UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL AND HUMAN SCIENCES

School of Psychology

THE INFLUENCE OF MINDFULNESS AND MENTAL HEALTH

ON MATERNAL SENSITIVITY AND CHILD OUTCOMES

ACROSS THE PERINATAL PERIOD

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ABSTRACT

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THE INFLUENCE OF MINDFULNESS AND MENTAL HEALTH ON MATERNAL SENSITIVITY AND CHILD OUTCOMES ACROSS THE PERINATAL PERIOD

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The first part of this thesis is a narrative synthesis of the literature that examines mindfulness and child outcomes across the perinatal period. A total of 13 studies met inclusion criteria and were discussed in relation to two categories: studies that explored dispositional mindfulness and studies that explored the feasibility and/or effectiveness of mindfulness interventions. The review highlighted evidence that suggests that dispositional prenatal mindfulness may be naturally protective against the development of psychopathology during the perinatal period. Intervention studies provide promising evidence that mindfulness interventions (both brief and intensive) can improve mood and wellbeing and have positive effects on some child health and socio-emotional outcomes. However, empirical evidence is still in its infancy, and very few conclusions can be drawn from this research in relation to the impact of maternal mindfulness on the development of maternal sensitivity and its longer-term impact on child development. The review identified a fundamental need for replication of studies using randomised controlled trials with active control groups and larger sample sizes. Longer follow-up periods are also required in order to identify whether the positive post-intervention effects are sustained into the postnatal period and beyond.

The second part of this thesis is an empirical study investigating the associations between mental health, dispositional mindfulness and maternal

sensitivity in expectant mothers during their third trimester of pregnancy. Signal Detection Theory was applied in order to differentiate between discrimination (whether expectant mothers can discriminate between happy and sad infant emotions) and response bias (whether expectant mothers have a propensity to rate emotional faces as either 'happy' or 'sad'). Results showed that mental health difficulties positively correlated with a greater propensity to interpret infant expressions (both positive and negative expressions) as 'sad'. Higher dispositional mindfulness was also associated with lower depression and lower anxiety. An association between dispositional mindfulness and maternal sensitivity was not found. Findings are discussed in relation to previous research and also highlight limitations with the maternal sensitivity task design. This research adds to the limited literature on dispositional mindfulness.

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DECLARATION OF AUTHORSHIP

I, Sara E. Carr, declare that the thesis entitled

The Influence of Mindfulness and Mental Health on Maternal Sensitivity and Child Outcomes across the Perinatal Period

and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research.

I confirm that:

▪ this work was done wholly or mainly while in candidature for a research degree at this University;

▪ where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

▪ where I have consulted the published work of others, this is always clearly attributed;

▪ where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;

▪ I have acknowledged all main sources of help;

▪ where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

▪ none of this work has been published before submission.

Signed:

Date: 25.05.2017

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I would also like to thank my sisters and brother - Christina, Katrina, Lisa and John, and my best friends Zoë and Gemma– you have all motivated me to keep going and been there to listen whenever I needed to talk.

This thesis would not have been possible without you all. Thank you.

CHAPTER 1

THE INFLUENCE OF MATERNAL MINDFULNESS ON SENSITIVITY TO

INFANT DISTRESS AND CHILD OUTCOMES

ACROSS THE PERINATAL PERIOD: A NARRATIVE REVIEW

Introduction

Within the past few decades, there has been a rapidly growing evidence base for the investigation of mindfulness as both a psychological construct and a form of clinical intervention (Keng, Smoski & Robins, 2011). Mindfulness has been defined as the 'non-judgmental awareness of experiences in the present moment' (Hölzel et al., 2011, p. 537; see also Kabat-Zinn, 1990). Dispositional mindfulness has been shown to be positively associated with a variety of indicators of psychological health, such as higher levels of positive affect, life satisfaction and adaptive emotion regulation (Brown & Ryan, 2003), enhanced sustained attention (Schmertz, Anderson & Robins, 2009) and lower levels of negative affect and psychopathological symptoms (Cash & Whittingham, 2010; Frewen, Evans, Maraj, Dozois & Partridge, 2008; Hofmann, Sawyer, Witt & Oh, 2010; Raes & Williams, 2010).

Research has also started to explore the role of mindfulness in relation to interpersonal interactions (Dekeyser, Raes, Leijssen, Leyson & Dewulf, 2008; Duncan & Bardacke, 2010), within parenting relationships, and in relation to the psychological well-being of caregivers and child behavioural and developmental outcomes (Duncan, Coatsworth & Greenberg, 2009; Parent et al., 2010; Parent, McKee, Rough & Forehand, 2016; Turpyn & Chaplin, 2016; van den Heuvel, Donkers, Winkler, Otte & Van den Bergh, 2015). However, theoretical models of mindful parenting are still in their infancy with limited empirical evidence (e.g., Duncan et al., 2009; Parent et al., 2010).

Sensitive mothers (those with high 'maternal sensitivity') respond to cues in a timely manner and match the cues to their infant's responses, development, and context (Leerkes, Blankson & O'Brien, 2009). Greater sensitivity to an infant's needs has been associated with more secure mother-infant relationships, better emotional development, higher social competence, and fewer behavioural difficulties (Beckwith, Cohen, & Hamilton, 1999; Davidov & Grusec, 2006; Leerkes et al., 2009). The perinatal period is considered a critical time point for the growth of sensitive and responsive caregiving, and the development of sensitive maternal responses can be observed as early as during pregnancy (Pearson et al., 2012; Pearson et al, 2013; van den Heuvel et al., 2015).

This narrative review will critique the research that examines the influence of mindfulness on mothers' sensitivity to infant emotions and distress. The chapter will initially explore the construct of mindfulness and define maternal sensitivity. A systematic literature search will help to examine how mindfulness has been investigated and utilised within the perinatal population in relation to maternal sensitivity and child outcomes. Insight from the maternal mental health literature, with particular emphasis on maternal psychological health associated with both mindfulness and maternal sensitivity, will also be explored.

Mindfulness

With origins in Buddhist practices and spiritualist philosophies (Kalupahana, 1987), mindfulness is a relatively new phenomenon to Western medicine and psychological contexts, largely beginning in the 1970s (Kabat-Zinn, 1982). Mindfulness has been used to describe a psychological disposition (or trait), a practice (e.g., mindful meditation), a state of awareness, or a psychological process (Germer, Siegel & Fulton, 2005). Kabat-Zinn (2003, p. 145) defined it as 'paying

attention, on purpose, in the present moment and non-judgmentally to the unfolding of experience moment-by-moment'. Epstein (1999) outlined that the intentions of mindful practice are to act with awareness and compassion in response to one's experiences within their immediate environment. The majority of research[1] appears to follow Bishop and colleagues' (2004) model, which proposes that mindfulness encompasses two components, self-regulation and orientation to experience. S*elf-regulation of attention* refers to developing an attentional awareness in which future worry and past rumination are replaced with present moment awareness (an awareness and observation of sensations, thoughts and feelings). Focusing is essential in order to reduce the experience of running on 'automatic pilot' (e.g., driving home from work and forgetting the route normally taken). It involves the ability to focus one's attention, as well as the ability to switch attention from one aspect of the experience to another (Keng et al., 2011). The second component is *orientation to experience*, which is concerned with an attitude of non-judgemental acceptance, curiosity and openness to one's attentional experience. In a theoretical review, Hölzel and colleagues (2011) evidence four distinct components of mindfulness, which include attention regulation, body awareness, emotion regulation and change in self-perspective.

Jon Kabat-Zinn was one of the first to adapt Buddhist mindfulness concepts into a Mindfulness-Based Stress Reduction (MBSR) course for the treatment of chronic pain (Kabat-Zinn, 1982). Other meditation-oriented interventions have followed, including Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams & Teasdale, 2002), through the incorporation of MSBR and cognitive therapy, which was initially developed for the treatment of depression. Other interventions that teach

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[1] Other research has focused primarily on the attentional aspects of mindfulness (e.g., Brown & Ryan, 2003).

mindfulness skills, using less meditation-oriented techniques, are now available to enhance psychological well-being and treat mental health problems, and include Acceptance and Commitment Therapy (ACT; Hayes, Stosahl & Wilson, 1999) and Dialectical Behaviour Therapy (DBT; Linehan, 1993).

Perhaps most prominently, mindfulness has been applied as an intervention for mental health difficulties (Hofmann et al., 2010) and holds an extensive evidence-base with a number of RCTs conducted amongst clinical and non-clinical populations (see Baer, 2003, Chiesa & Serreit, 2010, and Grossman, Niemann, Schmidt & Walach, 2004, for reviews). Mindfulness-based interventions have evidenced positive impacts on symptoms of anxiety (Shapiro, Schwartz & Bonner, 1998), depression (Grossman et al, 2010), perceived stress (Bränström, Kvillemo, Brandberg & Moskowitz, 2010) and bipolar disorder (Williams et al., 2008), and have also been shown to improve physical health, including reductions in chronic pain and fatigue (Khoury et al., 2013).

Mindfulness has also been explored as a positive psychological construct that allows for better resiliency in the face of major life transitions, stressors or adversity, known as dispositional mindfulness (Anicha, Ode, Moeller & Robinson, 2012; Brown & Ryan, 2003; Way, Creswell, Eisenbergert & Liebenmen, 2010). Anicha et al. (2012) put forward that dispositional mindfulness differs between individuals, just as individuals differ on awareness, attention and cognitive control. Most research on dispositional mindfulness has been examined among undergraduate populations (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), or in populations of meditators (Baer et al., 2008).

Maternal Mindfulness Interventions

Over the past decade, there has been an increased interest in perinatal mindfulness, including in clinical settings for women suffering from low mood, anxiety and stress both prenatally and postnatally (i.e., postnatal depression). Researchers, such as Dimidjian et al. (2015) have attempted to respond to the need for evidence-based psychotherapy interventions in place of the traditional pharmaceutical interventions (i.e., anti-depressants). In particular, empirical research is emerging that evidences the benefits of prenatal mindfulness interventions to reduce low mood and anxiety (Duncan & Bardacke, 2010; Dunn, Hanieh, Roberts & Powrie, 2012; Vieten & Astin, 2008), and stress (Beddoe, Yang, Kennedy, Weiss & Lee, 2009), and improve positive affect (Duncan & Bardacke, 2010) and self-compassion (Dunn et al., 2012).

In a recent systematic review and meta-analysis, Lever Taylor, Cavanagh and Strauss (2016) identified 17 studies of mindfulness-based interventions in the perinatal period, and concluded that pre to post analyses confirmed significant reductions in depression, anxiety and stress. It has also been argued that mindfulness-based interventions may improve birth outcomes and reduce adverse consequences for women and foetal development (Goodman, Rouse, Long, Ji & Brand, 2011; Matvienko-Sikar, Lee, Murphy & Murphy, 2016).

Kabat-Zinn (1990) argued that mindfulness has the potential to indirectly enhance interpersonal relationships through the development of self-compassion, which in turn leads to more effective responsiveness to others. The role of parental characteristics (mainly more negative characteristics, such as depression and anxiety) has been emphasised in relation to the development of youth psychopathology and behavioural and developmental outcomes (Kimonis, Frick & McMahon, 2014).

Research examining links between mindful parenting[2] and sensitivity (Duncan, et al., 2009), and parental dispositional mindfulness alongside parenting practices (Parent et al., 2010) is being explored, and have provided promising results. Studies reveal correlations between increased parental mindfulness and more effective parent-child relationships (Coatsworth, Duncan, Greenberg & Nix, 2010), reduced parenting stress (Bazzano et al., 2013) and improved youth psychosocial wellbeing (Haydicky, Shecter, Wiener & Ducharme, 2015; Geurtzen, Scholte, Engels, Tak & van Zundert, 2014; Parent et al., 2010; Parent et al., 2016). Very few studies have focused specifically on the perinatal period.

Maternal Sensitivity

Maternal sensitivity relates to a mother's ability to recognise, understand, and respond appropriately and consistently to her infant's emotional, physical and communicative needs (Ainsworth, Blehar, Waters & Wall, 1978; Ainsworth, 1979; Bowlby, 1969; Karl, 1995; Pearson et al., 2012). Infant cues (i.e., crying) signal to the mother that the infant needs something, but determining what the infant needs is often difficult (DelCarmen-Wiggins & Carter, 2004), especially for new mothers. By 6 weeks, infants are sensitive to the facial expressions and responses of their mothers and expect social interaction (Nadel, Carchon, Kervella, Marcelli & Reserbat-Plantey, 1999; Rochat & Striano, 1999). Maternal sensitivity is associated with the subsequent development of healthy attachment relationships (Ainsworth, 1979; Bowlby, 1969).

Whilst the majority of research has explored the predictors of sensitive caregiving, such as genetics, self-esteem, marital and socioeconomic status, social

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[2] Mindful Parenting has been defined as "paying attention to your child and your parenting in a particular way: intentionally, here and now, and non-judgementally" (Kabat-Zinn & Kabat-Zinn, 1997).

support, mental health, mother's attachment history, and child's temperament (McElwain & Booth-LaForce, 2006; Shin, Park & Kim, 2006; Plomin, DeFries, Craif & McGuffin, 2003; Stams, Juffer & van Ijzendoorn, 2002; Stein, Lehtonen, Harvey, Nicol-Harper & Craske, 2009), to name a few, more research is required to explore the cognitive processes or mechanisms that underlie sensitive caregiving so that appropriate interventions can be developed. It may be that dispositional mindfulness may advantage some mothers in their interactions and responsiveness towards their developing child (Zoeterman, 2014). In addition, mindfulness-based interventions may help to improve these interactions, or protect against the development of depression and other mental health difficulties, which have an impact on maternal sensitivity and parenting (see section, below).

Maternal Well-being and Sensitivity

Most of the research on psychopathology over the perinatal period has focused on perinatal depression and suggests that approximately 12-13% of women experience depressive symptoms over this period (Bennett, Einarson, Taddio, Koren & Einarson, 2004), with an estimated 10-30% of women experiencing postnatal depression[3] (Darcy et al., 2011, Gavin et al., 2005, Vesga-Lopez et al., 2008, depending on the criteria used for diagnosis). The prevalence of perinatal depression is also much higher in vulnerable populations with certain risk factors, including socioeconomic disadvantage, young, single mothers, individuals who have experienced complications, and previous psychopathology and stress (Bennett et al., 2004; VesgaLopez et al., 2008).

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[3] Depression experienced during gestation is termed antenatal depression; depression experienced during the postnatal period is termed postpartum depression (PPD) or postnatal depression (PND) in the literature.

Maternal depression and other mental health difficulties are well-documented risk factors for reduced maternal sensitivity and subsequent negative cognitive and socioeconomic outcomes in young children (Cummings, Davies & Campbell, 2000). There is evidence that depressed mothers are less responsive, less likely to engage in playful and affectively positive interactions, and demonstrate harsher and more impatient parenting with their children compared to non-depressed mothers (Campbell, Matestic, von Stauffenberg, Mohan & Kircher, 2007).

The World Health Organization has classified perinatal depression as a "major public health challenge" which needs to be tackled globally. Yet, despite these serious and far-reaching consequences, it is difficult for healthcare providers to accurately detect depression in expectant and new mothers (Flynn, Blow & Marcus, 2006). Other obstacles to treatment include women feeling discouraged for seeking help due to shame, fear of stigmatisation, lack of time and difficulty in securing childcare (Bennet et al., 2004). Whilst perinatal depression has similar symptoms to major depressive disorder (MDD), it is quantifiably different as it presents in a unique time period.

Current research findings suggest that attentional processing of infant distress cues during pregnancy as well as postnatally plays an important role in a mother's capacity to respond appropriately to her infant. Research by Pearson and colleagues (e.g., Pearson, Cooper, Penton-Voak, Lightman & Evans, 2010; Pearson, Lightman & Evans, 2009) has investigated the link between depressive symptoms and maternal sensitivity over the perinatal period. Pearson, Lightman and Evans (2011) showed that women who demonstrated greater attentional bias towards infant distress during late pregnancy reported more successful mother-infant relationships. Pearson et al. (2012; see also Pearson et al., 2010) showed that prenatal depression during mid-

pregnancy plays a fundamental role in the development of maternal responsiveness and proposed that depression may interrupt this cycle, resulting in disrupted mother-infant interactions and poor infant outcomes. Barker, Jaffee, Uher and Maughan (2011) also suggested that the third trimester is important in determining postnatal outcomes.

Stein et al. (2009) proposed a 'preoccupation' hypothesis. Their findings demonstrated that mothers who have depressive/anxiety symptoms are preoccupied with recurrent negative/anxious intrusive thoughts, increasing cognitive load and narrowed or self-focused attention. As a result, they tend to have difficulty attending to and responding to the outside world. The researchers proposed that one consequence of preoccupation is reduced responsivity to the infant and the environment (see also Field, 2010; Lovejoy, Graczyk, O'Hare & Neuman, 2000; Stein et al., 2012). However, Pearson, Lightman and Evans (2012) found that depressed women exhibited significantly greater systolic blood pressure towards infant distress compared to non-depressed women and proposed that these results suggest an oversensitivity to infant distress at the sympathetic level at least.

The maternal preoccupation hypothesis makes intuitive sense, particularly as impaired facial expression recognition has been associated with features of major depression, which could underlie some of the difficulties in social interactions of this population (Surguladeze et al., 2004). However, other research has found no link between depressive symptoms and maternal sensitivity (e.g., Sidor, Kunz, Schweyer, Eickhorst & Cierpka, 2011), although many studies into maternal sensitivity involve observations and could be criticised on these measures or other self-report measures used (Lindhiem, Bernard & Dozier, 2011). Campbell et al. (2004) found that maternal sensitivity (observed at 4 time periods between 6 and 36 months) was not associated

to patterns of depressive symptoms; however, the course and timing of depressive symptoms interacted with maternal sensitivity.

Significantly less research has focused on interactions between mothers with anxiety disorders and their infants (Feldman et al., 2009). Some studies have suggested that anxious mothers are over-stimulating and override the infant's moment-by-moment signals (Murray, Cooper, Creswell, Schofield & Sack, 2007). Other studies have failed to show maternal sensitivity differences between anxious mothers and controls (Weinberg & Tronick, 1998).

Aim of the Review

A plethora of theoretical and empirical papers have evidenced the usefulness of mindfulness interventions in improving psychological health and emotional wellbeing as well as reducing symptoms of mental health difficulties. Research has also suggested that dispositional mindfulness may help to protect against the development and maintenance of mental health difficulties and maternal distress. Recent research has turned its attention to applying mindfulness to mothers, with preliminary research suggesting that mindfulness interventions are useful in improving maternal wellbeing.

The association between mindfulness, mental health and the development of maternal sensitivity/child outcomes in the perinatal period is not clear. A systematic search and narrative review of the empirical evidence is important to evaluate the current status of the recent literature and provide guidelines to help shape future research and mindfulness interventions.

Review Objectives

1. To review the relationships between perinatal mindfulness, maternal sensitivity/child outcomes and mental health.

2. To critically evaluate the current findings within the literature.

3. To discuss recommendations for future research based on the findings of this review.

Method

Search Protocol

A systematic search was conducted using three different internet databases: PsychINFO, Web of Science, and PubMed. Papers were searched for relevant themes dating from January 1994 (as far back as the search terms allowed) to present (October 2016). Titles were screened for relevance and a number of papers were excluded at this stage. The studies which appeared to be applicable were examined at the abstract level, and full text was accessed if relevant to the review themes. Reference lists of the papers which were accessed were also examined for relevant articles.

The same search terms were entered into all three databases in order to systematically search the literature and reduce bias and errors in the selection process. The research question was divided into three main areas: 1) mindfulness, 2) maternal sensitivity, and 3) mental health, and displayed in Table 1.1. The initial search through PsychINFO yielded a total of 297 papers; with Web of Science and PubMed yielding an additional 46 and 35 papers, respectively (378 total papers retrieved).

Table 1.1

Search terms used to systematically search the current literature.

Area of Interest	Search Terms
Mindfulness	Mindfulness OR mindful* OR MBSR[1] OR MBCT[2] OR MBI[3]
Maternal Sensitivity	Maternal sensitivity OR responsiveness OR relationship OR attunement OR attachment OR bonding OR attention bias OR cognitive bias OR infant fac*
Mental Health	Mental health OR well-being OR well being OR depression OR anxiety OR mood OR stress OR psychopathology
Mother	Mother* OR maternal

Note: * signifies wildcard to collect related extensions of mother and mindful.
[1]MBSR = Mindfulness-Based Stress Reduction; [2]MBCT = Mindfulness-Based Cognitive Therapy; [3]Mindfulness-Based Intervention.

Inclusion and Exclusion Criteria

The articles were required to meet the following criteria in order to be included in the review: a) published in English; b) published in a peer-reviewed journal or a doctoral dissertation; c) mindfulness was offered as an intervention or measured as a disposition; d) a measure of maternal sensitivity or child outcomes[4] was used; and e) expectant mother and mother participants were in their perinatal period which ranged from the beginning of pregnancy to up to two years post-childbirth. Due to a limited evidence base for mindfulness related to maternal sensitivity, unpublished dissertations, pilot/feasibility studies and non-controlled studies were accepted, provided that they met the inclusion criteria and were of a high quality standard.

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[4] Developmental/social/psychological/emotional/behavioural/health outcomes. Papers which reported birth outcomes from the mothers' perspective were also included, as previous research has suggested that birth experience can have an impact on later attachment and maternal sensitivity (Wolke, EryigitMadzwamuse, & Gutbrod, 2013).

Papers were excluded if: a) they were literature reviews or meta-analyses; and b) there were no measures of maternal sensitivity or child outcomes.

Using the inclusion and exclusion criteria, a total of 265 studies were screened for eligibility using the title and abstract. Once irrelevant papers were excluded, a total of 25 papers were read in full and scrutinised for eligibility. An additional two papers were included from reference lists. A total of 13 studies were relevant, met the inclusion criteria, and were included in the review[5]. A visual representation of the selection process is included in Figure 1.1.

Results

Descriptive Summary of Studies

A descriptive summary of the design, measures and results of the studies were tabulated (see Tables 1.2 and 1.3 for the dispositional mindfulness and mindful intervention studies, respectively). The review aimed to explore the relationships between: 1) perinatal dispositional mindfulness and maternal sensitivity/child outcomes, and 2) between perinatal mindfulness interventions and maternal sensitivity/child outcomes. Consideration was also given to relationships between mental health and the mindfulness and child outcome factors. Studies were categorised into two groups: research that explored dispositional mindfulness ($n = 4$), and research that explored mindfulness interventions ($n = 9$), during the perinatal period.

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[5] Two studies were included which partially breached the inclusion and exclusion criteria. First, Eames, Crane, Gold and Pratt (2015) were not specifically focusing on the perinatal period, but the participants who took part had one child which ranged between 1 and 72 months, and so covered some of the postpartum period. Second, Perez-Blaso, Viguer and Rodrigo (2013) did not specifically focus on maternal sensitivity or child outcome measures, but included The Parental Evaluation Scale (FarkasKlein & Católica, 2008) which measured feelings of satisfaction and self-efficacy about motherhood in mothers of children up to two years.

Of the 13 identified relevant articles, 10 used a pregnant women population. Three studies recruited mothers in their postnatal period for a mindfulness intervention. Where age was provided, the mean age ranged from 24.7 years to 35.5 years. Sample sizes ranged from 13 to 777 participants and included prospective longitudinal designs ($n = 4$), non-controlled interventions ($n = 5$) and randomised controlled interventions ($n = 4$). All studies exploring dispositional mindfulness collected mental health and mindfulness self-report measures during the second/third trimester of pregnancy and then explored child outcomes in the first few months after birth. Mindfulness interventions were diverse, with all studies offering slightly different programmes that varied in intensity and encouragement of home practice. The psychometric measures used in the studies also varied greatly (see Table 1.4). A total of four standardised measures were used to explore the construct of mindfulness. Three intervention studies did not incorporate any measures of mindfulness (Chan, 2014; Meschino et al., 2016; Sriboonpimsuay et al., 2011). Chan (2014) used cord blood cortisol as an indicator of intra-uterine fetal mental health status[6]. A total of 19 different measures were used to assess mental health/psychological distress. In addition, child outcomes were the most varied of measures. These outcomes ranged from standardised measures of attachment and infant temperament/characteristics, to health and physiological outcomes (i.e., proportion of preterm births). Qualitative reports were also included as ways of exploring mindfulness and child outcomes. Other measures incorporated into study designs related to measures of life satisfaction, social support and self-compassion.

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[6] Chan (2014) proposes that this measure indicates a more/less stressful maternal environment.

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┌─────────────────────────┐
│   Titles and Abstracts  │
│  identified from initial│
│         search          │
│                         │
│         n = 378         │
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             │        ┌──────────────────────────────┐
             │───────▶│     Excluded n = 113         │
             │        │                              │
             ▼        │ Articles limited to those    │
┌─────────────────────────┐ available in             │
│   Titles and Abstracts  │ English, excluding       │
│  screened for eligibility│ reviews.                │
│                         │ Duplicates removed.      │
│         n = 265         └──────────────────────────────┘
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             │───────▶│     Excluded n = 240         │
             │        │                              │
             ▼        │ Articles did not meet        │
┌─────────────────────────┐ inclusion criteria or    │
│  Full article retrieved │ met exclusion criteria   │
│   and read for eligibility│ based on the Title     │
│                         │ and Abstract             │
│         n = 25          └──────────────────────────────┘
└─────────────────────────┘
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Excluded n = 14

6 = mothers not in perinatal period/children too old
3 = no maternal sensitivity or child outcomes
2= wrong construct (i.e., mind-mindedness)
2= qualitative study
1= not mothers (i.e., caregivers)

Included n = 2

Relevant articles identified from reference lists

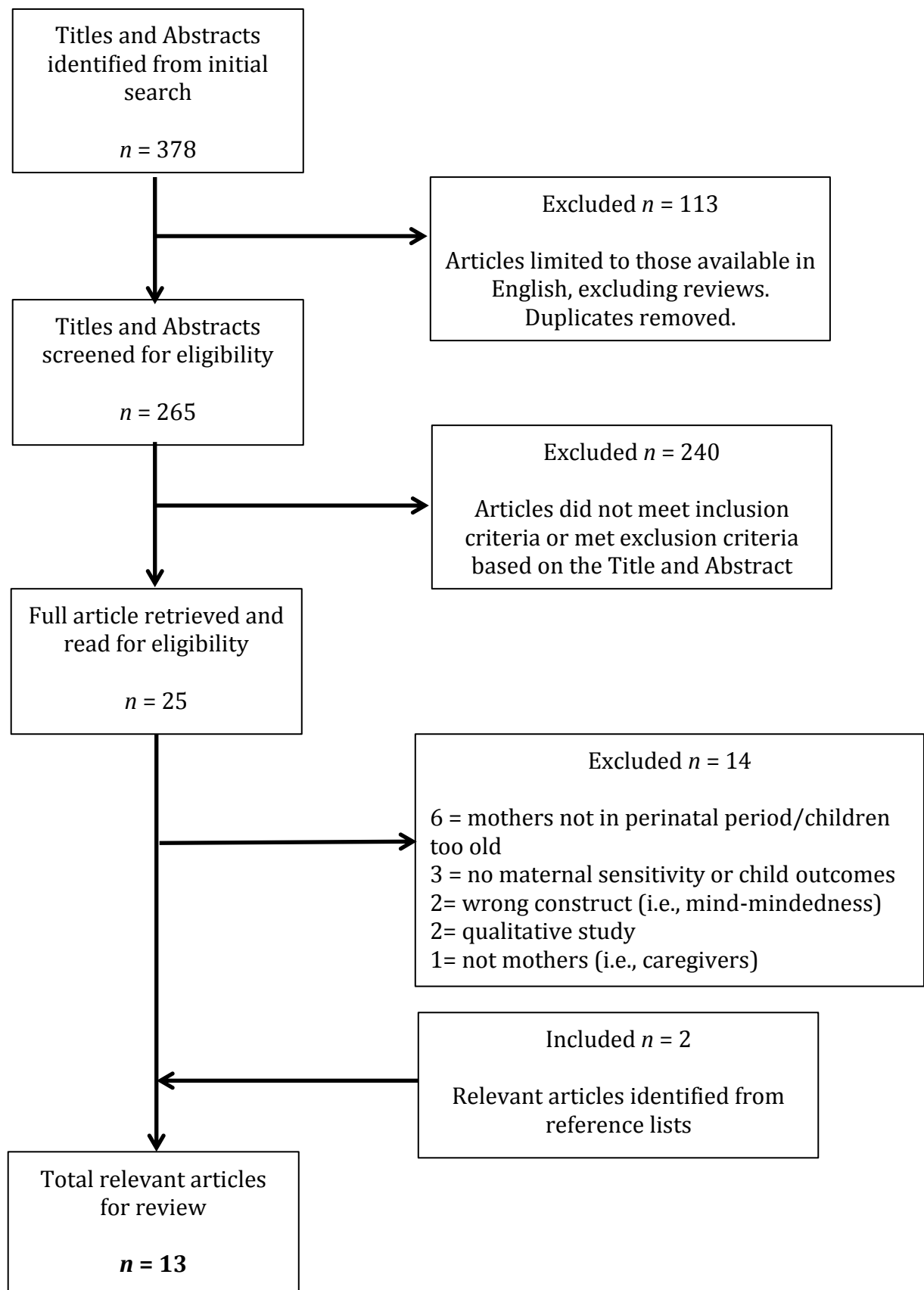Total relevant articles for review

n = 13

Figure 1.1. Visual representation of the systematic literature selection process.

Table 1.2. Characteristics of studies that explore dispositional mindfulness and child outcomes.

Study	Participants	Design	(1) Aim & (2) Methodology	Mental Health Measures	Mindfulness Measures	Infant/Child Outcome Measures	Results
Sawyer Cohen (2010) PhD thesis	$N = 196$ nulliparous women (age = 30.32; SD = 4.77). Recruited in second/third trimester (mean gestation = 27.21 weeks; SD = 7.87).	Prospective longitudinal study with pre-post test design	1) To examine whether prenatal mindfulness and selfcompassion are associated with increased prenatal and postnatal attachment, and fewer symptoms of anxiety and depression postpartum. 2) Self-report questionnaires completed online in second/third trimester (T1) and then again 3-8 months postpartum (T2).	Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987). State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983). Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet & Farley, 1988)	Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). Self-Compassion Scale (SCS, Neff, 2003)	Prenatal Attachment Inventory (PAI; Muller, 1993). Maternal Attachment Inventory (MAI; Muller, 1994).	Perinatal anxiety stable over time ($r = .719$, $p < .01$). Prenatal self-compassion predicted a considerable amount of variance in postnatal depression (15% variance), and anxiety (44% variance), which was in turn associated with postnatal attachment. Prenatal self-compassion and mindfulness together predicted significant variance in prenatal attachment (12% variance),which was also associated with postnatal attachment. Prenatal mindfulness directly related to postnatal attachment ($r = .233$, $p < .01$).
van den Heuvel, Donkers, Winkler, Otte & Van den Bergh (2015)	$N = 78$ mother-infant dyads. Women (mean age = 32.09, SD = 5.55) recruited in their second/third trimesters	Prospective longitudinal study with pre-post test design	1) To explore dispositional maternal mindfulness during pregnancy and its effects on infant neurocognitive functioning (auditory attention).	Anxiety subscale of the Symptom Checklist (SCL-90, Dutch version; Arrindell & Ettema, 1981).	Freiburg Mindfulness Inventory-Short Form (FMIs-14, Dutch version, Walach, Buchheld, Buttenmuller, Kleinknecht & Schmidt, 2006).	ERPs at 9 months.	Negative correlation between maternal mindfulness and anxiety measured during pregnancy ($r = -.270$, $p < .05$). Infants prenatally exposed to higher levels of mindfulness devote less in-depth processing to frequently occurring

Author	Sample	Design	Aims	Measures	Results
	(15th-22nd week gestation). 79 infants (one set of twins) mean age 43.90 weeks; SD = 1.84)		2) Mindfulness & anxiety measures administered to mothers at beginning of second/third trimester (T1). Anxiety measures and eventrelated potentials (ERPs) measurement took place 9 months post-birth (T2; ~60 mins).		irrelevant stimuli/habituate faster to these stimuli ($p = .002$). In contrast, infants exposed prenatally to higher levels of maternal anxiety process frequently occurring sounds more extensively/habituate slower ($p = .005$).
van den Heuvel, Johannes, Henrichs & Van den Bergh (2015)	$N = 90$ mother-infant dyads. Women recruited (mean age = 32.13; SD = 3.61) recruited in their second/third trimester (15th–22nd gestation). Infants mean age = 9.7 months; SD = 1.3	Prospective longitudinal study with pre-post test design	1) To investigate the association between dispositional maternal mindfulness during pregnancy and infant socio-emotional development and temperament at 10 months. 2) Mindfulness and anxiety measures taken at 20.5 weeks gestation (T1); infant socioemotional development and temperament taken approximately 10 months after delivery (T2). Measures completed by postal or digital questionnaires.	Anxiety subscale of the Symptom Checklist (SCL-90, Dutch version; Arrindell & Ettema, 1981). Freiburg Mindfulness Inventory-Short Form (FMIs-14, Dutch version, Walach et al., 2006). Infant socioemotional development: Ages and Stages Questionnaires: Social-Emotional (ASQ:SE 12; Squires, Bricker, Heo & Twombly, 2001). Infant temperament: short version of the revised Infant Behaviour Questionnaire (IBQR; Gartstein & Rothbart, 2003).	Maternal mindfulness during pregnancy associated with less self-regulation problems ($r = .273, p < .01$), less negative affectivity (difficult temperament; $r = -.213, p < .05$) and more effortful control ($r = .228, p < .05$ in infants at 10 months. Maternal anxiety during pregnancy associated with more self-regulation difficulties ($r = .346, p < .01$), more negative affectivity ($r = .419, p < .01$) and more surgency problems ($r = .247, p < .05$). Maternal anxiety mediated the association between maternal mindfulness and infant's selfregulation problems (with mediator: $r = -.253, p < .01$; without mediator: $r = -.176, p > .05$).

| Zoeterman (2014) PhD thesis. | $N = 777$. Women recruited in second/third trimester. Specific gestations not reported, and mean age/SD not reported. | Prospective longitudinal study with pre-post test design | 1) To investigate mindful awareness in pregnancy, depression in the post-partum period and birth experience. 2) Depression, anxiety and mindfulness measures completed during pregnancy (T1): Birth experience measure completed up to 6 months post childbirth (T2). Completion time of data collection 45-60 minutes x 2. | Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). | Five Facet Mindfulness Questionnaire – acting with awareness facet only (FFMQ; Baer, et al., 2006). | Birth experience measure: participants chose from a list of 33 words that described their labour, delivery and birth experience. Three primary factors: Negative Emotional Birth Experience; Positive Emotional Birth Experience; Spiritual Emotional Birth Experience. | Higher levels of acting with awareness (mindfulness) associated with lower levels of depression (T1: $r=-.402$, $p < .01$; T2: $r=-.323$, $p < .01$) and anxiety (T1: $r=-.463$, $p < .01$; T2: $r=-.384$, $p < .01$). Acting with awareness sig. decreased ($p < .001$) from pre to post childbirth, and levels of depression and anxiety increased. Negative emotional birth experiences positively correlated with postnatal depression ($r = .247$, $p < .01$) and anxiety ($r = .239$, $p < .01$). |

Note: T1 = time point one; T2 = time point two. Nulliparous = no previous births.

Table 1.3. Characteristics of studies that explore mindfulness interventions and child outcomes.

Study	Participants	Design	(1) Aim & (2) Methodology	Mental Health Measures	Mindfulness Measures	Infant/Child Outcome Measures	Results
Chan (2014)	*N* = 187 pregnant Chinese women between 12 and 28 weeks gestation. Treatment (*n*= 64; mean age = 33.34, *SD* = 4.11) and control (*n*=59; mean age = 33.84, *SD* = 3.74) groups.	Randomised controlled trial of pre and post intervention	1) To explore the effects of prenatal meditation on infant health and temperament. 2) Eastern-based Meditative Intervention (EBMI; Chan, 2010). Antenatal group - 6 sessions (duration and frequency not reported). Control group received introductory lecture. Birth weight, maturity, Apgar cord blood cortisol collected after delivery. Infant salivary cortisol levels collected 6 weeks and 5 months after delivery. Temperament questionnaire completed 5 months after delivery.	No mental health measure.	No reported measures of mindfulness.	Cord blood cortisol, Apgar score (Apgar, 1953), infant salivary cortisol, Carey Infant Temperament Questionnaire (Carey & McDevitt, 1978).	Percentage of babies who required special neonatal care lower in intervention group who practiced EBMI frequently (> 3 times per week) compared to women who did not engage in frequent practice. Cord blood cortisol level of intervention group (and within that, frequent practice group) is higher than control group. No differences between intervention and control group on infant salivary cortisol levels. Infants of intervention group reportedly have better temperament and more likely to approach new stimuli than control group at 5 months.
Duncan & Bardacke (2010)	*N* = 27 pregnant women in late second/ early third trimester (mean age = 34.61; *SD* = 4.22).	Non-controlled pre and post intervention	1) To describe the changes in the dimensions of the stress and coping process observed in pregnant women participating in MBCP with their partners during their third trimester of pregnancy.	Perceived Stress Scale (Cohen, Kamarck & Mermelstein, 1983). Revised Pregnancy Anxiety Scale (Levin, 1991).	3 subscales (acting with awareness, nonjudging, and nonreactivity) of Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006).	Qualitative responses post-birth of pregnancy experiences, labour and delivery, and early post-partum period in relation to practicing mindfulness, how it may have helped	Pre-post intervention mean differences were significant for anxiety (decrease; *d* = .81), depression (decrease; *d* = .38), mindfulness (increase; *d* = .74) attributed to non-judging (*d* = .49) and nonreactivity (*d* = .85) subscales Positive (*d* = .41) and negative (*d* = .39) affect

Author	Sample	Design	Aims / Intervention	Measures	Interview / Additional measures	Findings
			2) Mindfulness-Based Childbirth and Parenting Intervention (MBSR based) to improve maternal well-being. Antenatal group – 10 sessions. 9 weekly sessions (3 hours each) plus 7hr silent retreat and post-birth reunion. Birth partners also attended. In session practice of mindfulness; home practice 6 days per week for 30 mins. Self-report questionnaires completed pre and post intervention.	Centre for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Differential Emotions Scale (DES; Izard, 1977). The Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegan, 1988).		during birth and managing difficulties during postpartum period. as measured by PANAS, and positive affect as measured by DES ($d = .40$). Majority of participants reported engaging in formal mindfulness practice (e.g., set exercises), rest reported informal practice (e.g., staying in the present moment). Qualitative results viewed partner involvement as essential.
Dunn, Hanieh, Roberts and Powrie (2012)	$N = 19$ pregnant women. Treatment group participants ($n = 10$; between 12 and 28 weeks gestation; mean age = 35.33, SD = 4.53). Control group participants ($n = 9$; between 17 and 29 weeks gestation;	Intervention group and non-randomised treatment-as-usual control group. Pre and post intervention. Qualitative feedback via post-birth interviews.	1) To explore the effects of a mindfulness-based intervention on the psychological distress and well-being of pregnant women. 2) MBCT adapted programme. Antenatal group – 8 weekly sessions (duration of sessions and home practice not reported). Baseline, end of treatment and 6 weeks post-partum data collection.	Depression, Anxiety and Stress Scale (DASS21; Lovibond & Lovibond, 1995). Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). Self-Compassion Scale (Neff, 2003).	Mindful Attention and Awareness Scale (Brown & Ryan, 2003). Semi-structured interview to elicit personal accounts of pregnancy, childbirth and parenting.	Clinically reliable declines in depression, stress and anxiety that continued 6 weeks postpartum. Changes not seen for control group. Increase in mindfulness and self-compassion scores over time. All women interviewed reported that they continued to use mindfulness skills formally (i.e., CDs for meditation exercises) or informally (i.e., mindful breathing). Mindfulness skills have helped them cope with pregnancy, childbirth and parenting.

Author	Sample	Design	Aims / Intervention	Measures	Mindfulness measure	Results
Eames, Crane, Gold and Pratt (2015)	mean age 27.67, SD = 5.34). N = 13 socio-economically disadvantaged mothers (mean age = 31.73; SD = 8.16).	Non-controlled pre and post intervention (pilot study).	1) To assess whether socio-economically disadvantaged mothers demonstrate pre-post intervention change in terms of parental wellbeing and parenting related stress as a result of attending the mindfulness programme. 2) Mindfulness-Based Wellbeing for Parents (MBW-P) programme (adapted MBSR) Group – 8 weekly sessions (2 hours each). Short formal practices of between 10 and 30 minutes delivered in sessions. Daily informal home practice encouraged for 10-15 minutes twice a day. Self-report questionnaires completed pre and post intervention.	Parenting Stress Index- Short Form (PSI-SF; Abidin, 1995): Parental Distress subscale. Ruminative Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991). Beck Depression Inventory (BDI-II; Beck, Steer & Brown, 1996). Warwick-Edinburgh Mental Well-being Scale (WEMWBS; Tennant et al., 2007).	FFMQ (Baer et al., 2006).	Parenting Stress Index- Short Form (PSI-SF; Abidin, 1995): Parent-Child Dysfunctional Interaction and Difficult Child subscales. Baseline measurements indicate higher levels of stress, depression and rumination and less total wellbeing and facets of mindfulness, compared to community samples of data. No significant changes observed on subscales of PSI-SF (g =.81) but trends in expected direction. No significant changes observed in depression scores (g =.69). Mindfulness levels increased significantly (nonjudging g =.27; observing g =.91; describing g =.41); nonreactivity g =1.03; awareness g =.54).
Meschino, Phillipp, Isreal and Vigod (2016)	N = 13 mother-infant dyads experiencing postpartum depression/anxiety (mothers' mean age =	Non-controlled pre and post intervention (pilot study).	1) To evaluate the feasibility, acceptability, and compliance with a clinical trial protocol for the newly developed intervention, and to generate preliminary data of the intervention.	Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). The Beck Anxiety Inventory (BAI;	No reported measures of mindfulness.	Parenting Stress Index (PSI; Loyd & Abidin, 1985). Significant reduction in mean depression scores. Trend towards decreasing anxiety scores and lower stress.

	35.5, *SD* = 4.4). Infant mean age = 8.7 months, *SD* = 1.2.		2) 15 minute mindfulness training (origin not reported) with formal exercises.. Each session divided into four parts: mindfulness training, psychotherapy and education, dyadic infant-led play, group discussion. 3 postnatal groups (4-5 participants) met weekly for 2 hours.	Beck, Epstein, Brown & Steer, 1988).		
			Self-report questionnaires completed pre and post intervention.			
Muzik, Hamilton, Rosenblum, Waxler and Hadi (2012)	*N* = 18 pregnant women with first baby scoring >9 on EPDS.	Non-controlled pre and post intervention (pilot study). Qualitative feedback via post-birth interviews.	1) To explore the feasibility, acceptability, and efficacy of M-Yoga in reducing symptoms of depression among pregnant women with current and lifetime diagnoses.	Structured Clinical Interview for DSM-IV Axis I Disorders (SCIP-IP; First, Spitzer, Gibbon & Williams, 2001).	Five Facet Mindfulness Questionnaire-Revised (FFMQ-R; Baer et al., 2006).	Significant reductions in depression scores from pre to post treatment. Mindfulness skills improved significantly over the intervention (mainly due to non-judgment subscale).
			2) Antenatal mindfulness yoga (M-yoga) - 10 weekly sessions (90 minutes each). Home practice encouraged (frequency/duration not reported).	Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). Beck Depression Inventory (BDI-II; Beck et al., 1996).	Maternal Fetal-Attachment Scale (MFAS; Cranley, 1981).	Maternal-fetal attachment significantly increased overall and on all 5 subscales.
			Participants completed psychiatric interview and self-report questionnaires			

Study	Sample	Design	Aim / Intervention	Measures	Outcome	Results
Perez-Blasco, Viguer and Rodrigo (2013)	$N = 26$ breastfeeding mothers (mean age = 34.33; SD = 4.72). Intervention group and control groups (both n = 13). Average infant age = 10.75 months.	Randomised Controlled Trial a mindfulness-based intervention of pre-post intervention - pilot study (no intervention control).	1) To develop and evaluate a mindfulness-based intervention that promotes mindfulness parenting in breastfeeding mothers during the early parenting period (up to 2 years of age). 2) Mindfulness intervention (based on MBCT, MBSR and Mindfulness self-compassion). Postnatal group - 8 weekly sessions (2 hours each). Babies in the room. 2-3 x 10 minute meditations per session; 2 x 20 minute home practices per day. Participants completed self-report questionnaires at baseline and post intervention.	Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). FFMQ (Baer et al., 2006). Self-Compassion Scale (Neff, 2003). The Parental Evaluation Scale (Farkas-Klein & Católica, 2008); measures feelings of satisfaction and self-efficacy about motherhood in mothers of children 0-2 years old.		Mothers in treatment group scored significantly higher on maternal self-efficacy (partial η^2 =.38), some dimensions of mindfulness (observing partial η^2 =.60; awareness partial η^2 =.42; nonjudging partial η^2 =.43; nonreactivity partial η^2 =.32), and self-compassion (total partial η^2 =.32). Mothers in treatment group also exhibited less anxiety (partial η^2 =.30), stress (partial η^2 =.35), and psychological distress (partial η^2 =.32).
Sriboonpimsuay, Promthet, Thinkhamrop and Krisanaprakornkit (2011)	$N = 199$ pregnant women between 12 and 20 weeks gestation: mindfulness meditation group (n = 84;	Randomised controlled trial of pre and post intervention (without blinding).	1) To assess the efficacy of a meditation programme in the prevention of preterm birth. 2) 5 step mindfulness meditation programme (based on the Consciousness	Thai Self-Analysis Stress Test (Department of Mental Health, 1995). No reported measures of mindfulness.	Proportion of preterm births (prior to 37 weeks gestation).	Proportion of preterm births significantly less for mothers in meditation programme compared to controls. Significant changes in stress were found for participants assigned to the meditation programme but not control group.

Study	Sample	Design / Aim	Measures			Findings
	mean age = 24.7, SD = 4.5); control group (n= 115; mean age = 25.2, SD = 5.0).	Transformations Programme for Stress Management, Krisanaprakornkit et al., 2001). Antenatal groups – 5 weekly sessions (2 hours each). In session practice of mindfulness; intensive home practice - mini meditations of 2-3 mins 5 times per day plus a longer 30 min meditation once a day. Stress assessed at baseline, after 5 weeks, and two weeks after delivery.				No differences between groups in terms of type of delivery and birth weight.
Zilcha-Mano and Langer (2016)	N = 105 first time pregnant women between 25 and 30weeks gestation (mean age 28.71, SD = 3.74).	Randomised controlled trial of pre-post 1) To examine whether mindfulness training results in better childbirth outcomes for both mother and infant. 2) Short mindfulness program of attention to sensation variability. Participants in intervention condition took part in 1) short mindfulness training program of 1 x 30 min. engagement which was written instruction; and 2) completed brief diary entry (via web link sent to their phones) twice a day on mood and physical functioning. Exposure control condition exposed	Mental Health Inventory (MHI; Veit & Ware, 1983). The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965). Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen & Griffin, 1985).	Langer Mindfulness Scale (LMS14; Pirson, Langer, Bodner & Zilcha-Mano, 2015) and qualitative reports.	Apgar score (Apgar, 1953) to evaluate clinical status of newborns at 1 minute and 5 minutes after birth- parent self-report.	Mindfulness positively correlated to measures of well-being, positive affect, self-esteem, life satisfaction, and to the Apgar scores immediately and 5 minutes after birth. Mindfulness negatively correlation with distress and negative affect. Participants in the mindful intervention group showed better psychological outcomes after the mindfulness training compared to both control groups, which included greater increase in levels of well-being and positive affect, and greater decrease in levels of emotional distress and

participants to positive and negative experiences during pregnancy via reading stories of other women's experiences - these narratives sent one at a time at fixed intervals during 2 weeks of intervention.			negative affect. Effects did not persist to T3.
Measures taken at 3 time points: T1: weeks 25-30 gestation; T2: 3 weeks later; T3: 1 month after birth.			Qualitative narratives of the intervention group very different to the two control groups and centred around an increase in self-awareness with 5 subthemes: increase in awareness throughout the day in one's physical and emotional sensations; more complex view of the sensations and perception; process of abandoning past mindlessness in favour of more mindful mindset; relief at discovery of fluctuation of negative sensations; new insights about oneself in specific period of time.

Note: T1 = time point one; T2 = time point two; T3 = time point three.

Table 1.4.

Measures and tests used for each construct being investigated across the articles included in the review.

Construct	Measures used
Mindfulness	1. Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Kreitemeyer & Toney, 2006) 2. Freiburg Mindfulness Inventory-Short Form (Dutch version, Walach et al., 2006) 3. Mindful Attention and Awareness Scale (Brown & Ryan, 2003) 4. Langer Mindfulness Scale (Pirson, Langer, Bodner & Zilcha-Mano, 2015) 5. Qualitative responses
Child Outcomes	1. Prenatal Attachment Inventory (Muller, 1993) 2. Maternal Attachment Inventory (Muller, 1994) 3. Maternal Fetal-Attachment Scale (Cranley, 1981) 4. Infant socio-emotional development: Ages and Stages Questionnaires:Social-Emotional (Squires, Bricker, Heo & Twombly, 2001) 5. Infant temperament: short version of the revised Infant Behaviour Questionnaire (Gartstein & Rothbart, 2003) 6. Carey Infant Temperament Questionnaire (Carey & McDevitt, 1978) 7. Parenting Stress Index[7] (Loyd & Abidin, 1985) 8. Parenting Stress Index- Short Form[7] (Abidin, 1995) 9. Parental Evaluation Scale (Farkas-Klein, 2008) 10. Apgar score (Apgar, 1953) 11. Proportion of preterm births (<37 weeks gestation) 12. Birth experience measure: Negative/Positive/Spiritual Birth Experience (see Zoeterman, 2014) 13. Event-related potentials of auditory processing (ERPs; see van den Heuvel et al., 2015) 14. Infant salivary cortisol (see Chan, 2014) 15. Qualitative responses.
Mental Health	1. Edinburgh Postnatal Depression Scale (Cox et al., 1987) 2. State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) 3. Symptom Checklist-90 (Arrindel & Ettema, 1981) 4. Perceived Stress Scale (Cohen, 1988) 5. Revised Pregnancy Anxiety Scale (Levin, 1991) 6. Centre for Epidemiologic Studies Depression Scale (Radloff, 1977)

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[7] The Parenting Stress Index (Loyd & Abidin, 1985) includes a child domain that measures parent-reported child characteristics, behaviour and functioning, as well as stressors in the parent-child relationship, and so it can also be classified as a child outcome measure as well as a mental health measure.

	7. Differential Emotions Scale (Izard, 1977)
	8. The Positive and Negative Affect Schedule (Watson et al., 1988).
	9. Thai Self-Analysis Stress Test (Department of Mental Health, 1995)
	10. Mental Health Inventory (Veit & Ware, 1983)
	11. Rosenberg Self-Esteem Scale (Rosenberg, 1965)
	12. Depression, Anxiety and Stress Scale (Lovibond & Lovibond, 1995)
	13. Beck Anxiety Inventory (Beck et al., 1988)
	14. Beck Depression Inventory (Beck, Steer & Bornw, 1996)
	15. Structured Clinical Interview for DSM-IV Axis I Disorders (First, Spitzer, Gibbon & Williams, 2001)
	16. Parenting Stress Index- Short Form (Abidin, 1995)
	17. Ruminative Response Scale (Nolen-Hoeksema & Morrow, 1991).
	18. Warwick-Edinburgh Mental Well-being Scale (Tennant, Hiller, Platt, Joseph, Welsh, Parkinson, Secker & Stewart-Brown, 2007).
	19. Cord blood cortisol (intra-uterine fetal mental health status; Chan, 2014).
Other measures included in studies	1. Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988)
	2. Self-Compassion Scale (Neff, 2003; Neff & Ryan, 2003)
	3. Satisfaction with Life Scale (Diener, Emmons, Larsen & Griffin, 1985)

Dispositional Mindfulness

Only four studies which examined dispositional mindfulness in relation to child outcomes in the perinatal period were found (Sawyer Cohen, 2010; van den Heuvel et al., 2015a; van den Heuvel et al., 2015b; Zoeterman, 2014). One study focused on pre- and postnatal attachment (Sawyer Cohen, 2010), one on the birth experience (Zoeterman, 2014), one on infant socio-emotional development and temperament (van den Heuvel et al., 2015b), and one on infant's neurocognitive functioning in auditory processing (van den Heuvel et al., 2015a). Two of these studies were PhD theses (Sawyer Cohen, 2010; Zoeterman, 2014). All studies utilised a prospective longitudinal study design and collected standardised self-report measures of mental health and mindfulness during women's second and third trimesters, whilst measuring

a variety of child/birth outcomes postnatally up to 10 months post childbirth, with the latter collected either through self-report measures ($n = 3$) or an experimental design ($n = 1$).

Sawyer Cohen (2010) investigated women's well-being during pregnancy, and its association with postnatal mood, and prenatal attachment. The researcher found that prenatal mindfulness (measured by the FFMQ) and self-compassion together predicted significant variance in prenatal attachment. Interestingly, perinatal anxiety remained relatively stable over time, and was shown to be even more robustly related to postnatal attachment than depression.

Zoeterman (2014) found that higher levels of mindfulness (Acting with Awareness subscale of the FFMQ) were significantly associated with lower levels of depression and anxiety. The results also indicated that levels of depression and anxiety increased from pre to post childbirth. Negative emotional birth experiences (as assessed by asking participants to choose from a list of 33 words that described their labour, delivery and birth experience) were also positively correlated with depression and anxiety; however, mindfulness was not significantly associated with positive/negative/spiritual birth experience.

Van den Heuvel and colleagues (2015a, 2015b) also showed that maternal mindfulness was negatively correlated with maternal anxiety during pregnancy. Van den Heuvel et al. (2015b) found that greater maternal mindfulness during pregnancy was significantly associated with fewer reported infant self-regulation problems, less negative affectivity (perceived difficult temperament) and more effortful control (duration of orienting/attention control) of infants at ten months old. Moreover, maternal anxiety during pregnancy was associated with more self-regulation

difficulties, more negative affectivity and more surgency (activity level and high-intensity pleasure) problems.

In contrast to the above studies, van den Heuvel et al. (2015a) used an experimental design to examine child health outcomes, although self-report questionnaires for anxiety and mindfulness (FMIS-14; Walach et al., 2006) were still required during the participants' second trimester. The researchers specifically investigated infants' auditory processing with event-related potentials (ERPs) at nine months old. An ERP is the measured brain response that is the direct result of a specific sensory, cognitive, or motor event. Hence, ERPs were used to explore infant neurocognitive functioning (electrophysiological response to a stimulus) as a way of determining whether maternal mindfulness and anxiety during pregnancy affected infants' attention (neural processing of sounds). Van den Heuvel et al. (2015a) found that infants exposed prenatally to higher levels of mindfulness devoted less in-depth processing to frequently occurring stimuli, meaning that they habituated faster to these stimuli. The opposite was observed for infants exposed to prenatal anxiety. The researchers suggest that these findings are evidence that infant neurocognitive functioning may be affected by mindfulness and anxiety.

Based on her findings, Zoeterman (2014) proposed that the tendency to be aware in the present moment (a facet of mindfulness) serves as a protective factor against emergent post-partum depression and anxiety symptomology. Van den Heuvel et al. (2015a) hypothesised that mindfulness serves as a protective trait as it could prevent the negative consequences of prenatal exposure to stress on the fetus. Hence, positive traits of the mother (as well as negative traits) may also be contributing factors in 'programming' the infant prior to birth. Moreover, van den Heuvel et al. (2015b) posited that maternal anxiety mediates the association between maternal mindfulness

and infant self-regulation problems. The researchers suggest that maternal mindfulness has a positive effect on infant self-regulation by reducing maternal anxiety during pregnancy.

However, all of the studies are correlational, and it is not possible to assume causation from the results. Participants' previous experience with meditation or mindfulness were also not assessed, contributing to the difficulty of determining whether the variations in mindfulness and self-compassion are natural dispositional variations within the population, or whether some of the variance can be accounted for by previous experience with mindfulness. Very few conclusions can be drawn from this research on the impact of dispositional mindfulness in relation to child outcomes, due to the variety of child measures explored. Further, the studies fail to take into account the role of the father and other family or cultural influences, which may also have an impact on how a woman perceives stresses or challenges during this period of adjustment, and the sense of support she has with parenting postpartum.

Collectively, these studies provide some evidence that dispositional mindfulness is negatively associated with prenatal anxiety, with some evidence for a significant negative relationship between dispositional mindfulness and perinatal depression (i.e., Zoeterman, 2014). Thus, the findings suggest that qualities of prenatal mindfulness may be naturally protective against psychopathology during the perinatal period, although the mechanisms through which this association exists is not yet understood. The research highlights the need to focus on perinatal anxiety, which has largely been overlooked due to an over-reliance on depression as an indicator of prenatal distress (Miller, Pallant & Negri, 2006), but also the requirement for much more research in this area in order to further investigate the mechanisms underlying

the interactions/associations between mindfulness, mental health and maternal

sensitivity in the perinatal period.

Mindfulness Interventions

Nine studies examined the effectiveness of mindfulness interventions in relation

to child outcomes across the perinatal period (Chan, 2014; Duncan & Bardacke, 2010;

Dunn et al., 2012; Eames et al., 2015; Meschino et al., 2016; Muzik, et al., 2012;

Perez-Blasco et al., 2013; Sriboonpimsuay et al., 2011; Zilcha-Mano &

Langer, 2016).

The Effect of Interventions on Maternal Mindfulness

All of the interventions that were offered differed in terms of programme

design (or theoretical basis) and intensity of formal and homework mindfulness

practice (see Table 1.4 for more specific details of these elements). Eight of the

interventions were delivered in a group environment (i.e., antenatal or postnatal

class), with one study offering an individual mindfulness intervention delivered

through written instruction (Zilcha-Mano & Langer, 2016). The interventions

included a ten session Mindfulness-Based Childbirth and Parenting Intervention

(Duncan & Bardacke, 2010) and an eight session Mindfulness-Based Wellbeing for

Parents (MBW-P) programme (Eames et al., 2015), both based on adapted MBSR.

Dunn et al. (2012) used an eight week adapted MBCT programme, and Perez-Blasco

et al. (2013) delivered an eight-week mindfulness intervention based on MBCT,

MBSR and Mindfulness Self-Compassion. A six session Eastern-Based Meditative

Intervention (EBMI[8]; Chan, 2010), a ten session antenatal Mindfulness Yoga (MYoga;

Muzik et al., 2012) and 5 Step Mindfulness Meditation Programme (based on a

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[8] "The theoretical background of EBMI bases on the integration of mindfulness practice [including] the Four
Immeasurables [of Buddhism: loving-kindness, compassion, appreciative joy, equanimity], cognitive therapies

Consciousness Transformations Programme for Stress Management;

Scriboonpomsuay et al., 2011) were also described in the studies. Zilcha-Mano and Langer

(2016) offered the briefest mindfulness training of a total of thirty minutes but did not report

the origins of their mindfulness training. Meschino et al. (2016) also did not provide the

origins of their mindfulness training, which was delivered alongside psychotherapy and

education.

Five of the nine intervention studies tracked mindfulness from pre to post-

intervention. Duncan and Bardacke (2010) offered the most intensive antenatal

mindfulness intervention, with nine weekly three-hour sessions, plus a seven-hour

silent retreat and a post-birth reunion. Post-intervention, the researchers found

significant improvements on two of the three subscales of the Five Facet Mindfulness

Questionnaire (FFMQ; Baer et al., 2006), most notably, the Nonjudging and

Nonreactivity subscales, but they did not find significant improvements on the Acting

with Attention and Awareness subscale. Muzik et al. (2012) offered M-Yoga to

psychiatrically at-risk women and also found significant improvements in total FFMQ

mindfulness score and on the Nonjudging subscale, from pre to post intervention.

Similarly, Eames et al. (2015) ran a MBW-P programme for socio-economically

disadvantaged parents, and found moderate effect sizes in support of clinically

significant shifts in facets of mindfulness (most notably the Observing and

Nonreactivity subscales which had large effect sizes), although, the sample size was

particularly small (maximum mindfulness measure $n = 13$). Whereas the previous

studies that utilised the FFMQ were conducted on a prenatal sample, Perez-Blasco et al.

(2013) initiated a mindfulness-based intervention to breastfeeding mothers who were

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and Western psychology and psychotherapy" (Chan, 2014, p. 557). EBMI comprises well-known mindfulness
practices including mindful eating and walking, breathing practices and body scans.

randomised between treatment and control groups. Again, the sample size was small (n = 26), but the researchers found that compared to the control group, mothers in the treatment group scored significantly higher on several mindfulness dimensions (Observing, Acting with Awareness, Non-judging, and Nonreactivity subscales). Dunn et al. (2012) used the Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) and found a clinically reliable change in mindfulness scores of treatment group participants compared to control group participants (non-randomised) over the course of the intervention.

Zilcha-Mano and Langer (2016) examined the relationship between mindfulness (both as a trait and a state) and health and well-being outcomes in a randomised controlled trial which included a treatment group, an exposure control group and a no-treatment control group. The researchers gave participants the Langer Mindfulness Scale (LMS14; Pirson et al., 2015) to assess trait mindfulness preintervention only as a baseline measure. This would have been a useful measure to repeat post-intervention to determine whether mindful traits, as measured by the LMS14, remain relatively stable over the perinatal period, or can also be influenced through mindful interventions. Chan (2014), Sriboonpimsuay et al. (2011) and Meschino et al. (2016) did not take baseline measures of mindfulness, or report any standardised measures of mindfulness.

The most widely chosen standardised mindfulness measure in the previouslycited studies appears to be the FFMQ, with four of the studies reporting this measure. Perhaps the FFMQ is most popular because Baer et al. (2006) performed a metaanalysis of the five most frequently used mindfulness questionnaires and confirmed that mindfulness is properly conceptualised as a multifaceted construct. The FFMQ was developed based on this work.

The Effect of Interventions on Maternal Mental Health

Of the nine selected studies on mindful interventions, six included pre and post data for a specific standardised measure of depression (Dunn et al., 2012; Duncan & Bardacke, 2010; Meschino et al., 2016; Muzik et al., 2012; Eames et al., 2015); two, anxiety (Duncan & Bardacke, 2010; Meschino et al., 2016); and four, stress (perceived stress: Chan, 2014; Duncan & Bardacke, 2010; Sriboonpimsuay et al., 2011; and parenting stress: Eames et al., 2015). Three of the studies also incorporated pre and post data for more general measures[9] of wellbeing/psychological distress which included a measure of positive and negative affect[10].

In general, the mindful interventions produced significant improvements for each of these outcomes, but there was some discrepancy between studies. For instance, Zilcha-Mano and Langer (2016) used more general measures of mental health and psychological distress and reported significantly increased levels of wellbeing, and positive affect, and a greater decrease in levels of emotional distress and negative affect in mothers assigned to the mindfulness group compared to the exposure and no-treatment control groups. However, these effects did not persist at follow-up one month after delivery. In contrast to Zilcha-Mano and Langer's (2016) brief intervention, Duncan and Bardacke (2010) used an intensive and lengthy mindfulness intervention and also found significant pre-post intervention mean differences for increased positive affect and reduced negative affect (no follow-up). Duncan and Bardacke (2010) further observed significant decreases in anxiety and depression scores. Both Meschino et al. (2016) and Muzik et al. (2012) reported significant

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[9] Including the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) which has separate subscales for depression, anxiety and stress. Each subscale also taps the broader dimension of psychological distress or negative affect (Henry & Crawford, 2005).
[10] Positive and Negative Affect Schedule (PANAS; Watson et al., 1988).

reductions in mean depression scores from pre to post treatment. However, Meschino et al. (2016) observed only a trend towards decreasing anxiety and stress scores. Meschino et al. (2016) also did not use a measure of mindfulness so it is not possible to determine whether these reductions in mental health difficulties are directly related to engaging with mindfulness-based practice. Sriboonpimsuay et al. (2011) found significantly lower stress levels for participants assigned to the meditation programme compared to the control group. In contrast to the above studies, Eames et al. (2015) found no significant changes in parenting stress or depression scores from pre to post intervention (but found that mindfulness levels increased significantly). The researchers highlight that the findings could be reflective of the population of socio-economically disadvantaged mothers, as baseline measurements indicated higher levels of stress, depression (and rumination) and lower total well-being scores compared to community samples of data. However, participant numbers may have been too low ($n = 13$) to identify statistical changes in mental health.

Furthermore, Perez-Blasco et al. (2013) used the DASS-21 and showed that mothers who received the treatment exhibited significantly less anxiety, stress and psychological distress, but there were no significant differences between the treatment and control groups on depression scores post-intervention. Similarly, Dunn et al. (2012) used the DASS-21 and clinically reliable declines were observed in depression, anxiety and stress that continued up to six weeks postpartum. Both of the studies offer an eight-week mindfulness programme with homework. Dunn et al. (2012) used an adapted MBCT programme but failed to report the duration of the sessions and amount of required home practice. Perez-Blasco et al. (2013) also used an adapted programme based on MBCT, MBSR and Mindfulness Self-Compassion which ran for two hour weekly sessions, with a suggested twenty minute home practice twice per

day. However, both of these studies had small sample sizes, use different populations (pregnant women versus breastfeeding mothers), and slightly different study designs (Dunn et al. used a non-randomised design whereas Perez Blasco et al. used a randomised controlled trial) so the findings are somewhat difficult to compare, and also to generalise.

In contrast to the standard measures of anxiety and stress, Chan (2014) used cord blood cortisol as a physiological measure of maternal stress and found that the cord blood cortisol level in babies delivered by mothers in the intervention group was significantly *higher* than that of the control group. Chan posits that this finding supports that infants born from mothers in the intervention group were living in a less stressful maternal prenatal environment. This finding appears counterintuitive, and the article does not clearly highlight the reasoning behind this conclusion. However, further reading around this area (and of Bolten et al's, 2013, research) suggests that there is evidence that a higher level of cortisol is actually beneficial in the case of delivery: it means that babies are well prepared for the natural stress of birth, which prepares them to be alert upon entering the world. A more balanced endocrine system, which develops in a less stressful environment, enables an individual to have more appropriate stress responses, instead of a consistently elevated level of cortisol.

Two studies focusing on Eastern populations were deemed to be relevant to the review. Chan (2014) recruited Chinese women from Hong Kong, and Sriboonpimsuay et al. (2011) recruited Thai women from Udonthani in Northern Thailand. Interestingly, stress was the only measure of psychological distress measured in both studies, which may reflect cultural differences in expressing, diagnosing or conceptualising mental health difficulties like depression and anxiety. As mindfulness and meditative practices originated in the East, it could be argued that

the Eastern populations in these two studies may also have more experience with mindfulness concepts and find it easier to apply these ideas and practices to this unique time in a woman's life. However, Duncan and Bardacke (2010) also reported that 92.59% of participants who took part in their pilot study in California had prior experience with meditation or yoga. This percentage could be reflective of a subculture of America in which a 'better lifestyle' and healthy eating are often promoted, socio-economic differences (less opportunity and time to practice meditation), or could also reflect women who have experienced similar mindfulness concepts prior to the study having volunteered to participate. Unfortunately, the majority of reviewed studies did not report prior experience with mindfulness/meditation/yoga.

Despite some discrepancies in the study findings, the results regarding shifts in positive mental health and psychological distress outcomes from pre to post interventions, and between intervention and control groups, are encouraging and support the hypothesis that mindfulness interventions can have a significant impact on women's psychological distress and well-being across the perinatal period. More specifically, these studies offer some evidence that the impact of mental health difficulties, such as depression, anxiety and stress, can be reduced following an intervention. Zilcha-Mano and Langer (2015) suggest that the training cannot only increase positive affect, but also serves as a buffer against deterioration in mental health during pregnancy. There is very limited evidence that these effects are long lasting, therefore making a strong case for longitudinal and preferably culturally diverse studies with follow-up data in this area.

The majority of the intervention studies support previous research findings on prenatal stress and mood. Vieten and Astin[11] (2008) research was one of the first studies to pilot a mindfulness intervention (based on MBSR and MBCT) in a prenatal population and found that women in the mindfulness group showed statistically significant decreases in anxiety and negative affect compared to wait-list controls, but these differences were not maintained at three months follow-up, despite some trends in the expected directions for stress, anxiety, depression and affect. Comparably, Guardino, Schetter, Bower, Lu and Smalley (2014) also found significant decreases in pregnancy-specific and pregnancy-related anxiety from pre to post mindfulness intervention (based on Mindful Awareness Practices, MAPS, classes). Again, the effects were not sustained through follow-up at six weeks post-intervention. Vieten and Astin (2008) propose that expanding interventions to bridge between prenatal and postnatal periods by providing 'booster' sessions postnatally could have value in maintaining positive changes in mindfulness, stress and mood, but this is an area which needs further consideration and research.

Mindfulness Interventions and Child Outcomes

Health. Three studies focused on health outcomes (Chan, 2014; Sriboonpimsuay et al., 2011; Zilcha-Mano & Langer, 2016). Zilcha-Mano and Langer (2016) found that mindfulness was positively correlated to Apgar score[12] (Apgar, 1953) immediately and five minutes after birth, even when the researchers controlled for socioeconomic status. The Apgar score is a simple assessment of how a baby is doing at birth to determine whether

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[11] One of the most cited mindfulness-based intervention studies during pregnancy was written by Vieten and Astin (2008), but this study was not included in the systematic review as the focus of the paper was on improving mood and reducing stress. No child outcome measures were reported, which is the focus of the current review.

[12] The Apgar scale is determined by evaluating the newborn baby on five simple criteria on a scale from zero to two, then summing up the five values thus obtained. The resulting Apgar score ranges from zero to 10. The five criteria are Appearance, Pulse, Grimace, Activity, and Respiration.

additional medical assistance is required. In contrast, Sriboonpimsuay et al. (2011) and Chan (2014) did not find any significant differences for Apgar scores at one, five or ten minutes post-birth between the intervention and control groups, and between the frequent practice and non-frequent practice intervention groups, respectively.

Sriboonpimsuay et al. (2011) found that the proportion of preterm births were significantly less for mothers who had been randomised into the meditation programme compared to control participants. Moreover, Chan (2014) found that the percentage of babies who required special neonatal care was lower in the intervention group (14.8%), who practised the mindfulness intervention (EBMI) frequently (more than three times per week), compared to the intervention group who did not engage in frequent practice (33.3%).

The health literature supports the findings that a mother's stress appraisal of an event, such as her transition to parenthood, prompts the coping process and produces affective and physiological responses (Sriboonpimsuay et al., 2011), which have an impact on the health of the foetus. Mindfulness interventions may play a pivotal role in improving health outcomes, such as fewer preterm births, and a reduced chance of an infant requiring special neonatal care and medical assistance; however, the lack of studies investigating these associations, as well as the lack of consistency in health outcome measures, highlights the need for further research in this area.

Maternal Self-Efficacy, Infant Characteristics and Temperament. Perez-Blasco et al., (2013) was the only study that measured maternal self-efficacy (as measured by the Parental Evaluation Scale). Compared to the control group, the intervention groups mean scores indicated significantly higher maternal self-efficacy. Whilst not a direct child outcome measure, high levels of maternal self-efficacy have been shown to be related to maternal sensitivity, warmth (Teti & Gelfand, 1991) and

responsiveness (Stifter & Bono, 1998). It has also been linked to parenting practices that favour development, fewer behavioural problems in children, and a lower incidence of parental depression (Donovan, Leavitt & Walsh, 1997; Wells-Parker, Miller & Topping, 1990).

Two studies utilised the Parenting Stress Index. Meschino et al. (2016) used the full index (PSI; Loyd & Abidin, 1985) in their study that included a noncontrolled psychotherapy and mindfulness intervention. The PSI has a Child Domain score, derived from six child subscales related to parent reported child characteristics including acceptability, distractibility, adaptability, reinforces parent, demandingness, and mood, and was their main child outcome measure. There were no significant differences on any of the subscales, or on the total Child Domain score, between pre and post intervention, although most of the subscales shifted in the direction of improvement post-intervention. An exit survey completed by participants suggested that the infants' characteristics and behaviours had become more acceptable to the mothers. The researchers suggest that this result may be due to a mother's improved ability to 'mentalise' their infants, that is, a mother's ability to reflect on the mental state of her child in terms of feelings, thoughts, desires, intentions, and beliefs, and respond appropriately to cues. Effective mentalising has been shown to be correlated with a child's attachment security (Fonagy & Target, 2005; Grienenberger, Kelly & Slade, 2005). Wallin (2007) posited that the capacities to be mindful and mentalise are not exclusive and can complement one another in clinical practice. However, due to the nature of the intervention which included psychotherapy, it is difficult to determine whether mindfulness was an active component in creating this shift in mother-reported child characteristics and mentalising.

Eames et al. (2015) used the short form of the PSI (PSI-SF; Abidin, 1995), which contains three subscales of Parental Distress, Parent-Child Dysfunctional Interaction, and Difficult Child. None of the subscales or the total PSI-SF score indicated significant change from pre to post intervention; however, there was an observable shift post-intervention with more participants falling below the clinically significant percentile of concern. The results suggest improvement in parental distress and difficult child[13] subscales, with moderate to large effect sizes (.53 and .70, respectively). Moreover, the parents' view of behaviours, rather than the actual child behaviours per se, could indicate a shift in the mothers' *observing* and *non-reactivity* facets of mindfulness. Jones, Hastings, Vailiki, Keane and Rhule (2014) consider in their paper the potential mechanisms through which mindfulness mediates child behaviour problems as parents being less judgmental, less reactive and more aware of internal processes.

Chan (2014) also explored infant temperament five months after delivery. The findings showed that infants of the intervention group had significantly better temperament and more effective responses to new stimuli compared to the control group.

The findings related to maternal perceptions of self-efficacy, infant characteristics and temperament highlight the potentially positive effect of mindfulness-based interventions on changing perceptions of mothers in terms of self-efficacy, with mixed results regarding child characteristics and temperament. The shift in mother perceptions may in turn have an impact on mother-child interactions and may require more lengthy parenting interventions and/or more time to notice a difference in the interactions, but this is another area which needs future research focus.

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[13] The Difficult Child subscale assesses the presence of basic behavioural characteristics that could make children 'easy' or 'difficult' to manage, and include the parent's view of the child' temperament, defiance, non-compliance, and demandingness.

Attachment. A surprising finding of this review was that only one study examined the role of mindful interventions on attachment during pregnancy. Muzik et al. (2012) used the Maternal Fetal Attachment Scale (MFAS; Cranley, 1981) in a noncontrolled pre-post mindfulness-yoga (M-Yoga) intervention study. The MFAS assesses how often mothers engage in behaviours that indicate interaction and connection with their unborn child. The researchers found that maternal-foetal attachment significantly increased overall and across all five subscales from pre to post intervention (independent of depression symptoms and current psychopathology), and indicated that women who completed the intervention became more comfortable assuming the role of the mother, enjoyed interaction with the foetus and were more likely to engage in healthy behaviours during pregnancy. Importantly, Maas, de Cock, Vreeswijk, Vingerhoets and van Bakel (2016) showed that mothers who reported a higher quality of the maternal-foetal relationship were more sensitive in caregiving and free play interactions with their infants at six months old. The potential to improve maternal-foetal attachment through mindfulness interventions may, therefore, aid in the development of healthy maternal sensitivity and attachment postpartum, but much more research is required in this area.

Qualitative Reports of the Mindfulness Benefits from Pregnancy to the Postpartum Period. Duncan and Bardacke (2010) explored qualitative responses of mothers' pregnancy experiences, labour and delivery, and early postpartum period in relation to practising mindfulness. Using a team-based, interpretive phenomenological approach to analysis, the researchers found an overarching theme of participant use of formal mindfulness practice (e.g., sitting meditation, breath awareness, body scan), and informal practice (e.g., staying in the present moment). Many of the participants described using mindfulness to deal with stress related to the demands of the birth,

family life and the postpartum experience. Participants found that the core aspects of mindfulness, such as staying in the present moment and acknowledging that each moment will pass and be replaced by the experience of the next moment, to be beneficial for their emotional well-being, and their relationship quality with their baby and partner. The qualitative results also highlighted that partner involvement in the course was of benefit.

Comparably, Dunn et al. (2012) also conducted a qualitative analysis post-intervention and found that all women involved in their study reported continuing to use mindfulness skills either formally or informally after they had completed the course. Participants reported that stopping and breathing, developing an attitude of acceptance, and coming in to the present were all core aspects of mindfulness that they had used to cope with pregnancy, childbirth and parenting. Participants also highlighted the value of having a shared group experience.

Finally, Zilcha-Mano and Langer (2016) explored the influences of the mindfulness training on the pregnant women's well-being and affect using thematic analysis. Participants in the exposure control and no-treatment control groups were also involved in post-study interviews. The researchers found clear differences between the narratives of the mindfulness intervention group and the two control groups. More specifically, participants in the intervention group reported an increased awareness, insight about oneself, and a more integrative and complex view of sensations compared to the control groups. Zilcha-Mano and Langer (2016) put forward that the qualitative analysis confirms that the intervention was functioning as intended.

The qualitative findings offered by these studies provide a richer understanding of how mindfulness may be helpful across the perinatal period from pregnancy to postpartum. The themes demonstrate how women who have been

involved in the studies perceive the benefits of mindfulness across this time, and how they are applying it to also manage more general family and life stressors. Duncan and Bardacke (2010) propose that family-focused, relationship-oriented approach to teaching mindfulness skills may not only provide additional support for the mother, but also impact on more effective parenting practices.

Discussion

Quality of Studies

Whilst the literature incorporating mindfulness, mental health and child outcomes are still within their infancy, it is important to consider the quality of the studies presented in this review, with particular reference to how mindfulness was measured and/or manipulated.

Dispositional Research

Of the four studies that explored dispositional mindfulness and child outcomes, all of which utilised a prospective longitudinal research design with pre- and post-test measures, a higher quality rating would be given to van den Heuvel et al's (2015a, 2015b) peer-reviewed research in comparison to research conducted for the purpose of a PhD thesis (Sawyer Cohen, 2010; Zoeterman, 2014). However, Sawyer Cohen's (2010) and Zoeterman's (2014) research recruited many more participants (ns = 196 and 777, respectively) compared to participant ns of 78 and 90, respectively, for van den Heuvel et al's (2015a, 2015b) research, and it could be argued that their findings are more representative of women in the perinatal period. Another strength of both Sawyer-Cohen's (2010) and Zoeterman's (2014) research was in the measurement of both depression (as measured by the EPDS) and anxiety (as measured by the STAI), whereas van den Heuvel's (2015a, 2015b) research only explored anxiety. Arguably, it may be concluded that the former research offers the reader a more comprehensive and topical understanding of mental health difficulties within the perinatal period and may therefore have more practical clinical relevance.

All dispositional research applied well-known mindfulness measures. Sawyer Cohen (2010) used the full FFMQ, whereas Zoeterman (2014) only drew on the 'acting with awareness' facet of the FFMQ. Whilst this facet was directly linked to Zoeterman's aim of investigating mindful awareness in pregnancy, depression in the postpartum period and birth experience, other mindfulness facets may also have interacted with mental health during this period, and would have been beneficial to have been included in the results. Van den Heuvel (2015a, 2015b) used the short form of the FMI (FMIs-14). This measure has been shown to be a consistent and reliable measure of mindfulness, but one-dimensional (Walach et al., 2006) in comparison to the FFMQ which measures five facets of mindfulness and was constructed from through the analysis of pre-existing mindfulness scales, including the FMI (Baer et al., 2006). It is conceivable that the FFMQ is a stronger mindfulness scale; however, like other emerging psychological concepts, mindfulness is certainly one that will require considerably more attention and extensive multi-dimensional research before it is able to be better understood in Western psychology.

Intervention Research

In terms of the intervention research studies, Zilcha-Mano and Langer (2016) reported research design of the highest quality amongst the literature, which incorporated a randomised controlled trial of a pre-post intervention group, an exposure control group and a no-treatment control group. This design helps to support the research findings that the brief mindfulness training was responsible for better psychological (well-being and affect) outcomes observed between time point 1 (25-30 weeks) and time point 2 (3 weeks after T1) of the intervention group participants compared to the exposure control and no-treatment control groups. Sriboonpimsuay et al. (2011), Perez-Blasco et al. (2013) and Chan (2014) all incorporated randomised controlled trials but without active control groups. Duncan and

Bardacke (2010), Dunn et al. (2012), Eames et al. (2015), Meschino et al. (2016), Muzik et al. (2012) conducted non-controlled pre and post intervention studies.

The manipulation of mindfulness interventions varied greatly in terms of theoretical basis, duration and quality of reporting. For instance, studies by Duncan and Bardacke (2010) and Eames et al. (2015) both had an MBSR basis and had well-reported method sections detailing their frequency, duration and length of practice in session and as homework (see Table 1.3). Perez-Blasco et al. (2013), who offered an intervention derived from MBCT, MBSR and Mindful Self-Compassion, Sriboonpimsuay et al. (2011) who offered a 5 Step Mindfulness Meditation Programme, and Zilcha-Mano and Langer (2016) who conducted only a brief mindfulness training also reported studies to a high standard in terms of what the participants experienced. Other studies, such as Dunn et al. (2012), which offered an intervention with an MBCT basis, and Chan (2014) who offered an EBMI intervention, included information regarding the number of sessions, but failed to report the duration of these sessions and information about mindfulness practice as homework. In light of these omissions, it is more difficult to gauge the extent to which the mindfulness intervention is responsible for enacting change in mental health, mindfulness and/or child outcomes.

It is noteworthy that there are two studies which report interventions that have included two additional elements included alongside mindfulness, and therefore, these interventions have quite different content from the other studies discussed in this review. Meschino et al. (2016) offered mindfulness alongside psychotherapy and education including symptom reduction techniques, family of origin insight, parenting techniques, dyadic infant-led play. Muzik and colleague's (2012) intervention combined mindfulness and yoga (M-Yoga). "Yoga is an ancient practice… that involves meditative focus combined with physical poses" (Muzik et al., 2012, p. 235). However, although the additional study

design elements enhanced the potential scope of each study and benefit to participants, it is difficult to segregate whether mindfulness was the key component of change in the women's well-being, or whether the other components (psychotherapy, parenting education, yoga/exercise) also played a more pivitol or interactional role.

Moreover, three of the studies did not utilise any measures of mindfulness (Chan, 2014; Meschino et al., 2016; Sriboonpimsuay et al., 2011). The aims of these studies were focused on assessing the effects of mindfulness interventions on infant health (Chan, 2014, and Sriboonpimsuay et al.,2011) or to evaluate the feasibility of an intervention group with mothers experiencing postpartum depression (Meschino et al., 2016). However, without appropriate mindfulness measures, opportunities for gaining additional insights into individual's mindfulness and how this construct may have changed as a result of the intervention were lost.

Limitations of the Studies and Recommendations for Future Research

While the discussed studies demonstrate considerable strengths, a number of limitations exist within the literature and must be considered when drawing conclusions and contemplating future research directions.

Design

First, all of the dispositional mindfulness studies explored associations between mindfulness and postnatal mood and child outcomes using prospective cohort studies, and making it difficult to draw firm conclusions regarding causality, as well as understanding any confounding variables, such as paternal support that may also be impacting on the findings. In terms of the intervention studies, few used randomised controlled trials. Sriboonpimsuay et al. (2011), Chan (2014) and PerezBlasco et al. (2013) used an RCT design that compared a mindfulness intervention group to a wait-list control group. However, the researchers did not include active control groups which leaves open the

possibility that intervention effects could have been the result of additional time and attention paid to the intervention groups, as opposed to other mindfulness or therapeutic aspects of the intervention (Vieten & Astin, 2008). As research in this area is emerging and study designs are moving from feasibility and pilot studies to becoming more comprehensive, RCTs should aim to offer active control groups. To date, only Zilcha-Mano and Langer (2016) have conducted a mindfulness-based intervention study with both an exposure control group and a no-treatment control group.

Recruitment

All dispositional mindfulness studies used convenience sampling of pregnant mothers with only one study recruiting first time mothers (Sawyer Cohen, 2010). There was more variation in the recruitment of participants into the intervention studies, with the majority of studies focusing on a convenience sample of pregnant women (e.g., Duncan & Bardacke, 2010; Dunn et al., 2012); however, sample sizes were generally small. Some of the intervention studies focused on specific populations of women who were experiencing postpartum depression/anxiety, psychiatrically at-risk (Meschino et al., 2016; Muzik et al., 2012), socio-economically disadvantaged (Eames et al., 2015), or breastfeeding (Perez-Blasco et al., 2013).

Cowan and Cowan (2000) put forward that pregnancy is an opportune time for suggesting interventions as women are more open to interventions aimed at improving their own mental health prior to giving birth as medication is often refused due to unknown or damaging consequences to the developing foetus. Therefore, women may also be more open to participating in studies during this time period. Future research needs to continue to explore dispositional mindfulness and the impact of mindfulness interventions in a range of perinatal populations - including a variety of ethnic/cultural groups, participants living in different socio-economic situations, and women with

health difficulties - in order to develop a better understanding of the associations between mindfulness, mental health and maternal sensitivity/child outcomes, and whether different mechanisms of change are responsible across the differing cohorts of women both prenatally and postnatally.

Measures

The majority of studies relied heavily on self-report data for mental health, mindfulness and child outcome measures. The dispositional mindfulness studies were more concerned with mental health measures of anxiety, whereas the mindfulness intervention studies were more skewed towards mental health measures of depression and stress. No studies directly examined maternal sensitivity but focused on a variety of child outcome measures which have been associated with maternal sensitivity and attachment, including exploring health outcomes (i.e., proportion of preterm births; Sriboonpimsuay et al., 2011), neurocognitive development (van den Heuvel et al., 2015a) and qualitative analysis of the impact of mindfulness on pregnancy, birth, and the postpartum period (Duncan & Bardacke, 2010). Limited research makes it difficult to draw conclusions about child outcomes and how these directly relate to maternal sensitivity. More longitudinal studies that explore several mental health difficulties (depression, anxiety, stress) are required in order to track these measures beyond the early postnatal period.

Three of the nine intervention studies also did not report any mindfulness measures (Sriboonpimsuay et al., 2011; Chan, 2014; Meschino et al., 2016) and so, as a result, the degree to which improvements in mental health difficulties and child outcomes co-vary with increases in levels of mindfulness is unclear.

Intervention

All nine of the mindfulness intervention studies used differing mindfulness programmes, in terms of the theoretical basis (i.e., MBCT, MSBR, EBMI), including the intensity and duration of interventions, making them difficult to compare to one another. Overall, both brief (Zilcha-Mano & Langer, 2016) and more extensive interventions (Duncan & Bardacke, 2010; Dunn et al., 2012) provided promising evidence that mindfulness interventions can improve mood and well-being and have positive effects on some child outcomes (e.g., Chan, 2014; Muzik et al., 2012). Two of the studies offered mindfulness as part of a psychotherapy intervention (Meschino et al., 2016) or an antenatal mindfulness-yoga intervention (Muzik et al., 2012) and so it is difficult to determine whether mindfulness was an active mechanism of change or whether the additional parts of the intervention (psychotherapy, exercise) were also responsible for the changes observed.

Furthermore, follow-up measures were very limited across the studies. Dispositional mindfulness studies explored child outcomes up until ten months post childbirth. Intervention studies either explored post-intervention effects immediately after the intervention, up to five months after delivery (Chan, 2014).

The research offers emerging evidence that mindfulness interventions are helpful across the perinatal period. It is still unknown whether it is more effective to deliver mindfulness programmes before or after birth, or whether these should be offered during both time points in order to have more sustained effects on mood and child outcomes, as well as the potential to contribute to more effective mother-child interactions.

Limitations of the review

This review was limited to studies that focused on maternal mindfulness in relation to child outcomes across the perinatal period. Studies that explored associations between prenatal dispositional mindfulness and studies that examined the effectiveness of mindfulness interventions (prenatal and postnatal) were included. Moreover, this is a new field with studies identified from 2010 onwards. Hence, there is a lack of robust studies related to both areas of investigation, thereby limiting this review to a number of pilot and feasibility studies and non-controlled trials.

Considered as a whole, it was felt that a meta-analysis was not appropriate at this time given the limited evidence base and the variation in intervention programmes offered and child outcome measured across the studies. Future research must focus on closely replicating studies to explore how mindfulness may act as a protective factor in terms of reducing negative symptoms experienced by the mother, and in terms of improving child health, socio-emotional and developmental outcomes. Unquestionably, further understanding the mechanisms of how mindfulness leads to positive changes in mothers adapting to pregnancy and motherhood is required.

Conclusion

Fundamentally a normal and healthy process for most women, pregnancy can be challenging and may be perceived by some to be stressful with rapid physical and emotional changes. There is a lot of uncertainty about outcomes in pregnancy, labour, birth, and the postpartum experience.

The aim of this systematic review was to consider the relationships between mindfulness and maternal sensitivity in mothers across the perinatal period, whilst also exploring the interactions of these two factors with mental health. Given this new field of investigation, no studies exploring the direct relationship between mindfulness

and maternal sensitivity were found, necessitating a broader search exploring the relationships between mindfulness and child outcomes.

The risks associated with maternal depression and anxiety in relation to the development of maternal sensitivity and attachment relationships during this time of transition are increasingly being recognised and understood. However, much less is known about prenatal factors, such as mindfulness, that may serve to decrease the likelihood of postnatal mood symptoms or enhance attachment (Sawyer Cohen, 2010) and can offer mothers an alternative to pharmacological treatments which have been shown to be detrimental for the developing foetus (van den Heuvel et al., 2015b). Qualitative findings suggest that teaching mindfulness during the perinatal period may expand pregnant women's repertoires for adaptive strategies to not only coping with birth, but also better manage life and family stress into postpartum period. For healthcare providers to be able to stress the benefits of being mindful offers a more positive and proactive (and possibly more effective) message to pregnant women, in comparison to stressing the potential dangers of being anxious or low in mood. Future research needs to continue to develop this growing evidence base, along with investigating interventions using more gold standard RCTs with active control groups and longitudinal study designs.

The review has highlighted a number of promising empirical findings that show that mindfulness has the potential to reduce depression, anxiety and stress, and may help to promote healthier pregnancies, better birth outcomes, and enhance better socio-emotional development. The reviewed studies suggest that certain facets of mindfulness may be 'tuned up' or learned with mindfulness training in order to improve maternal well-being and child outcomes, although specific mechanisms for change are not yet understood. The following empirical paper aims to add to the

limited dispositional mindfulness literature and explores relationships between

mindfulness, mental health, and a unique measure of maternal sensitivity in expectant

mothers during the prenatal period.

CHAPTER 2

EXPLORING MENTAL HEALTH, MINDFULNESS AND MATERNAL
SENSITIVITY DURING THE THIRD TRIMESTER USING SIGNAL DETECTION
METHODOLOGY

In the UK, 700,000 women give birth each year (Hogg, 2014). Giving birth is a unique developmental time in a woman's life, but this transition has also long been conceptualised as a period of psychological upheaval (LeMasters, 1957). Up to 20 percent of women will experience the emergence of mental health difficulties during pregnancy, and the first year after childbirth, including depression, anxiety disorders, stress disorders, and postnatal psychotic disorders, among others, with significant long-term cost to society (Bauer, Parsonage, Knapp, Iemmi & Adelaja, 2014). Mental health difficulties can affect a mother's ability to care for her child, her parenting style, and her developing relationship with her baby, through her sensitivity and responsiveness to her child's needs. Subsequently, these difficulties do not only affect women and their partners, but they can also have an adverse impact on children's brain development and long-term outcomes (Center on the Developing Child at Harvard University, 2009).

There is a general shortage of midwives and other resources across the NHS, and the majority of maternity services (73%) do not have a specialist mental health midwife (Hogg, 2014). Consequently, the identification of perinatal mental health illnesses is often delayed or non-existent. Due to the potential long-term impact of these difficulties for both the mother and child, it is important to address the relationships between mental health difficulties and maternal sensitivity and to determine whether other factors may play a role in reducing or increasing the impact of mental health difficulties on this relationship. Research has demonstrated that the

quality of parents' interactions with their new offspring and the quality of their

attachment relationships can be improved through interventions (Barlow et al., 2015),

suggesting that early detection (potentially as early as during pregnancy) and a

preventative stance may be the most beneficial support for mothers and their families.

Maternal Sensitivity

Maternal sensitivity refers to a mother's ability to recognise, understand, and

respond appropriately and consistently to her infant's emotional, physical and

communicative needs (Ainsworth et al., 1978; Ainsworth, 1979; Bowlby, 1969; Karl,

1995; Pearson et al., 2012). Infant cues (e.g., crying) signal to the mother that the

infant needs something, but determining what the infant needs is often difficult

(DelCarmen-Wiggins & Carter, 2004), especially for new mothers. By 6 weeks,

infants are sensitive to the facial expressions and responses of their mothers and

expect social interaction (Nadel et al, 1999; Rochat & Striano, 1999). Interaction with

caregivers is arguably one of the most important elements of a child's early experience

and lays the social and emotional foundations of his/her development. It is through

these interactions that children start to recognise and regulate their own emotions and

build foundations for future relationships (National Scientific Council on the

Developing Child, 2004).

Sensitive mothers respond to cues in a timely manner and 'match' the cues to

their infant's responses, development, and context (Leerkes et al., 2009). These

maternal/infant interactions contribute to the development of early attachment

relationships. Ainsworth and Bell (1969) put forward that maternal sensitivity is

constructed of four components, including a mother's awareness of her infant's signals,

an accurate interpretation of them, an appropriate response to them, and a prompt

response to them. Greater sensitivity to an infant's needs has been associated with the

development of more secure and healthy mother-infant relationships (De Wolff & van Ijzendoorn, 1997), as well as better cognitive and emotional development, higher social competence, and fewer behavioural difficulties of the child (Beckwith et al., 1999; Davidov & Grusec, 2006; Leerkes et al., 2009).

Mental Health and Maternal Sensitivity

A significant risk for poorer maternal sensitivity is that of depression over the perinatal period (Bennett et al., 2004). Children of mothers with depression are more likely to be depressed themselves due to early psychobiological alterations, stress hormones and autonomic reactivity (Ashman, Dawson & Panagiotides, 2008).

Pearson and colleagues (e.g., Pearson et al., 2010; Pearson et al., 2009) investigated the link between depressive symptoms and maternal sensitivity over the perinatal period. Pearson et al. (2010) explored the association between depression and maternal sensitivity using an attentional task in which women at the beginning of their pregnancy were required to disengage attention from infant and adult faces displaying negative, positive and neutral emotions. Non-depressed women took longer to disengage attention from distressed compared to non-distressed infant faces, whereas there was no significant difference in disengagement between distressed and non-distressed infant faces for depressed women. In a follow-up study, women who demonstrated greater attentional bias towards infant distress during late pregnancy reported more successful mother-infant relationships (Pearson et al., 2011).

Pearson et al. (2012) also observed that the timing of the depression is of considerable importance. Using data from 900 mother-infant dyads, the researchers found that women reporting high depressive symptoms during mid pregnancy, but not postnatally at 8 months, had a 30% increased risk of low maternal sensitivity when the infants were 12 months, compared to women who reported consistently low depressive

symptoms. The researchers concluded that prenatal depression plays a fundamental role in the development of maternal responsiveness and proposed that depression may interrupt this cycle, resulting in disrupted mother-infant interactions and poorer infant outcomes (see also Pearson et al., 2010). Arteche and colleagues (2011) showed that depressed mothers were less sensitive towards happy infant faces. Barker et al. (2011) also suggested that the third trimester is important in determining postnatal outcomes.

Stein and colleagues (2009) posited a 'preoccupation' hypothesis that mothers who have depressive/anxiety symptoms are preoccupied with recurrent negative/anxious intrusive thoughts and narrowed or self-focused attention. As a result, they tend to have difficulty attending to and responding to the outside world. Stein et al. (2012) conducted an experimental study in which mothers diagnosed with generalised anxiety disorder and major depressive disorder were randomised to either a worry/rumination prime or a neutral prime task to activate recurrent negative thinking in order to examine the effect on mother-infant interaction and infant behaviour. A control group was also included in the study. Observations of the mother-infant interactions were taken before and after priming. The researchers found that disturbances in maternal cognitions in the context of postnatal anxiety and postnatal depression (to a lesser degree) do play a significant role in mother-infant interactions and reduce the sensitivity of caregiving (see also Field, 2010; Lovejoy, Graczyk, O'Hare & Neuman, 2000). Stein et al. (2012) proposed that negative effects on mother-child interactions are due to increasing cognitive load and narrowing maternal focus. The maternal preoccupation hypothesis makes intuitive sense, particularly as impaired facial expression recognition has been associated with features of major depression, which could underlie some of the difficulties in social

interactions of this population (Surguladeze et al., 2004). Campbell et al. (2004) found that maternal sensitivity (observed at 4 time periods between 6 and 36 months) was not associated to patterns of depressive symptoms; however, the course and timing of depressive symptoms interacted with maternal sensitivity. Martins and Gaffan (2000) conducted a meta-analysis which found that maternal depression increases the likelihood of both disorganised and insecure attachment styles and significantly reduces the likelihood of secure attachment styles.

In addition, Pearson and colleagues (2012) demonstrated that depressed women exhibited significantly greater systolic blood pressure towards infant distress compared to non-depressed women and proposed that these results suggest sympathetic over-sensitivity to infant distress. These findings appear to contradict the insensitivity hypotheses previously presented in maternal sensitivity research and advance the notion that attentional disengagement may be a result of avoidance (conscious or not). Pearson posits that it is possible that depressed mothers disengage from distressed infant faces to avoid their own emotional reaction to such stimuli.

In light of the present study, two findings appear especially relevant. First, depressive symptoms associated with differential attentional processing of infant emotions (neurocognitive processing) can be detected as early as the beginning of pregnancy. Second, these symptoms may impact on the development of maternal sensitivity and the developing mother-infant relationship. However, the paucity of research in this area provides considerable justification for further in-depth investigations in order to more fully explore the relationship between mental health difficulties and maternal sensitivity over the perinatal period. In this respect determining whether other factors can 'buffer' the impact of perinatal difficulties such as depression and anxiety, or improve maternal sensitivity, seems paramount.

Although interventions during the perinatal period have shown promising results, they are still very much in their infancy. Pearson et al. (2013) conducted a randomised controlled trial which investigated whether cognitive behaviour therapy (CBT) could normalise depressed pregnant women's dysfunctional attentional processing of infant distress observed at baseline. Participants (pregnant women who were classified as depressed) were randomised to an intervention group (that ran between the first and last trimesters) or a treatment as usual - a measure of attentional bias was taken before and after the intervention. Participants who experienced CBT demonstrated similar attentional biases post-intervention to non-depressed women, suggesting that it may be possible to alter mothers' basic processing of infant stimuli prenatally. In another pilot study, Pearson et al. (2016) used cognitive bias modification (CBM) techniques to retrain dysfunctional processing of affective stimuli in mothers of children under three years old. The researchers demonstrated that it was possible to change the threshold at which mothers perceive ambiguous infant faces as 'distressed' by increasing or decreasing their sensitivity to distress. The researchers recognise that the findings are difficult to generalise to clinical populations or longitudinally. While research findings are tentative, in light of the present study, evidence is emerging that a mother's processing of distressed infant stimuli can be adjusted-at least to some extent.

Mindfulness, Mental Health and Maternal Sensitivity

Mindfulness is the 'non-judgemental awareness of experiences in the present moment' (Kabat-Zinn, 1990). In a theoretical review, Holzel and colleagues (2011) highlighted several components of mindfulness meditation that might increase awareness and improve self-regulation. Specifically, researchers evidence four distinct components of mindfulness including attention regulation, body awareness, emotion regulation and change in self-perspective.

Mindfulness has been applied as an intervention for the treatment of depression (not specific to pregnant women or mothers) with the development of 'Mindfulness-based Cognitive Therapy' (MBCT; Williams & Kuyken, 2012) and holds a large evidence-base (Hofman et al., 2010). During the past decade there has been a rise in interventions that target mindfulness-related psychological processes, which are designed to increase the capacity for self-regulation in parents (Dumas, 2005). These interventions have been utilised explicitly with mindfulness-specific interventions, and also less directly within larger treatment protocols, such as Dialectical Behavior Therapy (DBT; Linehan, 1993). Mindfulness as an active treatment tool delivered through either of these avenues has been used clinically for women experiencing postnatal depression, anxiety and psychosis, with the notion that a mindfulness intervention focuses on a deficit that exists in individuals who are unable to cope with adversity (Zoeterman, 2014). Evidence suggests that mindfulness interventions can be effective across a range of mental and physical conditions (de Vibe, Bjorndal, Tipton, Hammerstrom & Kowalski, 2012) and during pregnancy (Duncan & Baracke, 2010). Vieten and Austin (2008) conducted a pilot study to explore the effectiveness of a MBCT group in women who self-identified as having 'mood concerns' during the last half of pregnancy. MBCT has been shown to lead to improved parent/child interactions and relationships, less stress, and fewer externalising symptoms of children. Women who experienced the group during the 2nd trimester manifested lower levels of stress, anxiety and depression during the rest of pregnancy and 6 weeks postnatally. In another pilot study, Jansen (2014) advances the notion that prenatal mindfulness level (as measured by the Freiberg Mindfulness Inventory) during the third trimester predicts child temperament (lower negative affect and higher effortful control) at 9 months.

More recently, mindfulness has been explored as a positive psychological construct that allows for better resiliency in the face of major life transitions, stressors or adversity, known as *dispositional* mindfulness (Anicha et al., 2012; Brown & Ryan, 2003; Way et al., 2010). Anicha et al. (2012) posited that dispositional mindfulness differs between individuals, just as individuals differ on awareness, attention and cognitive control. Most research on dispositional mindfulness has been examined among undergraduate populations (Baer et al., 2006), or in populations of meditators (Baer et al., 2008).

Dispositional mindfulness may help an expectant/new mother to counteract or embrace some of the changes at the time of pregnancy and childbirth and provide her with coping mechanisms for an emotional transition. Zoeterman (2014) proposed three theoretical functions of mindfulness during pregnancy and childbirth: 1) mindfulness interventions have been used in the treatment of emotion regulation difficulties, and it can be argued that pregnancy and motherhood is an emotionally salient time for women; 2) studies (e.g., Kinsley & Lambert, 2008; Brunton & Russell, 2008) have shown many neurobiological adaptations in pregnant women's and new mothers' brains from the pre-pregnancy state and provide some evidence of neuroplasticity that enables mothers to meet the demands presented by her offspring; and 3) women experience perceived cognitive impairments, including focused and divided attention (e.g., Crawley, Dennison & Carter, 2003).

Operationalising Maternal Sensitivity

Maternal sensitivity is difficult to operationalise and, therefore, measure. Nonetheless, various measures have been developed in order to explore which factors contribute towards good sensitivity/responsiveness in the caregiving relationship, including through the use of naturalistic observations (Evans, Moran, Bento &

Pederson, 2007), the Ainsworth's Strange Situation (Ainsworth et al., 1967), and mother-infant synchrony (Zentall, Boker & Braungart-Rieker, 2009), as well as more standardised measures, such as Ainsworth's Maternal Sensitivity Scale (AMSS; Ainsworth, Bell & Stayton, 1974). Some studies have defined maternal sensitivity within the attentional bias domain (see Pearson and colleagues research, above).

Maternal sensitivity has also been linked to maternal emotion recognition. Leerkes (2010) examined mothers' emotional and cognitive processes that are related to how sensitively mothers respond to infant distress and non-distress cues in an emotionally arousing context. Mothers' emotional and cognitive processes were explored with unfamiliar infants during the prenatal period, and with their own infants at six months postpartum to determine whether responses to unfamiliar and familiar infants correlated with one another, and the predictive validity of each in relation to mothers' behavioural responses to their own infants. Information was gathered with expectant mothers 4-6 weeks prior to their due date after the presentation of six brief videoclips of two different six month old infants displaying fear and anger responses of different intensities of emotions (low level, intense level, and a range of fear intensities). The participants were required to rate the valence and intensity of the infant's distress and identify the infant's emotions. They were also required to rate the extent to which they themselves felt various emotions whilst watching the clips, describe how they would respond and why, describe what the goals of their behaviour would be, and rate how efficacious they felt in responding. At six months postpartum, the mothers were observed interacting with their own infants across two tasks. The first task (non-distress task) involved a remote control truck (with lights, motion and sound) placed in front (but not within touchable range) of the infant. The mother was told to remain neutral and uninvolved for the first half of the task, and then was

advised that she could interact with the infant as she pleased. The second task (distress task) required the experimenter to gently hold the infant's forearms immobile for four minutes and not to interact. During the first minute, the mother was told to remain neutral and uninvolved and the mother could interact how she pleased for the remaining three minutes. Participants then completed a video-recall interview and gave ratings similar to what was required in the prenatal task. The researchers found that *accurate distress cue detection, negative emotional arousal*, and *goals in relation to crying (infant-orientated)* each predicted significant and independent variation in sensitivity. Emotion goals were the most consistent predictor of maternal sensitivity in both the prenatal and postnatal periods. Hence, Leerkes (2010) suggests that mothers who prioritise their infant's needs and value negative emotions are less likely to be threatened by or overwhelmed when responding to infant crying, and can in turn be more responsive in their caregiving. Other research has also supported that maternal sensitivity is particularly important in relation to distress cues, as opposed to non-distress cues (Del Carmen, Pederson, Huffman & Bryan, 1993; Leerkes et al., 2009; McElwain & Booth-LaForce, 2006).

Donovan and colleagues (2007) also explored maternal emotion recognition but argued that maternal sensitivity should be examined as a sum of its component parts. The researchers proposed that a signal detection methodology (Green & Swets, 1996; Macmillan & Creelman, 2005) can isolate the contribution of two components of maternal sensitivity: to determine whether any difficulties in maternal sensitivity can be attributed to impairments in infant emotion processing (termed 'sensory sensitivity') and/or whether the response of a mother is related to a bias in perceiving one type of emotion (happy/sad). Using this methodology, Donovan et al. investigated maternal sensitivity to small changes in infant's positive and negative affective signalling. The

findings demonstrated that sensory sensitivity at six months, mother-infant interaction at nine months, and infant attachment status were predictors of mother-toddler interaction at 24 months. More specifically, greater sensitivity to positive expressions was associated with more positive maternal behaviour at 24 months, whereas greater sensitivity to both positive and negative expressions was associated with more positive maternal affect at 24 months. The results suggest that mothers' early sensory sensitivity to infant signalling is important until at least the second year of life. Using signal detection methodology in this way might identify mechanisms that can be targeted in therapeutic intervention.

Study Overview

Perinatal mental health is a major public health concern with adverse outcomes and significant costs for the mother, infant and wider society. Current research infers that attentional processing of infant distress cues during pregnancy play an important role in a mother's sensitivity after her infant is born. Mental health difficulties may disrupt the development of maternal sensitivity or result in reduced responsiveness to the child. Theoretically, mindfulness may also play an important role in the development of maternal sensitivity. Few studies have utilised Signal Detection Theory (SDT) to operationalise maternal sensitivity in relation to maternal emotion recognition, but it is conceivable that this approach may provide a valid and reliable approach that can be replicated with different populations (Donovan, Leavitt & Taylor, 2005; Donovan et al., 2007; Taylor, Donovan, Miles, & Leavitt, 2009).

The primary aim of the present study is to examine maternal sensitivity using a SDT model in order to differentiate between *discrimination* (whether expectant mothers can discriminate between happy and sad infant emotions) and *response bias* (whether expectant mothers have a propensity to rate emotional faces as either

'happy' or 'sad'). To date, the researcher is not aware of any studies that have synthesised and explored mental health, mindfulness and maternal sensitivity collectively in an expectant mother population. Focusing on this time point seems particularly crucial in order to gain an understanding of the factors (mental health, mindfulness) that may hinder and/or assist the development of maternal sensitivity. Considered collectively, these aspects could subsequently lead to development of early, preventative interventions during the prenatal period.

Hypotheses

1. Mental health difficulties (anxiety and depression) will be associated with difficulties in maternal sensitivity during the third trimester of the prenatal period, as measured by SDT. It is hypothesised that there will be:

   a. negative correlations between mental health difficulties and *discrimination* between happy and sad expressions.

   b. a positive correlation between mental health difficulties and a more liberal *criterion* (greater propensity to rate emotional stimuli as 'sad').

2. Mental health difficulties (anxiety and depression) will be associated with lower dispositional mindfulness.

3. Higher dispositional mindfulness will be associated with greater maternal sensitivity. It is hypothesised that there will be:

   a. positive correlations between mindfulness and *discrimination* between happy and sad expressions.

   b. a negative correlation between mindfulness and a more liberal *criterion*.

Method

Participants

One hundred and four pregnant women aged between 18 and 44 years ($M =$ 29.21, $SD =$ 4.85) volunteered to participate in the study after reading an advertisement on social media (see Tables 2.1 and 2.2 for the specific demographic and pregnancy profiles of the sample). Women completed the prenatal part of the study midway through their third trimester ($M_{weeks} =$ 34.34; $SD =$ 2.44).

The advertisement (see Appendix A) outlined the research aims and activities and was placed on Facebook parenting and baby groups, including 'Yummy mums and mums to be support group', 'Pregnant in Beds, Herts and Bucks!', 'UK Breastfeeding and Parenting Support', 'Gentle Parenting UK' and Facebook pages including 'Mums to Be', 'The Calm Birth School' and 'Kicks Count'. Advertisements were also placed on the Babycentre and Netmums research forums. Approval to advertise on the Southampton National Childbirth Trust (NCT) Facebook page was also granted, and the NCT also put the advert into their October 2015 Hampshire newsletter. Interested mothers were asked to contact the researcher by email or phone.

Those who contacted the researcher were sent the information sheet (see Appendix B) and were included into the study if they were: 1) planning to be principal caretaker; 2) had access to the Internet to complete the online questionnaires and experimental task; 3) lived in the UK; and 4) were expecting their baby to be born between September 2015 and April 2016.

Table 2.1

Demographic profile of the participants.

Demographics	%
Marital status:	
Married	57.7
Cohabiting	34.6
Single	5.8
Separated	1.0
Not disclosed	0.9
Highest education:	
GCSEs	6.7
College education	38.5
University undergraduate degree	26.0
University postgraduate degree	28.8
Employment prior to maternity leave:	
Full time (37.5 hrs/week)	59.6
Part-time (average 20 hrs/per week)	23.1
Self-employed	8.7
Student	1.9
Unemployed	6.7
Ethnicity:	
British	89.4
Any other white Background	6.7
Irish	1.0
White & Asian	1.9
White & Hispanic	1.0

Table 2.2

Pregnancy profile of the participants.

Variables	%
Conception	
Natural	95.2
Intracytoplasmic Sperm Injection (ICSI)	1.0
Donor sperm	1.0
Not disclosed	2.8
Parity	
Primiparous	61.5
Multiparous	34.6
One child	25.0
Two children	4.8
Three children	1.9
Not disclosed	2.9
Planned delivery	
Natural/vaginal birth	96.2
Caesarean	3.8
Planning to feed baby	
Breastfed	76.9
Combination[14]	14.4
Formula	7.7
Not disclosed	1.0

One hundred and ninety seven women contacted the researcher. Of that number,

fourteen were not eligible to participate as they did not meet the inclusion criteria (7

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[14] Combination fed babies are both breast fed and formula fed.

women had due dates outside of the study timeframe; 2 women did not live in the UK; 5 only had access to an iPad or tablet[15]). Seventy nine women who were sent the information sheets either did not respond to the researcher to continue with participation ($n = 36$) or they had agreed to participate in the study, having met the inclusion criterion, but did not respond to subsequent emails ($n = 43$). Participants were offered £10 as an incentive for completing the study. Additionally, £50 worth of Mothercare vouchers were offered as a prize draw to increase motivation.

Design and Materials

Data reported in this chapter was extracted from a larger study that collected data midway through the third trimester and three months postnatally[16]. The analysis reported in this thesis will focus only on the prenatal data due to time restrictions[17] in collecting the data. The study was conducted online so that a greater number of mothers could be recruited across the UK (see Appendix C for a geographical map of participant locations). The questionnaires and computer tasks were completed at participants' own convenience.

Demographic and background questionnaires presented at the prenatal time point (see Appendix D) included details about participants' age, location, marital status, employment, highest education level, previous mental health difficulties, and alcohol//smoking status.

Mental Health Measures. The *Edinburgh Postnatal Depression Scale* (EPDS; Cox et al., 1987) is a well- recognised, validated and extensively used screening

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[15] The experimental emotion detection task was only programmed to run on a computer or laptop, as it was felt that a keyboard was necessary to accurately record reaction times.
[16] Pearson et al. (2010, 2011, 2012) suggest that the third trimester is a critical time in the development of maternal responsiveness.
[17] The postnatal data will be analysed once all postnatal data has been returned and will be written up for future publication into a peer-reviewed journal.

measure for pregnancy and postnatal depression (Murray & Cox, 1990). It consists of

10 items with four Likert-style response options and focuses on the cognitive and

affective features of depression during the past 7 days (somatic symptoms are excluded

due to confounding with pregnancy/postnatal health symptoms). The scale is validated

for use in the perinatal period because it avoids physical symptoms of depression and it

has been used with prenatal populations (Flynn, Sexton, Ratliff, Porter & Zivin, 2011).

The scale demonstrates good reliability with Cronbach's coefficient alphas reported

at .86 and .84 (see Flynn et al., 2011) for pregnant and postpartum women,

respectively.

Generalized Anxiety Disorder-7 (GAD-7; Spitzer, Kroenke, Williams & Lowe,

2006) is a brief self-report scale of 7 items to assess probable cases of generalised

anxiety disorder using four Likert-style response options from 'not at all' to 'nearly

every day'. The internal consistency of the GAD-7 has previously been reported with

a Cronbach alpha of .89 among pregnant women (Zhong et al., 2015).

Mindfulness Measure. The *Five Facet Mindfulness Questionnaire* (FFMQ;

Baer et al., 2006) is a 39-item measure composed of five unidimensional subscales that

were derived through analysis of pre-existing mindfulness scales, including the

Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the Freiburg

Mindfulness Inventory (FMI; Buchheld, Grossman & Walach, 2001), the Kentucky

Inventory of Mindfulness Skills (KIMS; Baer, Smith & Allen, 2004), the Cognitive

and Affective Mindfulness Scale (CAMS; Feldman, Hayes, Kumar, Greeson &

Laurenceau, 2007), and the Mindfulness Questionnaire (MQ; Chadwick, Hember,

Mead, Lilley & Dagman, 2005). Each facet is intended to measure one of five aspects

of mindfulness: *observing* (noticing internal and external experiences)*, describing*

(labelling experiences with words)*, acting with awareness* (attending to the present
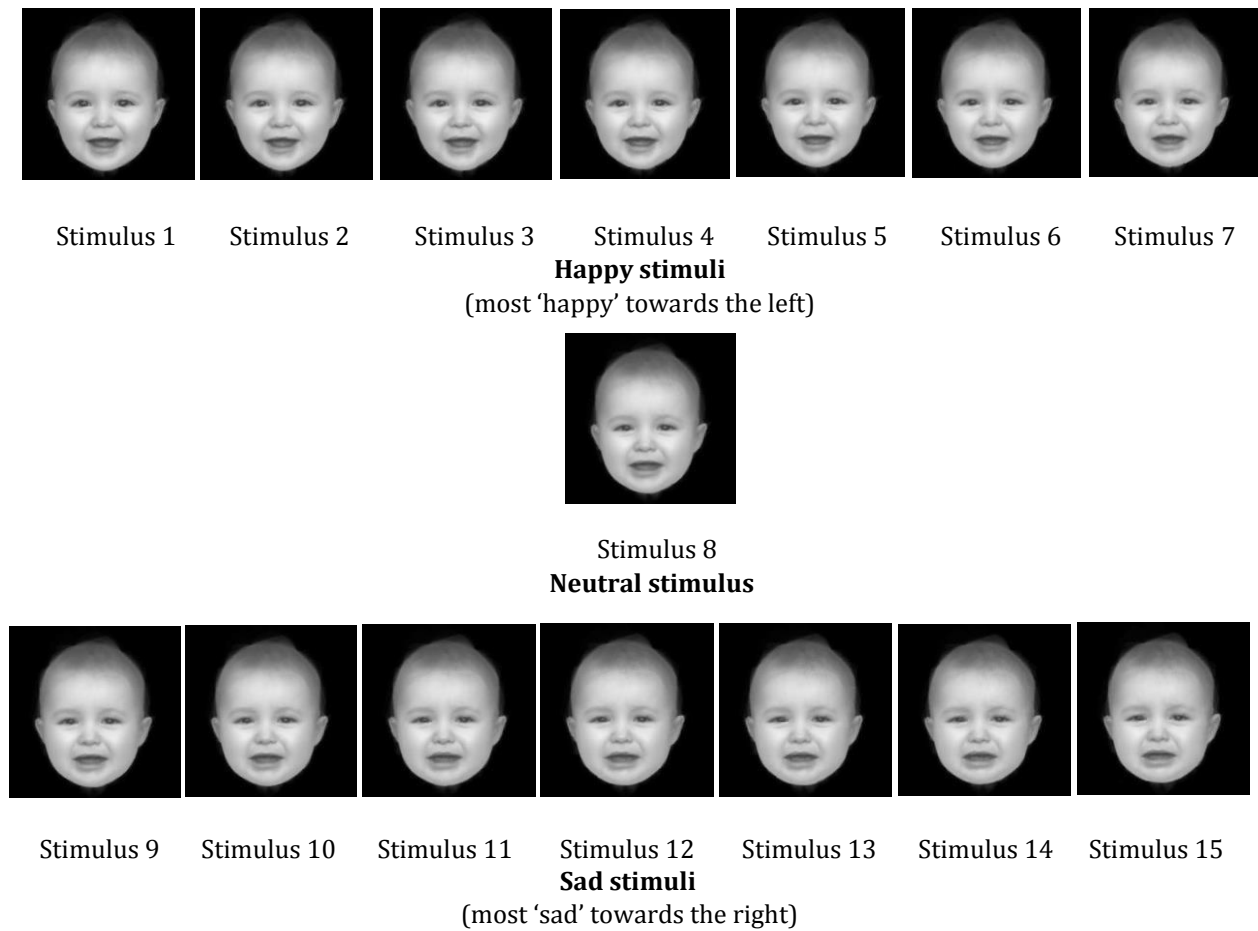
experience and avoiding 'automatic pilot'), *non-judging of inner experience* (taking a non-evaluative stance) *and non-reactivity to inner experience* (allowing thoughts to come and go without getting caught up with them). Baer et al. (2008) reported good reliabilities of .78 (observe), .91 (describe), .88 (awareness), .87 (non-judge) and .83 (non-react).

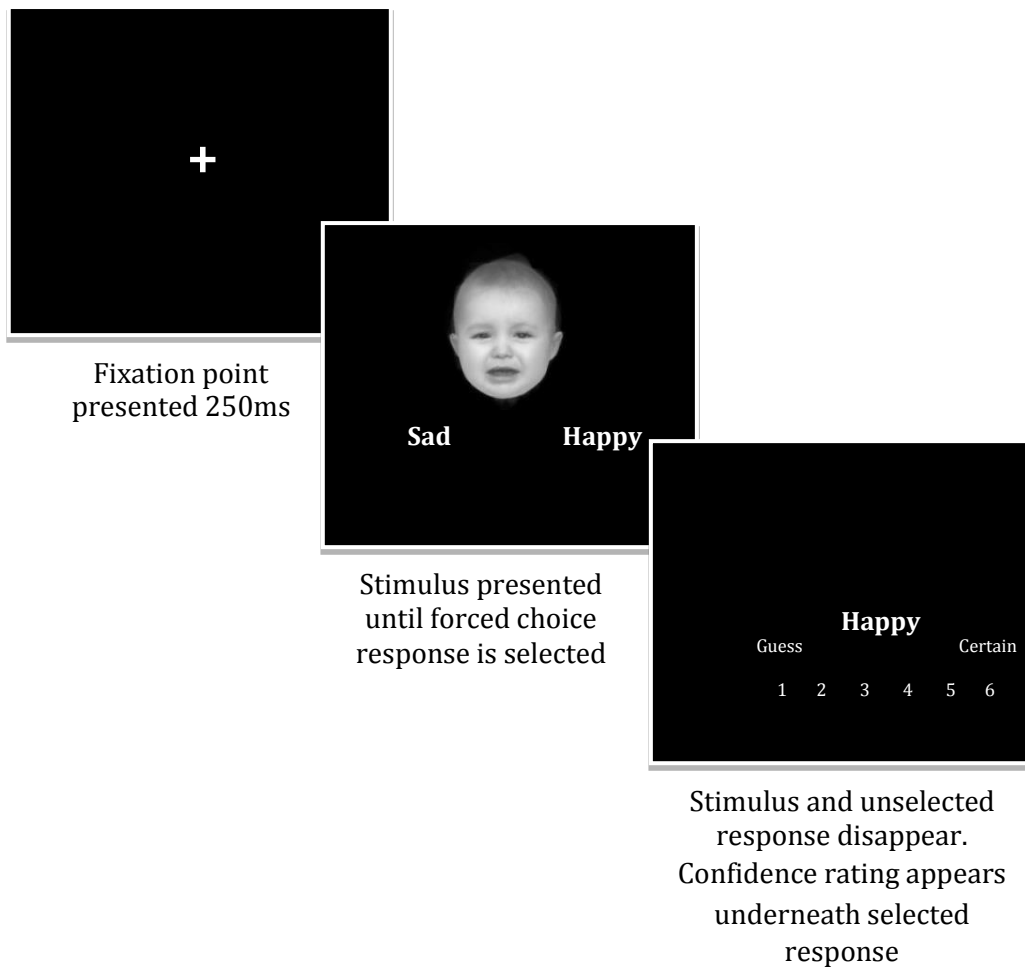***Maternal Sensitivity Measure – Emotion Recognition Task (ERT).*** A computerised emotion recognition task (ERT) was designed to run over the Internet. On a given trial, participants would see a black and white image of a baby's face and were required to indicate whether they believed the baby had a 'happy' or 'sad' expression. The task morphed prototypical face stimuli used by colleagues at the University of Bristol (Pearson et al., 2010) across 15 intensities (see Figure 2.1). Morphed stimuli allowed for greater control over stimulus intensity.

Participants were required to select whether they believed the baby was displaying a 'happy' or 'sad' expression by selecting the 'H' or 'S' keys on the keyboard, respectively (forced-choice response format). They were then asked to select a confidence rating between 1 (guess) and 6 (certain) by selecting the relevant numerical keys. Participants were required to complete eight trials of each stimuli (8 x 15 = 120 trials) which were presented in a random order for each participant (see Figure 2.2 for an example of an experimental trial). There was a two minute break after the first block of 60 trials and reaction times were recorded from the number of milliseconds that elapsed between the presentation of the stimulus and the participant key press. The task took approximately 8-10 minutes to complete.

| Stimulus 1 | Stimulus 2 | Stimulus 3 | Stimulus 4 | Stimulus 5 | Stimulus 6 | Stimulus 7 |

Happy stimuli
(most 'happy' towards the left)

Stimulus 8
Neutral stimulus

| Stimulus 9 | Stimulus 10 | Stimulus 11 | Stimulus 12 | Stimulus 13 | Stimulus 14 | Stimulus 15 |

Sad stimuli
(most 'sad' towards the right)

Figure 2.1. Happy, neutral and sad stimuli used in the emotion recognition task. Happy stimuli are morphed from 'most happy' (stimulus 1) to 'least happy' (stimulus 7); sad stimuli are morphed from 'least sad' (stimulus 9) to 'most sad' (stimulus 15).

Fixation point
presented 250ms

Stimulus presented
until forced choice
response is selected

Stimulus and unselected
response disappear.
Confidence rating appears
underneath selected
response

Figure 2.2. Schematic of the emotion recognition task. The programme started with a

countdown from '5' to '1' over 5000ms. The task would progress to the next trial if no

response had been selected within 10,000ms.

Procedure

Participants were informed of the study procedure prior to data collection via

online communication. Eight weeks preceding an individual's due date an email was

sent with a link to the online study (hosted by iSurvey; University of Southampton's

online data survey tool) and was asked to complete the first part of the study within two

weeks.

Participants viewed the information sheet and a consent form. Consent was sought by selecting a box on iSurvey. Researcher details were presented on screen and participants were encouraged to ask any questions via email. Participants were then instructed to click to the next screen in order to complete the online demographic and background questions as well as the mental health and mindfulness measures. Responses took approximately 15 minutes. Participants were then directed to a link for the emotion recognition task, which took them to instruction screens followed by the trials. The total time for the prenatal phase ranged between 25 and 40 minutes. Because of time constraints, participants sometimes requested completion of the questionnaires at a separate time from the emotion recognition task. Once the questionnaires and emotion recognition task were complete, participants could choose whether they would prefer half of their payment (£5) or wait until after the postnatal phase[18] to receive the full £10 (only 3% of participants chose the former option).

After completion of both time points, participants were presented with an online debriefing form (see Appendix E) and were encouraged to contact the researcher if they had any questions, or to give feedback on their experience. Participants were entered into a prize draw for Mothercare vouchers and were also offered a mindfulness CD on completion.

Ethical Considerations

The research protocol was reviewed and approved by the University of Southampton's Psychology Ethics Committee and by the University of Southampton's Research Governance Committee (see Appendices F and G,

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[18] The postnatal phase (data collection on going as part of larger study) followed the same format as the prenatal phase but included a postnatal questionnaire which consisted of questions regarding gestation at birth, baby's gender, delivery details, postnatal care, feeding, and plans to return to work when the participant's baby was three months old. The mental health, mindfulness, sleep and satisfaction with maternal care measures, and the emotion recognition task were also completed, along with the Postnatal Bonding Questionnaire (Brockington et al., 2001).

respectively). Participants were encouraged to contact the researcher if they felt that

they had experienced any adverse consequences or distress as a result of participating

in the study; however, no one subsequently contacted the researcher. Participants were

also encouraged to contact their GP, the NCT or the mental health charity, MIND, if

they were concerned about their mood. Telephone numbers and website details were

provided on the information sheet and debriefing form. Participants were given

information of their right to withdraw from the programme at any time without

penalty or interference to their usual care. Data was treated confidentially and stored

securely on an encrypted USB.

Data Management

Questionnaire and emotion recognition task data were downloaded from the

iSurvey website, and SPSS Statistics (Version 23) was used for statistical analysis.

Total scores for each standardised measure (EPDS, GAD-7, FFMQ (total and

subfactors) were calculated. Whilst 104 participants completed the questionnaire

measures, some participants had missing items[19], therefore not all composite scores and

subscales could be calculated for all measures. Eighty six participants went on to

complete the ERT. Participant drop out was due to difficulties with access to a

computer, difficulties with getting the programme to run on certain web browsers

(although this was specified in the initial emails), and lack of interest to complete the

task. The pairwise option was selected so that the majority of cases were included in the

analyses.

Signal Detection Analysis

Shown in Table 2.3 is a contingency table that summarises performance

measures on this task, based on signal detection theory (SDT). SDT is a rational choice

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[19] A recognised difficulty with completion of the questionnaires from a remote location.

theory of decision making under uncertainty, originated as a model of perceptual

judgement (Tanner & Swets, 1954). In a classic recognition task, a participant decides

whether or not an event has occurred (Galvin, Podd, Drga & Whitmore, 2003;

Macmillan & Creelman, 2005; Rotello, Macmillan & Reeder, 2004).

Table 2.3

The four task contingencies used to derive measures of performance in the emotion
recognition task, based on SDT[20].

Response	Signal	
	Present	Absent
Sad	Hit (H)	False Alarm (FA)
Happy	Miss (M)	Correct Rejection (CR)

There are four possible contingencies shown in the table: a 'sad' response when

a sad stimulus is presented (hit [H]), a 'sad' response when a happy stimulus is

presented (false alarm [FA]), a 'happy' response when a sad stimulus is presented

(Miss [M]), and a 'happy' response when a happy stimulus is presented (correct

rejection [CR]). Figure 2.3 shows a graph of two hypothetical distributions to further

illustrate this concept. The distribution on the left is for the noise-alone trials (i.e., the

happy stimuli), and the distribution on the right is for the signal-plus-noise

distributions (i.e., the sad stimuli). The horizontal axis is labelled internal response,

which is unique to each participant, but generally it is assumed that there is something

triggered within an individual which relates to them being more likely to record a

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[20] 'Sad' responses were classified as the 'signal' in this task.

'sad' response, and more likely to record a 'happy' response. The height of each curve

represented how probable that level of internal response will occur. For instance, there

may be lower confidence associated with noise-alone trials, and greater confidence

associated with signal-plus-noise trials.
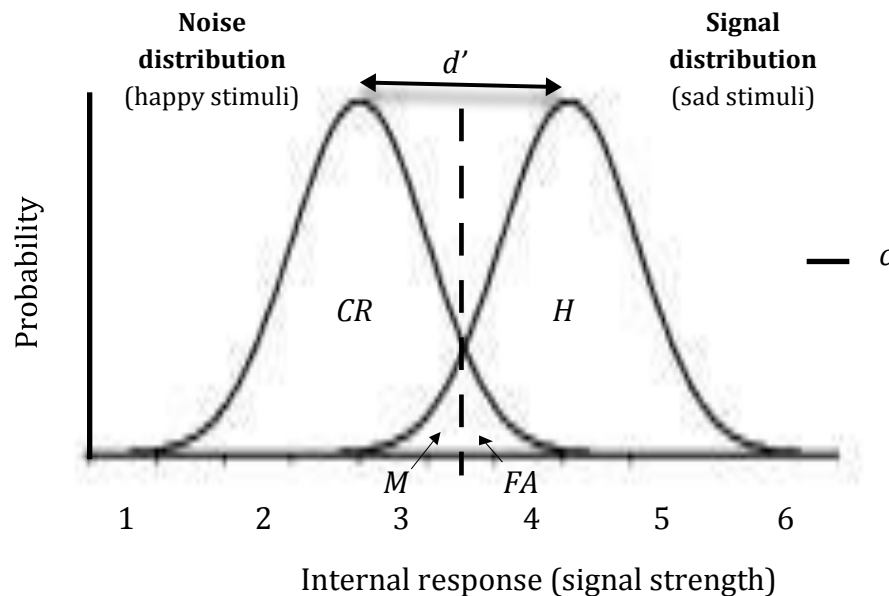
Figure 2.3. Internal response probability of occurrence curves for noise-alone and signal-

plus-noise distributions. The internal response is an individual's response to signal strength

under uncertainty. In this hypothetical example, the participant is likely to say the stimuli is

'sad' when their internal response is above a signal strength of 3, and is likely to say the

stimuli is 'happy' when their internal response is below 4 (criterion setting). There is an area

of overlap between the two distributions (between signals 3 and 4) which is the area of most

uncertainty for the individual (discriminability).

The dashed vertical line represents a participant's response criterion.

Whenever the internal response is greater than this criterion, the participant records a 'sad'

response. Whenever the internal response is less than the criterion, the participant records a

'happy' response. The current criterion in Figure 2.3 is set in a neutral position, but it could be set very liberal (the line would move towards the left on the graph), in which case the participant may respond to more stimuli as 'sad' expressions. A liberal response criterion is a greater propensity to rate stimuli as 'sad'. Consequentially, the participant will detect most of the sad expressions, but may miss a lot of the happy expressions. Conversely, if a very conservative criterion is set (the criterion line would move towards the right on the graph), then the participant will detect most of the happy expressions, but miss a lot of the sad expressions. In relation to women looking after babies in the real world, the consequences of having a particularly liberal or conservative bias may mean that women are responding not as optimally to their infants to promote sensitive caregiving. Theoretically, someone who has a high propensity to identify her infant's emotions as 'sad' (liberal criterion) may be more likely to avoid interactions with the child. Alternatively, she may overcompensate in her interactions and constrain her infant's exploration of the world. In contrast, someone who has a low propensity to identify her infant's emotions as 'sad' (conservative criterion; recognising most infant emotions as 'happy') may be missing a lot of the infant's distress cues.

The distance between the two response distributions represents how well a participant can discriminate between the happy (noise) and sad (signal-plus-noise) distributions. The further away the distributions from one another, the better discrimination. The value of d' (d-prime) which is calculated to determine discrimination is independent of the participant's criterion. The four frequencies can allow for the computation of a hit rate (HR) and false alarm rate (FAR) which can in turn be used to calculate discrimination between happy and sad response distributions (d': refers to the ability to discriminate between different infant emotional signals), and response criterion (c) (refers to the tendency to set a liberal or conservative criterion),

as separate measures of maternal sensitivity (see Table 2.4 for the formulae used to

calculate all of the measures).

Table 2.4

The formulae for each performance measure of the ERT.

Measure[1]	Formula	Data Range	Description
Hit Rate (HR) / Sad stimuli accuracy	Hs/(Hs+Ms)	.59 - .99[21]	Proportion of correctly classified 'sad' responses (responding 'sad' when a sad stimulus is presented). Higher scores represent more successful classifications, and greater accuracy of sad stimuli.
False Alarm Rate (FAR)	FAs/(FAs+CRs)	.01 - .62	Proportion of incorrectly classified 'sad' responses (responding 'sad' when a happy stimulus is presented). Higher scores represent more inaccurate classifications of the stimuli.
Overall accuracy	(Hs+CRs)/ (Hs+Ms+FAs+ CRs)	.68 - .99	Correctly responding 'sad' and 'happy' when 'sad' and 'happy' stimuli were presented, respectively, reflected an accurate response. Higher scores represent greater accuracy.

[21] The value of .99 represents the hit rate post-loglinear correction which enabled the distributions to be treated equally. Thus, all participants had a hit rate between .59 and .99.

Happy stimuli accuracy	CRs/(CRs + FAs)	.38 - .99	Accuracy of only the 'happy' stimuli response distribution. Higher scores represent greater accuracy.
Discrimination (d'^2)	$z(HR) - z(FAR)$	1.98 – 4.75	Higher scores represent better discrimination between happy and sad stimuli.
Criterion (c)	$-(z(HR) + z(FAR))/2$	-1.34 – 1.08	Positive values of c indicate conservative responding; negative values represent liberal responding; 0 indicates a neutral criterion.

[1]The HR and FAR for almost a third of participants (32%) was 1 or 0, respectively. Therefore, a correction of adding .5 to every SDT cell (Hs, Ms, FAs, CRs) was applied so that the distributions were treated equally (the loglinear approach; Hautus, 1995).

Results

Scale Reliabilities

Cronbach's alpha coefficients were calculated to estimate the internal consistency

for each construct. All scales were functioning with acceptable Cronbach alpha

reliabilities (see Table 2.5), according to the recommended threshold of .65 (DeVellis,

2005). The observing[22] subscale of the FFMQ has slightly less acceptable reliability

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[22] The observing subscale of the FFMQ has been shown to not correlate as well as the other subscales, and the scores tend to predict outcomes quite differently from the others. Research has demonstrated that it is not so good at measuring dispositional mindfulness and may be sensitive to changes with meditation practice (Baer et al., 2008). Recent reviews have suggested that self-focused attention can be maladaptive and is common in many psychological disorders (Mor & Winquist, 2002). However, mindfulness is a very complex concept that is not yet fully operationalised. Perhaps for this reason, the majority of research has used the FFMQ subscales in analyses, rather than the composite score.

(.75) compared to the other subscales, but this variance is in line with previous findings

(Baer et al., 2008), and the alpha coefficient is still above the threshold.

Table 2.5

Means, standard deviations and Cronbach's alpha for each standardised measure.

Measure	*n*	Mean	*SD*	Range	Cronbach's Alpha, α
EPDS	102	7.73	4.66	0-22	.86
GAD-7	104	5.37	4.25	0-21	.87
FFMQ	97	129.92	18.89	90-176	.90
Observing subscale	97	24.73	5.59	14-39	.75
Describing subscale	97	28.75	6.21	9-40	.91
Acting with Awareness subscale	97	26.69	5.84	11-38	.86
Non-judging subscale	97	28.65	7.59	10-40	.93
Non-reactivity subscale	97	21.09	4.84	12-35	.79

EPDS = Edinburgh Postnatal Depression Scale (depression); GAD-7 = Generalised
Anxiety Disorder (anxiety); FFMQ = Five Facet Mindfulness Questionnaire
(mindfulness).

Preliminary Analyses

Frequencies were run on each of the variables to explore the means, standard

deviations, and normality and variances of the distributions (see Table 2.5 for the

means and *SDs* of the standardised questionnaires and Table 2.6 for the means and

SDs of variables extracted from the ERT). Histograms and boxplots were also plotted,

which indicated the presence of some mild outliers on the EPDS, GAD-7, FFMQ

observing and describing subscales, and the accuracy, d', reaction time and confidence

variables of the ERT, but generally demonstrated normally distributed variables.

Table 2.6

Means and standard deviations of the emotion recognition task data (n = 86).

Variable	M	SD
Accuracy[1]		
happy + sad stimuli	.90 (.01)	.06
happy stimuli	.86 (.01)	.01
sad stimuli	.95 (.01)	.07
Confidence (1-6)		
happy stimuli	4.89 (.06)	.55
sad stimuli	4.64 (.07)	.66
neutral[2] stimuli	4.08 (.10)	.90
Reaction time (ms)		
happy stimuli	2331.65 (67.71)	627.87
sad stimuli	2227.72 (62.48)	579.41
neutral[1] stimuli	2693.20 (118.19)	1096.0
Sensitivity		
Response criterion[1] (c)	-.32 (.05)	.45
Discrimination[1] (d')	3.05 (.06)	.52

Note. Standard errors of the means are in parentheses.

[1]The calculations of accuracy, c and d' exclude the 'neutral' stimuli.

[2]Neutral stimuli refers to Stimuli 8 of Figure 2.1.

The outliers were examined in detail on a case by case basis for any obvious

errors, and to check whether scores on other variables fit with the more extreme

scores. None of the outliers were removed as they were felt to be a true representation

of the sample, and, more specifically, a good reflection of the variability in participant

mood, satisfaction with maternal care, mindfulness constructs, and performance on the

ERT. As a result of this exploration of the data, along with the skewness and kurtosis scores, it was determined that the data met the assumptions for normality and so parametric tests were chosen in the analyses (Field, 2009).

Descriptive Statistics

The mean depression score (as shown in Table 2.5) for the sample fell below the cut-off that signifies mild clinical depression (maximum score = 30). A score of >13 on the EPDS represents someone who is likely to be experiencing low mood of increased severity (Cox et al., 1987), although differing optimal cut-offs have been suggested by different researchers (Ji et al., 2011). In a simple background question asking participants to report previous or current mental health diagnoses (see Appendix D for the question), 40.4% of women reported previously or currently being diagnosed with depression. 12.75 percent of the sample fell into this depression category, which is in line with previous research on depression rates during pregnancy
(7-13%; Bennet et al., 2004; Gavin et al., 2005).

The mean anxiety score (see Table 2.5) of the sample fell within the mild range for anxiety (scores between 5 and 9 signal mild anxiety; maximum score = 21). 41.3 percent of the sample stated that they currently have, or previously have had, an anxiety diagnosis. Simpson, Glazer, Michalski, Steiner and Frey (2014) highlight in their paper that almost one quarter of pregnant women suffer from an anxiety disorder, and 8.5% suffer specifically from generalised anxiety disorder (GAD). Given a suggested cut off score of >13, 5.77% of the participants in this study may be classified as reaching diagnostic criteria for GAD.

The composite scores on the FFMQ for participants fell across a large range (90-176; maximum score = 195, subscale score maximum = 40 except for the nonreactivity subscale which has a maximum score of 35). The higher the score on each subscale, the

greater the individual's mindfulness disposition (Baer et al., 2006). Woolhouse, Mercuri, Judd and Brown (2014) report mean FFMQ full scale scores for pregnant women between 10 and 34 weeks gestation who were going to attend a randomised controlled trial of a mindfulness intervention to be 123.07 (SD = 20.74). The subscales ranged from a mean of 20.00 (SD = 6.04) to 27.29 (SD = 6.70). The measures in the current sample are comparable to these figures.

Table 2.1 shows participant characteristics of the sample. Over half of the participants were married (57.5%), had a university degree (undergraduate and/or postgraduate; 54.8%), were in full-time employment prior to maternity leave (59.6%), and identified with being White British (89.4%). The majority had conceived naturally (95.2%), and this would be their first child (61.5%) (see Table 2.2). A large percentage (96.2%) were planning a natural birth, and to exclusively breastfeed[23] (76.9%). Six percent of the participants reported drinking 1-2 units of alcohol per week during their pregnancy. The majority of participants reported not smoking (78% never smoked, 21% have not smoked during pregnancy, 1% was smoking three cigarettes per day).

Correlational Analyses

Correlations (Pearson's r) were performed between the standardised mental health and mindfulness measures and the maternal sensitivity performance data extracted from the ERT[24], which included accuracy, confidence, reaction times, response bias and discrimination (see Table 2.7). Correlations were also conducted to

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[23] The proportion of babies breastfed at birth in the UK is approximately 81%. At three and six months the number drops to 17%, and 1%, respectively (Renfrew, 2012).

[24] A repeated measures ANOVA on the ERT data determined that the proportion of infant faces that were classified as 'sad' differed significantly across the different stimulus blends[24] (see Appendix H, Figure 2.4), $F(1,85) = 3947.46, p < .001$.

explore the relationship between age, gestation, and standardised variables of depression, anxiety and mindfulness (see Table 2.8).

Exploratory Correlations

The following analyses were conducted in order to better understand the prenatal population included in this study. Older participants had significantly higher FFMQ total scores, most likely attributed to higher scores on the describing and acting with awareness subscales. Gestation (weeks of pregnancy) was not associated with any of the measures. Higher educational attainment (university vs. college and lower) was also associated with greater accuracy for happy stimuli, and greater accuracy overall.

Point-biserial correlations (r_{pb}) were run to determine the relationship between dichotomous categorical participant variables[25] (women intending to exclusively breastfeed vs. formula or combination feed; multiparous vs. primiparous; educated to college level and below vs. undergrad or higher; employed full time vs. part time/student/unemployed) and the continuous measures of age, mood, anxiety and mindfulness. The results showed a correlation between age and planned breastfeeding, $r_{pb} = -.255$, $n = 102$, $p = .010$, and education and breastfeeding, $r_{pb} = -.210$, $n = 103$, $p = .033$, indicating that older women, and women who had attained a higher education, were more likely to consider exclusively breastfeeding. A significant correlation also emerged between mindful non-reactivity and intending to breastfeed, $r_{pb} = .271$, $n = 96$, $p = .008$, which shows that women who are intending to combination or formula feed are scoring higher on this subscale.

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[25] The dichotomous groups were chosen based on participant numbers and distributions. Other demographic variables did not contain enough diversity to split the distribution of scores evenly or with enough of an *n* to allow for significance testing.

Those who were pregnant for the first time (primiparous) were more likely to report low mood, $r_{pb} = -.227$, $n = 102$, $p = .022$, and higher anxiety, $r_{pb} = -.217$, $n = 104$, $p = .027$. Multiparous women were associated with a higher FFMQ score, $r_{pb} = .274$, $n = 97$, $p = .007$, attributed to higher scores on the non-judging, $r_{pb} = .218$, $n = 97$, $p = .032$ and acting with awareness, $r_{pb} = .216$, $n = 97$, $p = .034$, subscales.

Full time hours of employment were significantly related to lower scores on the observing, $r_{pb} = -.354$, $n = 97$, $p < .001$ and non-reactivity, $r_{pb} = -.216$, $n = 97$, $p = .034$, subscales of the FFMQ, suggesting that women with full time hours are less likely to notice their internal and external experiences, and are more likely to get caught up or carried away by their thoughts and feelings.

Hypothesis 1: Mental health difficulties will be associated with difficulties in maternal sensitivity.

Pearson's correlations *(r)* demonstrated that lower mood ratings (as measured by the EPDS) were associated with higher anxiety (GAD-7). Worse mood and greater anxiety were associated with reduced recognition accuracy of happy infant emotion (see Table 2.7) and a greater propensity to rate the stimuli as a 'sad' emotion (irrespective of whether the stimulus was happy or sad), consistent with a more liberal criterion. Low mood was also associated with improved accurate detection of infant sadness.

Hypothesis 2: Mental health difficulties will be associated with lower dispositional mindfulness.

Low mood and greater anxiety were both associated with a lower level of mindfulness in terms of the FFMQ total score (see Table 2.8). More specifically, low mood significantly related to lower scores on the non-judging, describing and acting with awareness subscales of the FFMQ. Greater anxiety was associated with lower

scores on the non-judging, acting with awareness, describing and non-reactivity subscales (in order of relationship strength).

Hypothesis 3: Higher dispositional mindfulness will be associated with greater maternal sensitivity.

Analyses revealed a positive correlation between greater mindfulness (only the non-reactivity subscale) and confidence ratings for sad classifications. No other associations between mindfulness and maternal sensitivity measures were significant.

Correlations between the Performance Measures of the ERT

Greater overall accuracy was positively correlated with greater accuracy of happy stimuli and sad stimuli. Greater overall accuracy, greater accuracy of the happy stimuli and greater accuracy of the sad stimuli were all associated with a more conservative response criterion and better discriminability. Greater accuracy of the happy and sad stimuli were also negatively associated with lower confidence of the sad stimuli.

Higher confidence ratings for happy stimuli were associated with higher confidence for sad stimuli and shorter reaction times to the happy and sad stimuli. Higher confidence of the sad stimuli was correlated with shorted reaction time to the sad stimuli only. Higher confidence of sad stimuli was also associated with a more liberal response criterion. Finally, women who responded quicker to the happy stimuli also responded quicker to the sad stimuli.

Table 2.7

Correlations between standardised and ERT performance measures.

Variables	1 – 8	Accuracy			Confidence		RT		Bias	Discrimination
		10a	10b	10c	11a	11b	12a	12b	13a	13b
1. EPDS	(See Table 2.8 for correlation coefficients)	-.110	-.250*	.248*	.006	-.020	.046	-.006	-.285**	.008
2. GAD-7		-.142	-.218*	.140	-.003	-.049	.017	-.016	-.238*	-.055
3. FFMQ Total		-.073	-.031	-.069	.177	.286*	-.123	-.189	.007	-.092
4. FFMQ – Observing		.117	.159	-.070	.203	.136	-.018	-.111	.160	.071
5. FFMQ – Describing		-.128	-.094	-.068	.017	.179	-.038	-.051	-.036	-.143
6. FFMQ – Acting with Awareness		-.112	-.078	-.056	.064	.201	-.177	-.210	-.043	-.074
7. FFMQ – Non-judging		-.202	-.141	-.096	.134	.163	-.109	-.143	-.040	-.190
8. FFMQ – Non-reactivity		.218	.112	.163	.156	.243*	-.027	-.075	.009	.146
9. Education		.269*	.237*	.035	-.085	-.067	.048	.024	.152	.200
10. ERT Accuracy										
a. Overall			.825**	.231*	-.069	-.013	.147	.397**	.793**	.510**
b. Happy stimuli				-.359*	-.017	-.281**	-.047	.196	.820**	-.433**
c. Sad stimuli					.099	-.369**	.063	-.092	-.758**	.007
11. ERT Confidence										
a. Happy stimuli							.696**	-.360**	-.285**	-.061

b. Sad stimuli .208 -.363** -.330** -.098

12. ERT Reaction time

  a. Happy stimuli .756** -.067 .065

  b. Sad stimuli .190 .090

13. SDT Measures

  a. Bias (response criterion, c) .065

  b. Discrimination[1] (d')

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*= $p < .05$, **= $p < .01$.

Note. Correlations were run between the background measures of age, children (primiparous, multiparous), planned feeding (breast feeding, formula or combined) and employment (full-time, all others not full time) and all other ERT measures, but there were no significant correlations (all $ps > .05$) so these variables were not included in this table. Education (split into 'college and under' and 'undergraduate and postgraduate' education) did not moderate the above results. Correlations were also conducted using the most ambiguous emotion stimuli (mild happy: stimuli 6 & 7; and mild sad: stimuli 9 & 10), but no additional findings to the correlations reported above were yielded from this analysis.

Table 2.8

Correlations between age, gestation (weeks pregnant), and the standardised measures.

Variables	1	2	3	4	5	6	7	8	9	10
1. Age (years)										
2. Gestation	-.048									
3. EPDS	-.161	.053								
4. GAD-7	-.085	-.077	.827**							
5. FFMQ- Total	.239*	-.023	-.505**	-.430**						
6. FFMQ - Observing	.127	-.037	-.003	.021	.402**					
7. FFMQ - Describing	.260*	-.124	-.407**	-.250**	.715**	.172				
8. FFMQ – Acting with Awareness	.228	.070	-.370**	-.351**	.683**	-.009	.434**			
9. FFMQ – Non-judging	.151	.011	-.523**	-.465**	.725**	-.070	.391**	.478**		
10. FFMQ – Non-reactivity	-.060	.010	-.180	-.229*	.562**	.314**	.172	.162	.265**	

*= $p < .05$, **= $p < .01$

Discussion

The present research explored the associations between mental health, mindfulness and maternal sensitivity in a woman's third trimester of pregnancy (late prenatal period) using an online cross sectional study of expectant mothers across the UK. The effectiveness of mindfulness interventions has started to be explored during the perinatal period (e.g., Vieten & Austin, 2008); however, research exploring dispositional mindfulness in this population is limited. Dispositional prenatal mindfulness may protect prospective mothers from developing mental health difficulties, or may aid in the development of maternal sensitivity and mother-infant bonding. The current study used a signal detection approach to maternal sensitivity that differentiated between two distinct components of maternal sensitivity: *discrimination* (whether expectant mothers can discriminate between happy and sad infant emotions) and *response criterion* (whether expectant mothers have a propensity, or bias, to rate emotional faces as either 'happy' or 'sad').

The relationships between mental health (depression, anxiety), maternal sensitivity and mindfulness were examined during the third trimester of pregnancy. The set of analyses tested hypotheses that a) mental health difficulties would be associated with difficulties in maternal sensitivity (i.e. reduced sensitivity/discrimination and greater response bias); b) mental health difficulties would be associated with lower dispositional mindfulness; and c) higher dispositional mindfulness would be associated with greater maternal sensitivity.

Mental Health and Maternal Sensitivity

There was some support for the primary hypothesis, that mental health difficulties would be associated with difficulties in maternal sensitivity. Increased maternal anxiety and depression was associated with a greater propensity, or bias, to

perceive sadness in infant facial expressions (irrespective of actual expression). The mean proportion of sad classifications of the neutral stimulus was also particularly high ($M = .79$; see Appendix H, Figure 2.4). This extends previous evidence that adults display a negativity bias, or the propensity to attend to, learn from, and use negative information over positive information to inform decision making (e.g. Kahneman & Tversky, 1984). Findings also extend evidence of a perceptual 'negativity' bias in depression, characterised by increased attention to sad faces than happy faces (Gotlib, Krasnoerova, Yue & Joormann, 2004), and tendency to interpret emotionally neutral faces as sad (Leppänen, Milders, Bell, Terriere & Hietanen, 2004). However, the current study results do not support Donovan and colleagues' discrimination (sensory sensitivity) findings, or broader research on face emotion recognition in depression that has found reduced discrimination in participants who are depressed (e.g., Anderson et al., 2011). The prenatal time point is a unique period for participants, with the focus of the present data on the third trimester; whereas, Donovan and colleagues collected postnatal data.

This lack of support for differential discrimination based on mental health difficulties may be due to the characteristics of the participants. Whilst the study was advertised using various online methods, the study is difficult to generalise to the general population as over 50 percent of participants were educated to university undergraduate level or higher, and may have had an impact on the way participants responded to the ERT. However, education did not appear to moderate the results of the correlations. It may be that maternal sensitivity further develops once the infant has been born and becomes more noticeable between people who are experiencing mental health difficulties and people who are not at this point. Alternatively, the lack of statistically significant discrimination findings may be due to methodological

concerns with the task design, which are covered in more depth in the Limitations section, below.

The negative correlations between depression and accuracy and between anxiety and accuracy suggest that accuracy may also be an important part of the process by which women make decisions to attend to their infant. Meins, Fernyhough, Fradley and Tuckey (2001) conceptualised maternal sensitivity by focusing on mother's ability to *accurately* read her infant's mental states, termed appropriate mind-related comments, and found that a mother's use of appropriate mind-related comments is a better predictor of attachment security than maternal sensitivity.

Anxiety can be characterised by attentional bias, which refers to the tendency to selectively attend to threat stimuli, even when those stimuli are irrelevant to current goals and/or when it is in competition for attention with nonthreat stimuli (Beard, 2011). Anxiety, therefore, may be playing a different role in attending to emotional stimuli. For instance, Gotlib et al. (2004) found that participants who had depression directed their attention to depression-relevant (i.e., sad) faces, whereas participants who had anxiety (as measured on the GAD) were not attending selectively to happy, sad or anxiety-relevant (i.e., angry) faces. It may be that attentional biases are different for individuals who are experiencing depressive symptoms and those who are experiencing anxiety. Whilst it was not possible to run analyses that separates these two diagnostic categories due to a high rate of comorbidity, further research exploring whether differences in attentional biases and maternal sensitivity specific to women diagnosed with depression and/or anxiety is required.

Mental Health and Mindfulness

The present study provides evidence that mindfulness is positively associated with better mental health. Specifically, greater mindfulness was associated with lower

depression and lower anxiety. These associations are consistent with relationships often observed between mental health and mindfulness. For example, Feldman, Lavallee, Gildawie and Greeson (2016) review evidence that mindfulness moderates the association between stressful, aversive experiences and subjective distress, and decreases vulnerability to psychological disorders, such as depression, anxiety and substance use. Likewise, Keng and colleagues' (2011) comprehensive review of the empirical studies that have examined the effects of mindfulness on psychological health concluded that mindfulness is positively associated with psychological health, and training in mindfulness may bring about positive psychological effects, including subjective well-being, reduced physiological symptoms and emotional reactivity, and improved regulation of behaviour.

Mindfulness practices are increasingly being offered during antenatal preparation as a way of managing pain, reducing stress and anxiety, and have the potential to help parents prepare for childbirth (Warriner, Williams, Bardacke & Dymond, 2012). Warriner et al. (2012) argued that mindfulness not only reduces mental health, but promotes "life-long wellbeing" by reducing the escalation of negative thoughts that may compound pain or depressed mood. Hughes et al. (2009) proposed that mindfulness can increase the 'availability' of attention for the new baby as the techniques also help parents to purposely divert their attention to the 'present' more often.

In a recent study, Woolhouse et al. (2014) piloted an antenatal mindfulness intervention to reduce depression, anxiety and stress among pregnant women. The study was designed in two parts and included a non-randomised trial targeting women at risk of mental health difficulties (targeted population) and a randomised controlled trial (RCT) of a universal population. Measures of mood and psychological distress

were taken pre and post intervention. Although the participant numbers were relatively small (20 and 32 women for the non-randomised trials and RCT, respectively), the study provided evidence of significant group improvements to depression and anxiety in the non-randomised trial, and significant within group improvements to anxiety and mindfulness in the RCT.

The current study cannot determine cause and effect of the association between mental health and mindfulness, it is, therefore, not known whether having fewer reported mental health difficulties means that participants score higher on the FFMQ, or whether higher dispositional mindfulness acts as a protective factor to the development and/or maintenance of mental health difficulties.

Mindfulness and Maternal Sensitivity

The hypothesis that there would be an association between higher dispositional mindfulness and greater maternal sensitivity was not supported by the data. In light of the negative relationship between mental health and maternal sensitivity, and the negative relationship between mindfulness and mental health difficulties, it is possible that dispositional mindfulness of mothers could promote psychological well-being, and in turn, maternal sensitivity; however, there was no evidence of this pathway in the current data. Research examining links between mindful parenting[26] and sensitivity (Duncan et al., 2009), and a parent's dispositional mindfulness and parenting practices (Parent et al., 2010) are still developing.

Parent et al. (2016) examined the process by which parent dispositional mindfulness relates to child psychopathology through mindful parenting practices in a cross-sectional study. The researchers found that higher levels of parent dispositional

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[26] Mindful Parenting has been defined as "paying attention to your child and your parenting in a particular way: intentionally, here and now, and non-judgementally" (Kabat-Zinn & Kabat-Zinn, 1997).

mindfulness were indirectly related to lower levels of youth internalising (negative behaviours that are focused inward which include fearfulness, social withdrawal, and somatic complaints) and externalising (behaviours that are directed outward toward others, such as bullying, vandalism and arson) behaviours through higher levels of mindful parenting and lower levels of negative parenting across three developmental stages: young childhood, middle childhood and adolescence. Other research specific to the perinatal period has demonstrated that prenatal self-compassion and mindfulness together predict significant variance in prenatal attachment measured by self-report questionnaires (see the discussion regarding Sawyer Cohen's research, 2010; Chapter 1), which was also associated with postnatal attachment. Intuitively, the dispositional capacity to maintain present-moment focus and attention (mindfulness) should have some benefit in allowing parents to provide attention to their child in a non-judgmental way, and to shape parenting practices that were sensitive to the child's needs. Parent et al. (2016) highlight the need for further research to further explore the mechanisms by which these two associations (dispositional mindfulness, child behaviours) come together. Furthermore, Siegal (2007) has suggested that mindfulness practice and sensitive parent-infant interactions both promote neural plasticity in the mother in the same prefrontal brain regions, and could support the connection between dispositional mindfulness and the development of healthy maternal sensitivity.

Limitations

The present research aimed to extend the work by Donovan and colleagues on maternal emotion recognition with the use of SDT in a prenatal population. It is plausible that this task may not have been the ideal method for measuring maternal sensitivity, especially given the infancy of this design in measuring this construct. Descriptive statistics suggested that the ERT did not reveal substantial variability in

expression recognition accuracy and bias with some performance indices approaching ceiling. Participants, on the whole, were highly accurate and the majority of them demonstrated good discrimination between the happy and sad stimuli. However, the ERT was useful in that it was still able to show significant correlations between accuracy and response criterion with depression and anxiety. There was also a benefit to running a signal detection analysis in that maternal sensitivity could be operationalised in terms of how well an expectant mother discriminates between happy and sad stimuli, and whether the mother holds a more liberal or conservative response criterion, i.e. 'negative bias'.

The research would have benefitted from a pilot study regarding the suitability of the stimuli, the number of trials presented to participants, and to reduce ceiling effects, particularly as the neutral stimulus (stimulus 8) had a much higher proportion of sad classifications than expected ($M = .79$). However, the collection of stimuli had previously been piloted and used in other research on attentional biases in mothers, and so it may be that this sample of women in the prenatal period were actually perceiving the neutral stimulus as more negative than anticipated. This measure of maternal sensitivity, delivered in an emotion recognition task could be replicated with similar or clinically different populations and could be a useful tool of consideration for future research into maternal sensitivity. The majority of previous dispositional mindfulness studies have utilised self-report measures (Sawyer Cohen, 2010; van den Heuvel et al., 2015b; Zoeterman, 2014) but have not focused on maternal sensitivity. The distinction between two components of maternal sensitivity also makes theoretical sense (Donovan et al., 2009), in that a mother has to first of all detect which emotion her infant is expressing, and then respond appropriately to that emotion in order to develop a sensitive and interactive bond. Ainsworth and Bell (1969) put forward that

maternal sensitivity is constructed of four components, including a mother's awareness of her signals, an accurate interpretation of them, an appropriate response to them, and a prompt response to them, and SDT goes some way in measuring these components.

In addition, the study was based online for both recruitment of participants and completion of the questionnaires and ERT. Whilst this method increased sample size and power, the task did not detect several predicted associations e.g. reaction times and confidence. The testing procedure relied on participants to set up the task on their own via an emailed link, and offered a relatively flexible approach by which participants were able to complete the study wherever they wanted and at the time most convenient to them. Advice was offered to participants to complete the task in a quiet room, but some experimental control was lost using this method. There should also be consideration of selection bias. Only women who had access to a PC and the Internet could take part, and there was participant attrition if they were unable to access the ERT on certain web browsers. Moreover, a high proportion of participants had an undergraduate degree or higher, and were White British. Ideally a task that is more accessible to a broader demographic should be developed for future research.

Finally, the primary aim was to explore mindfulness in relation to maternal sensitivity but multiple regression analysis could not be conducted on the grounds that there were no correlations between these variables. It is a possibility that there may be no associations between mindfulness and maternal sensitivity during the last trimester of pregnancy and that these associations are more notable after birth; however, given the limitations of the current emotion recognition task, future research might use a modified task to reduce ceiling effects. Examining changes in mental health, mindfulness and maternal sensitivity over time would also be useful to identify the

most effective time point during the perinatal period to offer support, screening and/or interventions to expectant mothers. To this end, follow-up data is being collected from this sample to examine predictors of mental health outcomes in mothers, and their maternal sensitivity, three months after the baby is born. This includes as measure of mother-child bonding (the Postnatal Bonding Questionnaire; Brockington et al., 2001).

Further Research, Implications and Conclusions

To the researcher's knowledge, this is the first study to examine dispositional mindfulness in relation to maternal sensitivity in the late prenatal period. The study highlights a unique methodology for exploring maternal sensitivity and the findings extend other signal detection studies by exploring associations that include mindfulness as a factor, alongside mental health and maternal sensitivity.

Understanding the cognitive processing underpinning maternal sensitivity during the third trimester has the potential to contribute towards developing strategies for expectant mothers. In particular, insights along these lines may help to prepare women who are identified as having greater difficulties in interacting sensitively to their infants. Hence, future research in this area could aid in the development of preventative interventions, such as early screening during pregnancy for insensitive or inappropriately timed caregiving interactions. Whilst the current study goes some way in supporting the associations between mindfulness and mental health noted in previous literature (see Chapter 1), more research to further explore the relationship between mindfulness and maternal sensitivity across the perinatal period is needed. Findings might be especially beneficial for women suffering from postnatal depression, anxiety or stress, and/or experiencing difficulties in terms of responding to their infant's distress cues alongside evidencing the use of mindfulness interventions.

Above all, this research has the potential to highlight the opportunities for effective early intervention, such as enhancing mothers' attention to nuances in infant signalling (Donovan et al., 2007), with the aims of improving the lives of women, as well as strengthening emotional and developmental outcomes for the child.

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APPENDICES

Appendix A Study Advertisement.

University of Southampton

INVITING ALL MUMS TO BE!

We are looking for pregnant women to take part in a computer-based study.

You will be asked to complete some on-line questionnaires and a short computerised task in your 3rd trimester and then again when your baby is 3 months old.
Both sessions will last approximately 30-45 minutes.

Your contribution in this research will help improve our understanding of the challenges women face during the perinatal period (the time before and after birth), including emotional well-being, and may help develop programmes of support for mothers in the late stages of pregnancy and during early motherhood.

You will be given £10 for taking part, and offered a mindfulness-meditation CD on completion. You will also be entered into a prize draw to win £50 of Mothercare vouchers!

For further details, or if you are pregnant (any stage) and would like to participate, please contact:
Sara Carr
Trainee Clinical Psychologist
University of Southampton
s.e.carr@soton.ac.uk
study phone: 07810120383

Appendix B

UNIVERSITY OF
Southampton

INFORMATION & CONSENT FORM

A STUDY EXPLORING MINDFULNESS, MOOD AND RESPONSIVENESS:
FROM PRENATAL TO POSTNATAL.

Researcher name: Sara Carr
ERGO Study ID number: 14210

What is the research about?
I am Sara Carr, a trainee clinical psychologist at the University of
Southampton, funded by Taunton and Somerset NHS Trust. I am
requesting your participation in a study exploring the factors that
might improve mental health in new mothers, and how mothers
respond to infant distress. The study will examine how these factors
change between the late stages of pregnancy and the early weeks of
motherhood.

Why have I been chosen?
Participants are women over the age of 18 years who are expecting a
child, planning to be the principal caregiver, and live in the UK. You
may have been recruited via pregnancy groups, in person or online.

What will happen to me if I take part?
The study will take place at two time points: at approximately 34
weeks in pregnancy (6 weeks before due date) and at 3 months after
your baby is born.

3rd TRIMESTER	3 MONTHS POST-BABY
1.Questionnaires	1.Questionnaires
2. Emotion task 2. Emotion task	

Both time periods will involve completing online questionnaires about
you and your pregnancy/baby and a short online computer-based task.
The computer task will require you to view an image of an infant's face
and you will be asked whether you think the infant is happy or sad.
Your involvement should take approximately 30 minutes per time
point.

Are there any benefits in my taking part?
You will receive £10 for taking part and you will also be provided with a mindfulness (meditation/relaxation) CD on completion of the study. Recent evidence suggests that mindfulness practice can improve mood and enrich parenting.

You will also be entered into a competition to win £50 of Mothercare vouchers!

Importantly, your contribution in this research will help to improve our understanding of the challenges women face during the perinatal period, including the ups and downs of emotional well-being, and may help to develop programmes of support for mothers in the late stages of pregnancy and during early motherhood.

What happens if I change my mind?
Participants have the right to withdraw from the study at any time without penalty or interference to their usual care.

What happens if something goes wrong?
In the unlikely case of concern or complaint please contact the chair of the Ethics Committee, Psychology, University of Southampton, SO17 1BJ, UK. Phone: +44 (0)23 8059 3856, email fshs-rso@soton.ac.uk

Where can I get more information?
If you have any questions about giving consent, or would like to discuss the study further prior to taking part, please contact me, Sara Carr at s.e.carr@soton.ac.uk or on the study phone: 07810120383.

Sara will contact you just before 34 weeks with the link to the first part of the study! Thank you again for your interest.

Appendix C

A map of the participant locations across the United Kingdom (including England, Scotland, Northern Ireland and Jersey).

Appendix D

Demographic and background prenatal questionnaire.

1. Age _____

2. Town & County_____

3. Weeks pregnant _____ weeks

4. Pregnancy planned?
   • Yes
   • No

5. Highest maternal education
   • no education
   • GCSES (school)
   • A Levels/BTEC/equivalent (college)
   • 1st degree (university)
   • Higher degree (Masters/Doctorate; university)

6. Marital status
   • Single
   • Co-habiting (living together)
   • Married
   • Widowed
   • Divorced

7. Ethnicity White
   • British
   • Irish
   • Gypsy or Irish Traveller
   • Any other White background

   Mixed/multiple ethnic groups
   • White and Black Caribbean
   • White and Black African
   • Any other Mixed/Multiple ethnic background

   Asian/Asian British
   • Indian
   • Pakistani
   • Bangladeshi
   • Chinese
   • Any other Asian background

Black/African/Caribbean/Black British
- African
- Caribbean
- Any other Black/African/Caribbean background

Other Ethnic group
- Arab
- Any other ethnic group

8. Employment
- part-time _____ hrs
- full-time
- self-employed
- unemployed
- student

9. Current alcohol consumption per week (small glass of wine = 2 units)
- None
- _____ units

10. Current smoking status
- Never
- Not during pregnancy
- Yes approximately _____ per day/week (delete as appropriate)

11. Previous/current mental health difficulties
- Depression
- Anxiety
- Other _____

12. Type of delivery you are planning
- Natural
- C-section

13. Planning to
- Breastfeed
- Formula feed
- Combined feeding

Appendix E

UNIVERSITY OF
Southampton

Debriefing Statement

A STUDY EXPLORING MINDFULNESS, MOOD AND RESPONSIVENESS:
FROM PRENATAL TO POSTNATAL.

The aim of this research was to explore whether a woman's mindfulness (one's awareness of the present moment), mood (low mood and anxiety) and responsiveness to infant emotions change over time from the third trimester to 3 months postnatal. It is expected that there will be a wide variation in responses, but it may be that a woman's mindfulness level and mood may impact on how sensitively she is in responding to different infant emotions. Your data will help our understanding of the development of maternal sensitivity, and help to target early interventions that will promote well-being in the early stages of motherhood.

Once again results of this study will not include your name or any other identifying characteristics. The research did not use deception. If you would like a summary of the research finding once the project is finished, please let me know.

We have tried to ensure that the questions in this study do not cause any distress. However, it is not uncommon to experience some anxieties or concerns when completing questionnaires about pregnancy, birth or post-birth, and mood, and support is available. If participating in this study raises any issues for you, we recommend that you contact one of the following resources:

➢ Your local GP

➢ National Childbirth Trust: the UK's largest charity for parents
0300 330 0700
http://www.nct.org.uk/

➢ MIND: the mental health charity
0300 123 3393 or text 86463 9am-6pm Mon-Fri
http://www.mind.org.uk/

If you have any further questions please contact me, Sara Carr, at s.e.carr@soton.ac.uk. or on the study phone.

Thank you for your participation in this research.

If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk, you may contact the Chair of the Ethics Committee, Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: +44 (0)23 8059 3856, email fshs-rso@soton.ac.uk

Appendix F

Your Ethics Submission (Ethics ID:14210) has been reviewed and approved

ERGO [ergo@soton.ac.uk]

To: Carr S.E.

Friday, May 29, 2015 9:57 AM

Submission Number: 14210
Submission Name: THE ROLE OF MINDFULNESS AS A MEDIATOR IN THE RELATIONSHIP BETWEEN MATERNAL DEPRESSION AND MATERNAL SENSITIVITY OVER TIME: PRENATAL TO POSTNATAL
This is email is to let you know your submission was approved by the Ethics Committee.

Please note that you cannot begin your research before you have had positive approval from the University of Southampton Research Governance Office (RGO) and Insurance Services. You should receive this via email within two working weeks. If there is a delay please email rgoinfo@soton.ac.uk.

Comments
1.Please just add start date and end date on the study advert before you start running the study.

Click here to view your submission

ERGO : Ethics and Research Governance Online
http://www.ergo.soton.ac.uk

DO NOT REPLY TO THIS EMAIL

Appendix G

Submission Number 14210:
Submission Title THE ROLE OF MINDFULNESS AS A MEDIATOR IN THE RELATIONSHIP BETWEEN MATERNAL DEPRESSION AND MATERNAL SENSITIVITY OVER TIME: PRENATAL TO POSTNATAL:
The Research Governance Office has reviewed and approved your submission

You can begin your research unless you are still awaiting specific Health and Safety approval (e.g. for a Genetic or Biological Materials Risk Assessment) or external ethics review (e.g. NRES).The following comments have been made:

"
This is to confirm the University of Southampton is prepared to act as 'Research Sponsor' for this study, and the work detailed in the protocol/study outline will be covered by the University of Southampton insurance programme.
As the Sponsor's representative for the University this office is tasked with:
1. Ensuring the researcher has obtained the necessary approvals for the study
2. Monitoring the conduct of the study
3. Registering and resolving any complaints arising from the study

As the Chief/Principal Investigator you are responsible for the conduct of the study and you are expected to:
1. Ensure the study is conducted as described in the protocol/study outline approved by this office
2. Advise this office of any change to the protocol, methodology, study documents, research team, participant numbers or start/end date of the study
3. Report to this office as soon as possible any concern, complaint or adverse event arising from the study

Failure to do any of the above may invalidate your ethics approval and therefore the insurance agreement, affect funding and/or sponsorship of your study; your study may need to be suspended and disciplinary proceedings may ensue.
On receipt of this letter you may commence your research but please be aware other approvals may be required by the host organisation if your research takes place outside the University. It is your responsibility to check with the host organisation and obtain the appropriate approvals before recruitment is underway in that location.
May I take this opportunity to wish you every success for your research
Submission ID : 14210
Submission Name: THE ROLE OF MINDFULNESS AS A MEDIATOR IN THE RELATIONSHIP BETWEEN MATERNAL DEPRESSION AND MATERNAL SENSITIVITY OVER TIME: PRENATAL TO POSTNATAL
Date : 01 Jun 2015
Created by : Sara Carr

Appendix H

Emotion Recognition Task Stimuli Classification

Significantly fewer happy stimuli were classified as 'sad' compared to the sad stimuli (see Figure 2.4). There was a gradual increase in mean sad classifications and variability from stimulus 1 (strong happy; $M = .01$, $SD = .03$) to stimulus 5 ($M = .10$, $SD = .17$). Stimuli 6 and 7 (mild happy) had means of .40 ($SD = .31$) and .38 ($SD = .30$), respectively. Stimulus 8, which was classified as 'neutral' had a mean of .79 ($SD = .22$). There was a gradual increase in mean sad classifications and variability from stimulus 9 (mild sad; $M = .86$, $SD = .19$) to stimulus 15 (strong sad, $M = .99$, $SD = .03$). This analysis demonstrates that the stimuli used in the ERT were actually showing the differences between sad and happy stimuli that was expected.
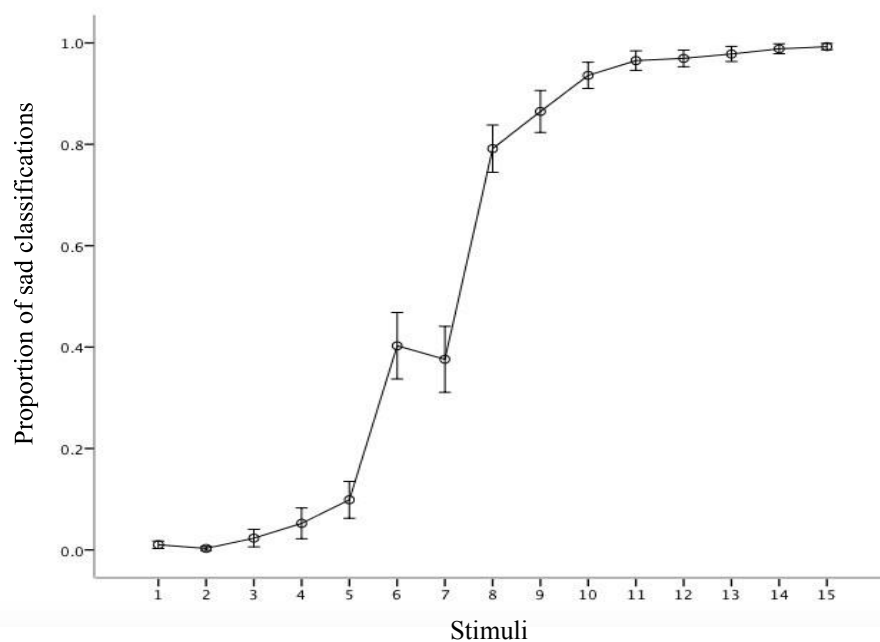

Figure 2.4. The proportion of 'sad' classifications across each of the stimuli. 'Happy' stimuli are numbered 1-7 (1=most happy), 'sad' stimuli are numbered 9-15 (15=most sad); stimulus 8 is classified as 'neutral'. Error bars represent 95% confidence intervals.