 2) the safety of your baby, 3) the future of your baby, 4) how you will bond with your baby, 5) something bad happening to your baby. The mothers were also asked to
answer yes or no to the 2 remaining questions: 6) do you ever picture your baby, 7) do you have a nickname for your baby? In this study, a high PMP scale score (excessive PMP) and a score that differed significantly between the two groups of study mothers were indicative of altered PMP. A total PMP score was also calculated to address the second study aim (see section 5.2.2).

4.4.2 Infant Measures of Pain Behaviour Self-Regulation and Coding Procedures

In the original study by Warnock et al. (2014), infant pain behaviour self-regulation following a HL was coded from pre-recorded videotapes using the cross-validated Newborn Distress Pain Related Behaviour Coding System (ND-BCS). This tool was selected because it allows for concurrent and continuous coding of infant behaviour movement, posture, respiration responsiveness, and cry behaviour (Warnock, 2003). The ND-BCS was also selected because of the ability to generate time-based measures during the immediate response and recovery of infant pain behaviour while discriminating between pain and non-pain events (Warnock & Sandrin, 2004).

Four different coders who were trained in the ND-BSC and who were blinded to study purpose and to the infant group coded the pre-recorded infant behaviour study videotapes. These coders however, could not be blinded to study phase because the technician’s hand was visible during the HL. Self-regulation behaviours that were excluded from coding included those that were not visible to coders for 20 s or more during any 60 s time block of a study sub-phase (due to research technicians walking in front of the camera or when the technician held the infant heel during HL) and infant reflexive foot and leg movements.
4.5 Data Analysis

To meet my primary and secondary study aims in this study, I employed a two group comparison to examine if there were any group differences in PMP scale scores of mothers with MDA and of mothers without MDA. To conduct the two group comparison I made use of the non-parametric Mann-Whitney U test in view of the small number of participants in the maternal study groups.

To examine relationships between maternal MDA, PMP and infant behaviour self-regulation post pain event, I used several approaches. This included the use of simple correlations between the preceding measures to first identify statistically significant correlations. I then used simple linear regression as appropriate to examine if total PMP scale score (calculated by summing the frequency of the PMP scale scores that were found to be statistically significant) would predict the three measures of infant behaviour self-regulation Post-HL that were reported to be predicted by MDA in the original study by Warnock et al. (2014). The level of significance (p or alpha) was set at 0.05 and all data analyses were completed using SPSS version 23.

There are two approaches, parametric and non-parametric, that can be used for comparative and correlational analysis. I chose to use non-parametric approaches, including the Mann-Whitney U and Spearman rho to analyze many of the aims in this thesis study. Although non-parametric analyses are not as statistically powerful as their parametric alternative, they are credible statistical approaches when the stringent parametric assumptions cannot be met, such as distribution of scores or sample size (Pallant, 2013). For comparative analysis, I chose to use the Mann-Whitney U as opposed to a parametric alternative, such as the independent-samples t-test, because there was a small matched and
smaller unmatched study sample. If there were distortions in the data such as an abnormal distribution of the population, the small sample size would violate the assumption of a normally distributed population required to use the parametric test (Pallant, 2013). Similarly, for the correlational analysis, I chose to use the Spearman rho rather than the Pearson $r$ because of the small study sample size. Since this secondary analysis used a small matched and smaller unmatched study sample, the non-parametric statistical approaches were appropriate.
Chapter 5: Results

In this chapter I will present the results of the secondary data analysis I completed based on the maternal (i.e., MDA and PMP) and infant (i.e., infant pain behaviour self-regulation) data collected by Warnock et al. (2014). The results are based on the total sample of 30 mothers for prenatal maternal measures (MDA and PMP) and a matched sample of the 21 maternal infant pairs for postnatal measures of infant pain outcomes and behaviour self-regulation.

5.1 Prenatal Measures

In this study, prenatal maternal measures from the sample of 30 mothers included three maternal mental health measures of MDA (i.e., EPDS, HAM-D, and HAM-A) and the seven PMP measures (i.e., infant growing/developing normal, safety of infant, future of infant, bonding with infant, something bad happening to infant, picture your infant, and nickname for infant). I analyzed subject characteristics by maternal group, group differences in MDA and PMP measures, and correlations between the maternal mood measures and the PMP measures.

5.1.1 Maternal Subject Characteristics

Demographic characteristics of the 30 mothers that were compared by maternal group, MDA exposed \((n=13)\) and non-MDA exposed \((n=17)\), are summarized in Table 1. As can be seen in Table 1, the two maternal groups did not differ on demographic characteristics or on factors that may be considered a risk factor for maternal depression, such as parity (Warnock et al., 2014).
Table 1. Comparison between Maternal Subject Characteristics (N=30)

<table>
<thead>
<tr>
<th>Maternal demographics characteristics</th>
<th>MDA exposed (n=13)</th>
<th>Non-MDA exposed (n=17)</th>
<th>t (df)</th>
<th>p</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.38 (5.82)</td>
<td>34.29 (4.89)</td>
<td>-0.217 (19)</td>
<td>.830</td>
<td>-0.09</td>
</tr>
<tr>
<td>Education (years)</td>
<td>16.27 (5.40)</td>
<td>19.24 (3.96)</td>
<td>0.997 (19)</td>
<td>.331</td>
<td>0.46</td>
</tr>
<tr>
<td>Prior born children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>8</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Law</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. MDA exposed = study group of mothers with prenatal depression and anxiety; Non-MDA exposed = control group of mothers with no prenatal depression and anxiety; EPDS = Edinburgh Postnatal Depression Scale; HAM-D = Hamilton Depression Scale; HAM-A = Hamilton Anxiety Scale. Maternal demographic scores are means (SDs in parentheses) t-test, p < .05, two-tailed.
The non-parametric Mann-Whitney U test revealed significant differences in EPDS, HAM-D and HAM-A between the two maternal study groups \((p < .05)\). The results are displayed in Table 2. Findings showed that MDA exposed mothers had significantly higher EPDS \((U = 13.5, z = -4.073, p < .001)\), HAM-D \((U = 14.0, z = -4.052, p < .001)\), and HAM-A \((U = 16.0, z = -3.962, p < .001)\) scores than the non-MDA exposed mothers. Since the EPDS, HAM-D, and HAM-A were found to be statistically significant, I examined the mean rank for the two maternal groups, MDA exposed and non-MDA exposed, to determine the direction of the difference (Pallant, 2013). The mean rank of the MDA exposed group was higher than the non-MDA exposed group indicating the higher EPDS, HAM-D, and HAM-A scores in the MDA exposed group.

Table 2. Comparison of Prenatal Mental Health Measures \((N=30)\)

<table>
<thead>
<tr>
<th></th>
<th>(U)</th>
<th>(Z)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPDS</td>
<td>13.5</td>
<td>-4.073</td>
<td>*&lt;.001</td>
</tr>
<tr>
<td>HAM-D</td>
<td>14.0</td>
<td>-4.052</td>
<td>*&lt;.001</td>
</tr>
<tr>
<td>HAM-A</td>
<td>16.0</td>
<td>-3.962</td>
<td>*&lt;.001</td>
</tr>
</tbody>
</table>

*Note. EPDS = Edinburgh Postnatal Depression Scale; HAM-D = Hamilton Depression Scale; HAM-A = Hamilton Anxiety Scale.*

Mann-Whitney U test, \(p < .05\), two-tailed, *\(p < .05\).

5.1.2 Prenatal Primary Maternal Preoccupation Measures

Table 3 shows results of the Mann-Whitney U test that was used to compare any group differences in the seven measures of PMP between mothers allocated to the MDA exposed group or to the non-MDA exposed group \((p < .05)\). Of the seven PMP measures, five showed statistically significant group differences: infant growing/developing normal \((U = 41.5, z = -3.023, p < .003)\), safety of infant \((U = 57.0, z = -2.319, p < .020)\), future of infant \((U = 59.0, z = -2.232, p < .026)\), bonding with infant \((U = 56.0, z = -2.345, p < .019)\), and something bad happening to infant \((U = 62.0, z = -2.157, p < .031)\). On each of the preceding five measures, the MDA exposed group of mothers had higher PMP scores when compared
to the non-MDA exposed group. I determined this by comparing the mean ranks of the two groups. Statistically significant group differences in scores were not seen for two of the seven PMP measures (picturing of infant and nickname for infant).
Table 3. Comparison of Prenatal Primary Maternal Preoccupation Measures (N=30)

<table>
<thead>
<tr>
<th>Study Group</th>
<th>MDA exposed (n=13)</th>
<th>Non-MDA exposed (n=17)</th>
<th>U</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant growing/developing normal</td>
<td>4</td>
<td>1</td>
<td>41.5</td>
<td>-3.023</td>
<td>.003</td>
</tr>
<tr>
<td>Safety of infant</td>
<td>3</td>
<td>1</td>
<td>57.0</td>
<td>-2.319</td>
<td>.020</td>
</tr>
<tr>
<td>Future of infant</td>
<td>3</td>
<td>2</td>
<td>59.0</td>
<td>-2.232</td>
<td>.026</td>
</tr>
<tr>
<td>Bonding with infant</td>
<td>2</td>
<td>1</td>
<td>56.0</td>
<td>-2.345</td>
<td>.019</td>
</tr>
<tr>
<td>Something bad happening to infant</td>
<td>3</td>
<td>1</td>
<td>62.0</td>
<td>-2.157</td>
<td>.031</td>
</tr>
<tr>
<td>Picturing of infant</td>
<td>1</td>
<td>1</td>
<td>110.0</td>
<td>-0.029</td>
<td>.977</td>
</tr>
<tr>
<td>Nickname for infant</td>
<td>1</td>
<td>1</td>
<td>90.5</td>
<td>-1.025</td>
<td>.306</td>
</tr>
</tbody>
</table>

Note. MDA exposed = study group of mothers with prenatal depression and anxiety; Non-MDA exposed = control group of mothers with no prenatal depression and anxiety.
Mann-Whitney U test, p < .05 two-tailed., *p < .05.
5.1.3 Prenatal Mental Health and Primary Maternal Preoccupation Correlations

A non-parametric Spearman rho was performed to determine statistically significant correlations between the seven PMP measures and the three prenatal maternal mental health measures (EPDS, HAM-D, and HAM-A). To interpret a Spearman rho, I first examined the results for significance and then I examined the significant results for the direction and strength of the relationship. A negative sign in front of the correlation coefficient ($r_s$) means there is a negative correlation between the variables and conversely a positive correlation coefficient means there is a positive correlation between the variables (Pallant, 2013). A negative correlation means that as one variable increases the other decreases whereas a positive correlation means that as one variable increases, so too does the other (Pallant, 2013). The strength of the relationship is determined by examining the size of the correlation coefficient: an $r_s$ of .10 to .29 means there is a small correlation, an $r_s$ of .30 to .49 means there is a medium correlation, and an $r_s$ of .50 to 1.0 means there is a large correlation (Pallant, 2013).

Results of the Spearman rho analysis are displayed in Table 4. A medium positive statistically significant correlation was observed between EPDS and three of the PMP measures: infant growing/developing normal ($r_s = .428$, $p = .018$), bonding with infant ($r_s = .371$, $p = .044$), and something bad happening to infant ($r_s = .407$, $p = .025$). One PMP measure, safety of infant, also revealed a highly significant medium positive correlation with EPDS ($r_s = .480$, $p = .007$). Results also showed a statistically significant medium positive correlation between the HAM-D but only on one PMP measure: infant growing/developing normal ($r_s = .376$, $p = .041$). The HAM-A, however, was not correlated with any of the seven PMP measures.
Table 4. Correlation between Maternal Prenatal Measures: Preoccupations and Mental Health (N=30)

<table>
<thead>
<tr>
<th>Maternal Mental Health</th>
<th>EPDS</th>
<th>HAM-D</th>
<th>HAM-A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rs</td>
<td>p</td>
<td>rs</td>
</tr>
<tr>
<td>Infant growing/developing normal</td>
<td>.428</td>
<td>*.018</td>
<td>.376</td>
</tr>
<tr>
<td>Safety of infant</td>
<td>.480</td>
<td>**.007</td>
<td>.336</td>
</tr>
<tr>
<td>Future of infant</td>
<td>.333</td>
<td>.075</td>
<td>.255</td>
</tr>
<tr>
<td>Bonding with infant</td>
<td>.371</td>
<td>*.044</td>
<td>.273</td>
</tr>
<tr>
<td>Something bad happening to infant</td>
<td>.407</td>
<td>*.025</td>
<td>.309</td>
</tr>
<tr>
<td>Picturing of infant</td>
<td>-.027</td>
<td>.886</td>
<td>.073</td>
</tr>
<tr>
<td>Nickname for infant</td>
<td>.127</td>
<td>.504</td>
<td>-.057</td>
</tr>
</tbody>
</table>

*Note. EPDS = Edinburgh Postnatal Depression Scale; HAM-D = Hamilton Depression Scale; HAM-A = Hamilton Anxiety Scale.
Values represent median values of preoccupation variable based on 30 mothers (13 mothers with MDA exposed group, 17 mothers in non-MDA exposed group).
Spearman correlation, p < .05. two tailed, * p < .05, ** p < .01.
5.2 Postnatal Measures

The postnatal measures included the matched sample of 21 maternal infant pairs to examine infant pain behaviour self-regulation. The data analysis included maternal and infant subject characteristics and simple linear regression to determine if PMP predicts infant behaviour self-regulation measures post pain event and by infant group.

5.2.1 Matched Sample Maternal and Infant Subject Characteristics

Table 5 provides a summary of the demographic characteristics for the matched sample of 21 maternal infant pairs that were compared between infant study groups: MDA exposed \((n=11)\) and non-MDA exposed \((n=10)\). As Table 5 shows, the two infant groups did not differ on any demographic characteristic or on factors that have been documented to alter infant behaviour outcomes such as smoking (Warnock et al., 2014). In addition, mothers of infants in the two groups did not differ on any characteristic that is considered a risk factor to maternal depression similar to the unmatched sample discussed previously (see section 5.1.1).
### Table 5. Comparison between Maternal and Infant Subject Characteristics: Matched Sample (N=21)

<table>
<thead>
<tr>
<th>Study Group</th>
<th>MDA exposed (n=11)</th>
<th>Non-MDA exposed (n=10)</th>
<th>t(df)</th>
<th>p</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal demographics characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>33.27 (5.27)</td>
<td>32.80 (4.63)</td>
<td>-0.217 (19)</td>
<td>.830</td>
<td>-0.09</td>
</tr>
<tr>
<td>Education (y)</td>
<td>16.27 (5.62)</td>
<td>18.50 (4.47)</td>
<td>0.997 (19)</td>
<td>.331</td>
<td>0.46</td>
</tr>
<tr>
<td>Prior born children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>5</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Law</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant demographic characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant birth weight (grams)</td>
<td>3327 (337)</td>
<td>3555 (416)</td>
<td>1.38 (19)</td>
<td>.184</td>
<td>0.63</td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>39.98 (1.44)</td>
<td>39.68 (1.45)</td>
<td>-0.438 (19)</td>
<td>.641</td>
<td>-0.20</td>
</tr>
<tr>
<td>Postnatal age at heel lance (HL)</td>
<td>36.27 (13.52)</td>
<td>38.40 (11.89)</td>
<td>0.182 (19)</td>
<td>.707</td>
<td>0.08</td>
</tr>
<tr>
<td>APGAR score at 1 min</td>
<td>8.36 (2.11)</td>
<td>7.90 (1.66)</td>
<td>-0.55 (19)</td>
<td>.585</td>
<td>-0.25</td>
</tr>
<tr>
<td>APGAR score at 5 min</td>
<td>8.81 (0.98)</td>
<td>9.00 (0.47)</td>
<td>0.58 (19)</td>
<td>.601</td>
<td>0.26</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>5/6</td>
<td>8/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery method (vaginal/c-section)</td>
<td>8/3</td>
<td>8/2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. MDA exposed = study group of mothers with prenatal depression and anxiety; Non-MDA exposed = control group of mothers with no prenatal depression and anxiety; EPDS = Edinburgh Postnatal Depression Scale; HAM-D = Hamilton Depression Scale; HAM-A = Hamilton Anxiety Scale. Infant and maternal demographic scores and maternal prenatal mental health scores are means (SDs in parentheses) t-test, p < .05, two-tailed.*
For the matched sample (N=21), a Mann-Whitney U test was completed to compare mothers in MDA exposed group and in the non-MDA exposed group on the three prenatal maternal mental health measures (EPDS, HAM-A, HAM-D). The results of this comparison are displayed in Table 6. Findings showed that the MDA exposed mothers had significantly higher EPDS ($U = 5.0, z = -3.527, p < .001$), HAM-D ($U = 12.0, z = -3.037, p = .020$), and HAM-A ($U = 9.5, z = -3.210, p = .010$) scores than the non-MDA exposed mothers. The mean rank of the MDA exposed group was higher than the non-MDA exposed group; therefore, higher EPDS, HAM-D, and HAM-A scores are observed in the MDA exposed group.

Table 6. Comparison of Prenatal Mental Health Measures (N=21)

<table>
<thead>
<tr>
<th>Measure</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPDS</td>
<td>5.0</td>
<td>-3.527</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>HAM-D</td>
<td>12.0</td>
<td>-3.037</td>
<td>.020</td>
</tr>
<tr>
<td>HAM-A</td>
<td>9.5</td>
<td>-3.210</td>
<td>.010</td>
</tr>
</tbody>
</table>

Note. EPDS = Edinburgh Postnatal Depression Scale; HAM-D = Hamilton Depression Scale; HAM-A = Hamilton Anxiety Scale.
Mann Whitney U test, p < .05, two-tailed, * p < .05.

5.2.2 Infant Behaviour Self-Regulation Measures

Separate simple linear regressions were completed to first determine if MDA would again predict the three infant measures of behaviour self-regulation that had been previously reported by Warnock et al. (2014): strained/erratic limb movement, immobility, and weak/exhausted cry. I then conducted separate simple regressions to determine if PMP would predict the same infant measures. When I obtained results of each of these separate tests, I examined the proportion of variance by looking at the $r^2$ which is used to evaluate the regression model (Pallant, 2013). According to Pallant (2013), a small value of $r^2$ indicates that the model does not fit the data well. The $r^2$ describes the proportion of variance in the dependent variable, in this case infant behaviour self-regulation (strained/erratic limb
movement, immobility, and crying), that is explained by the regression model. In the event there is an overestimation of the true value, an adjusted $r^2$ is instead used to correct the overestimation that may be due to a small sample size. Hence, results of the adjusted $r^2$ are more valid than the non-adjusted $r^2$ result. For this reason, I reported on the adjusted $r^2$.

Results showed that during Post-HL, MDA exposure was significantly associated with the three infant self-regulation behaviours infant strained/erratic limb movement ($b = .539, t = 2.793, p = .012$), immobility ($b = .467, t = 2.305, p = .033$), and weak/exhausted cry ($b = .547, t = 2.850, p < .010$). Prenatal MDA exposure explained a significant proportion of variance in the strained/erratic limb movement (adjusted $r^2 = .254, F(1, 19) = 7.800, p = .012$), immobility (adjusted $r^2 = .177, F(1, 19) = 5.313, p = .033$), and weak/exhausted cry (adjusted $r^2 = .263, F(1, 19) = 8.125, p = .010$) behaviours.

To determine if PMP would predict the three infant measures, I calculated a total PMP score rather than running multiple tests on each of the five PMP measures. The reason for doing this is because running multiple tests would overinflate the results. Results showed that during Post-HL, the total prenatal PMP score was significantly associated with strained/erratic limb movement ($b = .448, t = 2.182, p = .042$) and immobility ($b = .523, t = 2.675, p = .015$). The total prenatal PMP score explained a significant proportion of variance in strained/erratic limb movement (adjusted $r^2 = .158, F(1, 19) = 4.763, p = .042$) and immobility (adjusted $r^2 = .235, F(1, 19) = 7.157, p = .015$).

Of interest, when comparing PMP with MDA on predictive values, it appears that both were predictive of infant measures but that MDA was a stronger predictor and on all three of the infant measures. These values may suggest that PMP with MDA are correlated with each other as noted in the literature review of this thesis. The low adjusted $r^2$ results
may also suggest that there are likely other factors that account for the infant measures other than PMP and MDA.
Chapter 6: Discussion and Conclusions

The purpose of this thesis study was to examine any group differences in self-reported prenatal PMP in women with and without prenatal MDA during the second trimester of pregnancy and to investigate relationships between and amongst these maternal prenatal measures and infant pain behaviour self-regulation. This thesis study is a secondary analysis of prenatal PMP and MDA and postnatal infant behaviour self-regulation from a previous study by Warnock et al. (2014). In that study MDA was found to predict alteration in infant pain behaviour self-regulation Post-HL but the authors did not analyze the self-reports of PMP they had collected from the mothers of the study infants they had collected in the second trimester of pregnancy.

This discussion chapter interprets significant findings of this secondary analysis in which PMP measures were analyzed to examine whether mothers with MDA also had excessive prenatal PMP and if PMP was linked to altered infant pain behaviour self-regulation. This chapter discusses what the result findings mean including strengths and limitations, implications for nursing theory and practice, and recommendations for future research are also outlined in this chapter. To finish, this thesis study presents conclusions of this secondary analysis in reference to the research purpose and hypotheses.

6.1 Significant Findings

To my knowledge, this thesis is the first study to have examined associations between prenatal mental health measures of MDA and PMP and postnatal infant pain behaviour self-regulation, concurrently. This is strengthened by using MFA theory was used as a guiding framework to help me interpret the significance of the maternal mental health measures and determine how MDA and excessive PMP may or may not be related to infant factors, which
may impede a mother’s ability to form attachment to her unborn child. Findings from this study contribute to our overall understanding of complex pathways of association between MDA, PMP, and infant pain behaviour self-regulation. By using MFA as a framework to concurrently examine the variables of PMP, MDA, and postnatal infant behaviour self-regulation, this study provides foundational information needed to help guide development of targeted interventions rooted in attachment theory to support mothers with MDA in the prenatal period and offers insight that is essential to improve postnatal pain assessment of MDA exposed infants. The findings also provide important information for the fields of infant pain and for the fields of prenatal maternal mental health, especially as it pertains to associations between PMP and MDA.

The first study hypothesis was that during second trimester of pregnancy, women with MDA would differ in their self-reported PMP than compared to women with no MDA. This hypothesis was supported for five of the seven PMP measures: infant growing/developing normal, safety of infant, future of infant, bonding with infant, and something bad happening to infant. Mothers with MDA reported higher PMP scale scores on each of the preceding PMP measures compared to mothers with no MDA. This finding is not surprising. The PMP measures that were used in this study come from the YIPTA and YIPTA-R tools that have previously been used to distinguish symptoms of depression and anxiety, and even OCD (Feldman et al., 1999; Leckman et al. 1999). The findings validate previous findings that excessive prenatal PMP is associated with prenatal MDA (Ambrosini et al., 2012; Brockington et al., 2006; Goecke et al., 2012).

In the present study, mothers with MDA composing both the unmatched and matched study samples also had higher scores on each of the three prenatal health measures EPDS,
HAM-D, and HAM-A. The size of the study sample did not appear to influence the results. As for the PMP measures, increased scale scores on each of the four PMP measures (infant growing/developing normal, safety of infant, future of infant, bonding with infant, and something bad happening to infant) were associated with increase in mean levels of EPDS. One measure, infant growing/developing normal, was also positively correlated with the HAM-D.

These positive correlations are not surprising since excessive prenatal PMP has been shown to be a risk factor of MDA (Ambrosini et al., 2012; Brockington et al., 2006; Goecke et al., 2012). That these correlations were present during the prenatal period also support the prenatal use of the EPDS. Originally the EPDS was developed to screen for postnatal depression, but since then, it has been validated for use during all three trimesters of pregnancy (Bergink et al., 2011; Eberhard-Gran et al., 2001; Gavin et al., 2005). The EPDS may be able to capture the uniqueness of depression and anxiety during this distinct period in a women’s life.

There was however, a lack of correlation between the PMP measures and the HAM-A measures. As previously noted, Winnicott (1956) had discussed concerns with PMP in a manner that is normal or temporary which coincides with Leckman et al. (2004) description of too intense levels of PMP as a concern. Both concerns are indicative of excessive PMP as I have defined. Although I found lack of correlation, the findings of PMP scores may still be related to anxiety. Perhaps the HAM-A is not sensitive enough to capture excessive PMP in pregnancy since PMP is considered a normative state of heightened sensitivity and that the associated anxiety seen with PMP is essential to help the mother prepare for and develop pre and postnatal attachment to her infant (Feldman et al., 1999; Warnock et al., 2009). The
EPDS however, has been reported to not only assess depression, but anxiety as well, which may be another reason why it correlated with the majority of the PMP measures (Phillips, Charles, Sharpe, & Matthey, 2009; Pop, Komproe, & van Son, 1992). Future studies with larger sample sizes may also help detect symptoms of anxiety.

In this thesis, it was also hypothesized that there would be associations between the prenatal measures of MDA and PMP and postnatal infant pain behaviour self-regulation following an acute pain procedure (HL). This hypothesis was partially supported. In this study, MDA grouping and total infant exposure to prenatal MDA and to PMP scale scores predicted two of the three patternings of altered infant pain behaviour self-regulation post-pain event (pain recovery) including strained/erratic limb movement and immobility. These findings support Warnock et al. (2014) findings of delayed pain recovery in MDA exposed infants. Warnock et al. (2014) also found that infants in the MDA exposed group continued to cry in a weak and exhausted manner and to exhibit strained/erratic limb movements and immobility for a longer span of time Post-HL compared to infant controls. In this thesis study, the exposed infant group also showed statistically higher total PMP scores. This points to excessive PMP as one factor which may contribute to delayed infant pain recovery.

The simple regression findings also showed that MDA predicted crying in a weak/exhausted manner but not by total prenatal PMP scores. However, weak infant crying has also been reported in infants with dual exposure to MDA and to maternal prenatal use of SSRI antidepressant medications (Cohen et al., 2000; Lundy et al., 1999; Warnock et al., 2009). This may explain why weak/exhausted cry was predicted by MDA. Another possible reason may be Type II error in that the low numbers of study infants with prenatal exposures
to SSRI medication \((n=4)\) was too small to have detected a significant PMP predictive finding.

In this thesis study, I replicated the simple regressions that Warnock et al. (2014) performed involving MDA and the three infant behaviours but also ran simple regressions involving total PMP scale scores to compare the resultant findings. In addition, I then compared those two measures with the infant measures. Interestingly, when comparing the PMP predictive values with MDA values, MDA was the stronger predictor and on all three of the infant measures. This supports prior findings that PMP and MDA are correlated with each other (Ambrosini et al., 2012; Brockington et al., 2006; Goecke et al., 2012). However, the adjusted \(r^2\) results were low which may suggest that in addition to PMP and MDA, other factors likely account for the finding of altered infant behaviour self-regulation.

6.2 **Strengths and Limitations**

There are several strengths that are prominent in this study. Most notably, this thesis study contributes to the fields of maternal mental health and infant pain by reporting the associations between prenatal mental health measures of MDA and PMP and postnatal infant pain behaviour self-regulation concurrently. In doing so, MDA was found to be correlated with self-reported PMP at second trimester and the MDA exposed group of mothers was found to have higher PMP scores than the non-MDA exposed group of mothers. As well, excessive PMP was found to predict increase in the proportion of time that MDA exposed infants spent exhibiting strained/erratic limb movement and immobility Post-HL. This supports a directional nature of these pathways of association since measures from both MDA and PMP are predictive of altered infant behaviour self-regulation. This adds clarity to the pre and postnatal bond that is inherent between mothers and infants.
By using secondary analysis of data, there is risk that the data collected by others will contain deficiencies in sampling method, data collection, and variables examined which can lead to concerns with validity and reliability of evidence generated in the secondary analysis (Garmon Bibb, 2007; Magee, Lee, Giuliano, & Munro, 2006; Polit & Beck, 2012). To ensure best use of the data and to minimize risk in using data already analyzed, I devoted time to familiarize myself with the data set and worked closely with my supervisor in all phases of the data analysis (Magee et al., 2006). In addition, I formulated new questions and selected a theoretical framework that was matched to my research study aims and intended purposes.

However, this thesis study has limitations. The small sample size of the study limits the generalizability of study findings. Another limitation is that I only analyzed infant pain behaviour self-regulation but did not include other infant pain indicators such as measures of infant heart rate variability and salivary cortisol or the five facial actions from the Neonatal Facial Coding System (NFCS) which were measured and analyzed by Warnock et al. (2014). Heart rate variability in response to pain has been used in several studies to reflect distress and the infant’s ability to self-regulate post-pain procedure (Grunau et al., 2005; Lucas-Thompson et al., 2008; Oberlander & Saul, 2002; Warnock et al., 2014). This is because heart rate variability parallels behaviour pain responses and can implicate sympathetic central nervous system activation which reveals the infant’s capacity to respond to an event (Oberlander & Saul, 2002). Salivary cortisol is a biological indicator used to evaluate infant HPA axis stress response post-pain procedure (Herrington et al., 2004). When coupled with behavioural and physiological indicators, salivary cortisol may be insightful for assessing infant self-regulation and adaptation to pain or not and for differentiating pain reactivity from pain recovery (Herrington et al., 2004; Warnock & Sandrin, 2004).
6.3 Implications for Nursing Practice and Research

Even though MDA is prevalent in pregnancy, social stigma towards depression and anxiety remains a barrier for mothers to seek help (Beck, 2001). This is especially concerning given that delay in early detection and treatment of these serious illnesses is known to hamper the mother-infant relationships. Such delays also increase infant risk for long-term maladaptive patterns in biobehavioural regulation including altered pain behaviour self-regulation, as identified in this secondary analysis and other studies (Beck, 2001; Kinsella and Monk, 2009; Monk, 2001; Oberlander & DiPietro, 2003; Oberlander et al., 2005; Yonkers et al., 2009). An important contribution of the findings of this thesis study is that it furthers understanding of prenatal MDA, contributory factors such as prenatal PMP, and their potential consequences to postnatal infant pain behaviour self-regulation by concurrently examining all of these variables.

Early screening of mothers who are considered at risk for MDA and timely implementation of interventions, such as nurse family partnership programs, prior to onset of symptoms needs to be the goal (Beck, 2001; Leckman et al., 2002). Additionally, MFA can be used to help women to achieve a healthy level of PMP and influence their level of depression (Coyl et al., 2002; Feldman et al., 1999; Field et al., 2006; Goecke et al., 2012; Leckman et al., 2002; Sroufe et al., 1999). Depression has been shown to affect the mother's availability to her infant and her ability to synchronize with her infant states limiting her capacity to engage in the relationship-building of bonding needed for development of secure attachment (Feldman et al., 1999). In this study, excessive PMP was correlated with measures of MDA. If this same correlation is again observed in future studies, it may be possible that PMP scores may be able to predict MDA and vice versa. For example, it may
be possible that the five questions used in this study (infant growing/developing normal, safety of infant, future of infant, bonding with infant, and something bad happening to infant) could be used to help screen and identify mothers in the second trimester of pregnancy.

Findings from this study can also be used to identify infants at risk for altered pain behaviour self-regulation. For example, developing targeted pain assessment protocols that also screen for prenatal MDA and PMP may be important for the prevention and treatment of pain in infants since the behaviours that the maternal-infant dyads exhibit are not necessarily typical (Oberlander et al., 2005; Warnock et al., 2009; Warnock et al., 2014). Currently, there are several infant pain assessment tools available for clinicians that have demonstrated validity and clinical utility, but none include explicit items for scoring infant ability to self-regulate to and from a pain event (Ruskin, Amaria, Warnock, McGrath, 2010). Still, clinicians can make direct use of the two behaviours of altered infant pain behaviour self-regulation from this secondary analysis to help inform and guide them when assessing pain recovery in infants with prenatal exposure to MDA and/or to PMP.

To further the field of infant pain assessment, nurse researchers can incorporate all three infant behaviours into an existing validated infant behaviour pain scale. Doing this may not only help to detect and prevent future prolonged recovery and potential dysregulation in newborn infants with prenatal exposure to MDA and/or to PMP, but it will also serve to heighten clinician awareness of the relevance of infant self-regulation as an indicator of infant neurobehaviour and the importance of continuing pain assessment of infants well into the recovery phase of any routine infant pain and stress inducing clinical event. Because the three behaviours pertain primarily to pain recovery, their incorporation into existing validated pain behaviour tools may also help advance understanding of pain recovery in
infants who experience repeated pain events or to help identify mechanisms other than MDA and PMP that may be underlying infant alterations in behaviour self-regulation. Researchers may also consider including measures of infant and maternal stress cortisol measures. Doing this, will help broaden and deepen insight on the underlying or mediatory role of MDA and PMP on infant pain self-regulation.

Accumulating evidence suggests that maternal driven infant pain interventions such as breastfeeding are effective in alleviating procedural pain in newborns (Campbell-Yeo, Fernandes, & Johnston, 2011) and that they afford multiple mutual benefits for both mother and infant. For example, breastfeeding facilitates maternal infant skin to skin contact and the mother’s ability to establish early union and relationship with her infant while providing the infant containment, sucking, sweet solution and breast milk (Shah, Herbozo, Aliwalas, & Shah, 2012). These findings are important but they are limited. One main reason is that very few maternal driven infant pain intervention studies have reported including mothers with MDA in the study sample (Warnock et al., 2009). Hence, it is currently unknown if these mothers even engage in such infant pain care interventions and if they do whether they and their infants receive the same benefits or even if underlying MDA would confound effectiveness of the intervention. Nurse researchers can help address this gap in knowledge by encouraging mothers with MDA and their infants as study participants via appropriate preliminary screening, by documenting resultant outcomes, and by developing targeted infant pain interventions that are sensitive to the needs of these maternal-infant populations as appropriate. Given the preliminary nature of the PMP study findings, more research is required to determine if this prenatal maternal factor warrants early screening and incorporation in infant pain tools and in maternal driven infant pain interventions.
Although this study focused on maternal measures, future research should also include paternal (father) preoccupations and depression. Findings of several studies that included measures of mental health of fathers have consistently identified prenatal paternal depression as an additional risk factor to poor infant outcomes by confounding effects on maternal mental health (Field et al., 2010; Field et al., 2006a; Field et al., 2006b; Leckman et al., 1999; Kim et al., 2013). Field et al. (2006a) identified mothers coupled with depressed fathers had marginally higher scores on depression and anxiety scores than the mothers coupled with non-depressed fathers and that fathers living with depressed mothers had significantly higher depression and anxiety scores than the fathers living with non-depressed mothers. They discussed the importance of identifying and developing interventions for prenatally depressed fathers to prevent the negative effects they may have on the mother’s prenatal mood state that may indirectly effect fetal development and postnatal infant outcomes. Future studies should focus on both paternal and maternal mental health measures prenatally and the effects on postnatal infant behaviour outcomes.

6.4 Conclusions

The primary aim of my thesis study using secondary data from Warnock et al. (2014) was to examine any group differences in self-reported PMP in women with and without prenatal MDA during the second trimester of pregnancy. The secondary aim was to investigate the relationships between and amongst maternal prenatal measures (MDA and PMP) and infant behaviour self-regulation. To study these variables, an unmatched sample of 30 mothers were used to examine the relationships between prenatal mental health measures and a matched sample of 21 mothers and their infants were used to explore predictive measures of MDA and excessive PMP to altered infant behaviour self-regulation measures.
The EPDS, HAM-D, HAM-A, and 7 measures of PMP were used to assess maternal mental health measures and the three infant behaviours strained/erratic limb movement, immobility, and weak/exhausted cry were used to determine altered infant pain behaviour self-regulation (pain recovery).

Results of this study support the finding of Warnock et al. (2014) that infants exposed to prenatal MDA have altered pain recovery behaviours but that other factors may play a role in the behaviours. This study also helped answer new questions and generate new findings. The focus on PMP resulted in preliminary novel findings that showed excessive prenatal PMP to be correlated with the EPDS and HAM-D measures and that it was predictive of two patternings in altered infant pain behaviour self-regulation. Although preliminary, these findings, together with the findings of MDA, can be used to help inform the timing and assessment of maternal prenatal mental health screening and the development of targeted prenatal interventions based on a foundation of MFA. As well, assessment and management of infant procedural pain can be targeted to meet the unique needs of infants with prenatal MDA and PMP exposure. The three patterns of altered pain behaviour self-regulation can be used to help inform and guide clinicians when assessing pain recovery in these infants.

Encouraging maternal involvement in infant pain care and supporting the powerful regulatory role of the infant’s mother during infant pain events is important. Findings of future research will help to inform and guide the development of targeted maternal driven infant pain interventions for mothers with MDA and/or PMP and their infants that would support and promote the powerful regulatory role of the infant’s mother while providing pain relief to the infant during and following exposure to routine pain events.
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Appendices

Appendix A: Edinburgh Postnatal Depression Scale

Edinburgh Postnatal Depression Scale¹ (EPDS)

Name: _______________________________ Address: __________________________________

Your Date of Birth: ________________________ Phone: ________________________________

Baby’s Date of Birth: _______________________

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt IN THE PAST 7 DAYS, not just how you feel today.

Here is an example, already completed.

I have felt happy:
1. Yes, all the time
2. Yes, most of the time This would mean: “I have felt happy most of the time” during the past week.
3. No, not very often Please complete the other questions in the same way.
4. No, not at all

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - As much as I always could
   - Not quite as much now
   - Definitely not as much now
   - Not at all

2. I have looked forward with enjoyment to things
   - As much as I ever did
   - Rather less than I used to
   - Definitely less than I used to
   - Hardly at all

3. I have blamed myself unnecessarily when things went wrong
   - Yes, most of the time
   - Yes, some of the time
   - Not very often
   - No, never

4. I have been anxious or worried for no good reason
   - No, not at all
   - Hardly ever
   - Yes, sometimes
   - Yes, very often

5. I have felt scared or panicky for no very good reason
   - Yes, quite a lot
   - Yes, sometimes
   - No, not much
   - No, not at all

6. Things have been getting on top of me
   - Yes, most of the time I haven’t been able
to cope at all
   - Yes, sometimes I haven’t been coping as well as usual
   - No, most of the time I have coped quite well
   - No, I have been coping as well as ever

7. I have been so unhappy that I have had difficulty sleeping
   - Yes, most of the time
   - Yes, sometimes
   - Not very often
   - No, not at all

8. I have felt sad or miserable
   - Yes, most of the time
   - Yes, quite often
   - Not very often
   - No, not at all

9. I have been so unhappy that I have been crying
   - Yes, most of the time
   - Yes, quite often
   - Only occasionally
   - No, never

10. The thought of harming myself has occurred to me
    - Yes, quite often
    - Sometimes
    - Hardly ever
    - Never

Administered/Reviewed by ________________________________ Date _______________________


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### Appendix B: Hamilton Depression Scale

**HAMILTON DEPRESSION RATING SCALE (HAM-D)**

(To be administered by a health care professional)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1. | **DEPRESSED MOOD**  
   - 0: Absent  
   - 1: Absent  
   - 2: Occasional weeping  
   - 3: Frequent weeping  
   - 4: Extreme symptoms |
| 2. | **FEELINGS OF GUILT**  
   - 0: Absent  
   - 1: Self-reproach, feels he/she has let people down  
   - 2: Idea of guilt  
   - 3: Present illness is a punishment; delusions of guilt  
   - 4: Hallucinations of guilt |
| 3. | **SUICIDE**  
   - 0: Absent  
   - 1: Feels life is not worth living  
   - 2: Wishes he/she were dead  
   - 3: Suicidal ideas or gestures  
   - 4: Attempts at suicide |
| 4. | **INSOMNIA - Initial**  
   - 0: Absent  
   - 1: Occasional  
   - 2: Frequent |
| 5. | **INSOMNIA - Middle**  
   - 0: Absent  
   - 1: Occasional  
   - 2: Frequent |
| 6. | **INSOMNIA - Delayed**  
   - 0: Absent  
   - 1: Occasional  
   - 2: Frequent |
| 7. | **WORK AND INTERESTS**  
   - 0: No difficulty  
   - 1: Feelings of incapacity, listlessness, indecision and vacillation  
   - 2: Loss of interest in hobbies, decreased social activities  
   - 3: Productivity decreased  
   - 4: Unable to work. Stopped working because of present illness only. (Absence from work after treatment or recovery may rate a lower score) |
| 8. | **RETARDATION**  
   - 0: Absent  
   - 1: Slight retardation at interview  
   - 2: Obvious retardation at interview  
   - 3: Interview difficult  
   - 4: Complete stupor |
| 9. | **AGITATION**  
   - 0: Absent  
   - 1: Occasional  
   - 2: Frequent |
| 10. | **ANXIETY - PSYCHIC**  
    - 0: No difficulty  
    - 1: Tension and irritability  
    - 2: Worrying about minor matters  
    - 3: Apprehensive attitude  
    - 4: Fears |

The HAM-D is designed to rate the severity of depression in patients. Although it contains 21 areas, calculate the patient’s score on the first 17 answers.
HAMILTON DEPRESSION RATING SCALE (HAM-D)
(To be administered by a health care professional)

11. ANXIETY - SOMATIC
   Gastrointestinal, indigestion
   Cardiovascular, palpitation, Headaches
   Respiratory, Cough- expectorant, etc.
   0 = Absent
   1 = Mild
   2 = Moderate
   3 = Severe
   4 = Incapacitating

12. SOMATIC SYMPTOMS - GASTROINTESTINAL
   (Loss of appetite, heavy feeling in abdomen; constipation)
   0 = Absent
   1 = Mild
   2 = Severe

13. SOMATIC SYMPTOMS - GENERAL
   (Headaches in limbs, back or head; cutaneous backache; loss of energy and fatigability)
   0 = Absent
   1 = Mild
   2 = Severe

14. GENITAL SYMPTOMS
   (Loss of libido, menstrual disturbances)
   0 = Absent
   1 = Mild
   2 = Severe

15. HYPOCHONDRIASIS
   0 = Not present
   1 = Self-absorption (toddly)
   2 = Preoccupation with health
   3 = Quenous attitude
   4 = Hypochondriacal delusions

16. WEIGHT LOSS
   0 = No weight loss
   1 = Slight
   2 = Obvious or severe

17. INSIGHT
   (Insight must be interpreted in terms of patient's understanding and background.)
   0 = No loss
   1 = Partial or doubtful loss
   2 = Loss of insight

TOTAL ITEMS 1 TO 17: ____________
0 - 7 = Normal
8 - 13 = Mild Depression
14 - 18 = Moderate Depression
19 - 22 = Severe Depression
≥ 23 = Very Severe Depression

18. DIURNAL VARIATION
   (Symptoms worse in morning or evening. Note which it is.)
   0 = No variation
   1 = Mild variation; AM ( ) PM ( )
   2 = Severe variation; AM ( ) PM ( )

19. DEPERSONALIZATION AND DEREALIZATION
   (Feelings of unreality, nihilistic ideas)
   0 = Absent
   1 = Mild
   2 = Moderate
   3 = Severe
   4 = Incapacitating

20. PARANOID SYMPTOMS
   (Not with a depressive quality)
   0 = None
   1 = Suspicious
   2 = Ideas of reference
   3 = Delusions of reference and persecution
   4 = Hallucinations, persecution

21. OBSESSIONAL SYMPTOMS
   (Obsesive thoughts and compulsions against which the patient struggles)
   0 = Absent
   1 = Mild
   2 = Severe

Appendix C: Hamilton Anxiety Scale

**HAMILTON ANXIETY SCALE (HAM-A)**

| Patient Name: ___________________________ | Today's Date: ___________________________
|------------------------------------------|------------------------------------------|

The Hamilton Anxiety Scale (HAM-A) is a rating scale developed to quantify the severity of anxiety symptomatology, often used in psychotropic drug evaluation. It consists of 14 items, each defined by a series of symptoms. Each item is rated on a 5-point scale, ranging from 0 (not present) to 4 (severe).

<table>
<thead>
<tr>
<th>Score</th>
<th>0 = Not present</th>
<th>4 = Severe</th>
</tr>
</thead>
</table>

1. **ANXIOUS MOOD**
   - Worries
   - Anticipates worst

2. **TENSION**
   - Startles
   - Cries easily
   - Restless
   - Trembling

3. **FEARS**
   - Fear of the dark
   - Fear of strangers
   - Fear of being alone
   - Fear of animal

4. **INSOMNIA**
   - Difficulty falling asleep or staying asleep
   - Difficulty with Nightmares

5. **INTELLECTUAL**
   - Poor concentration
   - Memory Impairment

6. **DEPRESSED MOOD**
   - Decreased interest in activities
   - Anhedonia
   - Insomnia

7. **SOMATIC COMPLAINTS: MUSCULAR**
   - Muscle aches or pains
   - Tenderness

8. **SOMATIC COMPLAINTS: SENSORY**
   - Throat
   - Blurred vision

9. **CARDIOVASCULAR SYMPTOMS**
   - Tachycardia
   - Palpitations
   - Chest Pain
   - Sensation of feeling faint

10. **RESPIRATORY SYMPTOMS**
    - Chest pressure
    - Choking sensation
    - Shortness of Breath

11. **GASTROINTESTINAL SYMPTOMS**
    - Dysphagia
    - Nausea or Vomiting
    - Constipation
    - Weight loss
    - Abdominal Flatness

12. **GENITOURINARY SYMPTOMS**
    - Urinary frequency or urgency
    - Dysmenorrhea
    - Impotence

13. **AUTONOMIC SYMPTOMS**
    - Dry Mouth
    - Flushings
    - Pallor
    - Sweating

14. **BEHAVIOR AT INTERVIEW**
    - Fidgets
    - Tremor
    - Pacing