

Bipolar disorder in the perinatal period.

Transition to motherhood and mother-infant interactions.

PhD Thesis

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Oslo, Norway, 2020

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*Series of dissertations submitted to the
Faculty of Social Sciences, University of Oslo
No. 795*

ISSN 1564-3991

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Cover: Hanne Baadsgaard Utigard.
Print production: Reprintsentralen, University of Oslo.

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Acknowledgements

Above all, I want to acknowledge and express my gratitude to each mother and infant who participated in this research. During an important time of their lives, I was allowed access to valuable experiences. Their generosity made this project possible.

The fathers did not directly participate in the research included in this thesis. However, their contributions in other parts of the overarching study have been of very important value. Thank you.

I am greatly indebted to my main supervisor, Dag Vegard Skjelstad, who taught me to use my best endeavours to conduct proper research, who challenged me to think critically, but also creatively. Consistently, he prioritised to read and comment on my work, gave direct feedback with qualified insight and impressive knowledge. Eventually, in my writing process, I often asked myself, “What would Dag think...?”, and pushed myself further in academic achievement.

I am also deeply grateful to my co-supervisor, Kari Slinning, for her unfailing clear thoughts and extensive knowledge in maternal and infant mental health. Her scientific guidance and constructive criticism, in combination with a constant enthusiasm for the research, has been a great inspiration. To both Dag and Kari, thank you for vital support in times of hardship and for sharing times of joy.

I want to thank Vestre Viken Hospital Trust for financing the research.

My sincere gratitude goes to Heidi Taksrud and Lars Hammer (current and former head of the Department of Child and Adolescent Mental Health), and Torun Valø Balchen (head of the Child and Adolescent Mental Health Outpatient Clinic, BUP Drammen), for giving me the opportunity to conduct clinical research, and their steady faith in me being able to complete the project. I also want to thank Paul Møller, head of the Department of Mental Health Research and Development, for important support and enthusiastic interest in the project.

My sincere thanks go to Meike Meier and Catarina Furmark for their consistent commitment to thorough assessments of mother-infant interaction recordings, based on their outstanding expertise. Also, special thanks to Meike for insisting on coffee breaks and chats about life outside the research project – what a warm, friendly support and recreation!

Many thanks go to my former and current colleagues at the Infant Mental Health Team at BUP Drammen: Sidsel Haug, Nancy Moss, Randi Næss, Synnøve Drejer, Ellen Sæther Hansen, Marit Simonsen, Bodil Nyjordet Tveten, Heidi Rosland and Elisabeth Frøyland. It has been a delight to be part of such a vital, competent and inspiring milieu. The research project was initiated from our experiences in working with high-risk pregnant women and infant families. The support and involvement from my dear colleagues has meant a lot to me.

I am deeply appreciative of the reliable and friendly help of Cathrine Brunborg with the statistics, and of her valuable contributions to Papers II and III. I express my gratitude to Vibeke Moe and Torill Sundet Siqveland, for letting me access and use comparison data for mother-infant interactions, and for their constructive contributions to Papers II and III.

Many thanks go to all health professionals who helped me to recruit participants to the research. Their collaboration has been invaluable. Thanks to Helene Brennhovd Holth for transcribing interviews and Aud Andersen for assistance with administrative practicalities.

During the research, I have got acquainted with colleagues at the Vestre Viken Department of Mental Health Research and Development. Thank you all, for positive support and interest.

I am privileged to have a close family and a large social network with treasured friends, who deserve my heartfelt gratitude. Individually and collectively you have given me warm, friendly support, although there have been periods with sparse contact due to work load. I am thankful and lucky to have you all in my life.

A very special and deep thank you to Snefrid Anke, for all enduring support! Most importantly, by regular walks with Selma, no matter weather, she made it possible for me to focus time and energy on my writing, and Selma could be a happy dog.

Lastly, I want to express my love and gratitude to my children, Marcus and Minna, who have given me the deepest pleasure and meaning in being their mother. During the research process, they have patiently accepted my long working hours and my mental absence despite physical presence. Still, they have cheered me to the finishing line, and given me genuine encouragement and support. Thank you!

In gratitude, I dedicate this thesis to my beloved sister, Tarja Susanne Birkoff.

Having a witness, who validates, is a gift to resilience and strength.

Summary of the thesis

Pregnant women with bipolar disorder (BD) have a high risk of illness relapse postpartum, including psychosis. Postpartum mood episodes occur in a psychologically sensitive phase of life and present significant implications for the mother, the infant and the father. Despite the high risk, there is a scarcity of studies regarding the perinatal impact and management of BD. In particular, there is a significant knowledge gap regarding the perceived needs of women with BD in the transition to motherhood and on mother-infant interactions in the context of maternal BD.

The aim of this thesis was to generate knowledge that may inform more comprehensive and psychologically oriented perinatal care for women with BD and their families that responds to the complex challenges of becoming a mother with an enduring severe mental disorder. The main objective of this thesis was to investigate the transition to motherhood, from a subjective and dyadic perspective, for women with BD. To fulfil this objective, we conducted a prospective mixed methods study, where women with BD and their infants were followed up from pregnancy/maximum three months postpartum to 12 months postpartum.

In Paper I, we chose a qualitative approach to investigate how perinatal women with BD relate to the risk of illness relapse postpartum. This approach enabled us to explore subjective experiences in an open and inclusive manner and to obtain detailed and rich information. We individually interviewed 13 primiparous and 13 multiparous women with BD in pregnancy or early postpartum. We explored the women's concerns and how they prepared for the dual demands of mood episodes and motherhood. In Paper I, we thus describe the contents of women's perinatal concerns as well as their perceptions of their resources and preparations. A main finding was that even if women with BD are aware of the postpartum risk, they relate to it differently, expressing low, moderate and high levels of concern, which in turn, impacts their perinatal deliberations and preparations.

In Papers II and III, we describe mother-infant interaction patterns in dyads in which the mothers have BD (N=26 in Papers II and III) compared to dyads in which the mothers have no mental disorder (N=30 in Paper II and N=28 in Paper III). We assessed maternal, infant and dyadic interaction behaviours. For these investigations, we employed a quantitative methodology with standardised assessments. In Paper II, we examined mother-infant interactions at three months postpartum and whether concurrent affective symptoms of

mothers with BD were associated with interaction quality. In Paper III, we investigated the patterns and development of mother-infant interactions from 3 to 12 months.

The main findings of both papers were that there were difficulties with dyadic coordination and reciprocity in mother-infant interactions among the BD dyads. The mothers with BD and their infants experienced challenges in “finding” each other and sharing a positive “rhythmic dance”. Subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours. On the positive side, there was little expression of negative affect or tension in maternal, infant and dyadic behaviour, and some positive changes in infant behaviour from 3 to 12 months were observed. At three months postpartum, we could not find significant associations between maternal symptom load and interaction quality. The interactional findings suggest that mother-infant interaction patterns may enhance the developmental risk for bipolar offspring.

A conclusion, and the main clinical implication of this thesis, is empirical support for the importance of more comprehensive and psychologically oriented perinatal care for women with BD and their families. In perinatal prevention planning and counselling, women with BD ought to be given opportunities to share their thoughts, concerns and deliberations and should be encouraged and supported in making adaptive preparations for childbirth and the postpartum period. In postpartum follow up, early detection of maternal mood deviations is crucial, and mother-infant interactions need to be targeted to promote resilient infant development.

List of Papers

Paper I:

Anke, T.M.S., Slinning, K., & Skjelstad, D.V. (2019). “*What if I get ill?*” Perinatal concerns and preparations in primi- and multiparous women with bipolar disorder. *International Journal of Bipolar Disorders*, 7:7.

Paper II:

Anke, T.M.S., Slinning, K., Moe, V., Brunborg, C., Siqueland, T. S, & Skjelstad, D.V. (2019). Mothers with and without bipolar disorder and their infants: group differences in mother-infant interaction patterns at three months postpartum. *BMC Psychiatry*, 19:292.

Paper III:

Anke, T.M.S., Slinning, K., Moe, V., Brunborg, C., Siqueland, T. S, & Skjelstad, D.V. (2020). Bipolar offspring and mothers: Interactional challenges at infant age 3 and 12 months - a developmental pathway to enhanced risk? *International Journal of Bipolar Disorders*. Manuscript submitted, under review.

Abbreviations

BD: Bipolar disorder

BD I: Bipolar I disorder

BD II: Bipolar II disorder

DSM-V: Diagnostic and Statistical Manual of Mental Disorders, 5th edition

EPDS: Edinburgh Postnatal Depression Scale

ICD-10: The International Classification of Diseases, 10th edition

IDS: Inventory of Depressive Symptomatology

MBU: Mother and Baby Unit

MMMR: Multimethod and mixed methods research

MP: Multiparous

PCERA: Parent-Child Early Relational Assessment

PP: Primiparous

RSA: Respiratory sinus arrhythmia

SMD: Severe mental disorder

YMRS: Young Mania Rating Scale

Definitions

Perinatal Refers to the time period closely before and after birth. In the medical literature, it is usually defined as starting in the 20th to 28th week of gestation and ending 1-4 weeks after birth. In the perinatal mental health literature, the entire pregnancy and the first 12 months after birth may be included in the perinatal period. This is the definition applied in the current thesis.

Postnatal Postnatal usually applies to the baby when referring to the time period after childbirth. Commonly defined as the first 6-8 weeks.

Postpartum Postpartum usually applies to the mother when referring to the time period after childbirth. In the perinatal mental health literature, the first 12 months after childbirth may be included in the postpartum period. This definition is applied in the current thesis.

Primiparous Bearing a child for the first time, experiencing the first childbirth.

Multiparous Bearing a child $\geq 2^{\text{nd}}$ time, experiencing $\geq 2^{\text{nd}}$ childbirths.

1. Background

1.1 General introduction

Becoming a mother is a major event in a woman's life. It is recognised as one of life's most central developmental transitions, especially for the primiparous (PP), placing significant adjustment demands on the woman (Cohen & Slade, 2000; Nelson, 2003; Raphael-Leff, 2010; Stern, 1995). Psychologically, the transition to motherhood implies reorganisations in the woman's representations of herself and her relationships with significant others. The development of a relationship and interaction with the infant is a core process (Brockington, 1996; Brockington, Aucamp, & Fraser, 2006; Cohen & Slade, 2000; Nelson, 2003; Raphael-Leff, 2010; Stern, 1995).

Currently, there is little evidence-based knowledge regarding the transition to motherhood and early mother-infant interactions in the context of enduring severe mental disorders (SMD) such as schizophrenia, recurring major depression and bipolar disorder (BD) (Dolman, Jones, & Howard, 2013; Mowbray, Oyserman, Zemencuk, & Ross, 1995). Conceivably, each of these disorders will cause the woman to face the dual demands of illness and motherhood. However, BD is recognised as a particularly high-risk condition in the perinatal period (Kendell, Chalmers, & Platz, 1987; Munk-Olsen et al., 2009; Munk-Olsen, Laursen, Pedersen, Mors, & Mortensen, 2006; Viguera et al., 2011). During the postpartum period, women with BD are far more likely to suffer from illness relapse than women with any other mental disorder, and childbirth is a powerful trigger of mania and psychosis (Jones, Chandra, Dazzan, & Howard, 2014; Kendell et al., 1987; Munk-Olsen et al., 2009; Munk-Olsen et al., 2006; Pope, Sharma, & Mazmanian, 2014; Wesseloo et al., 2016). In this vulnerable period, illness relapse may have adverse consequences for both the woman and her family.

In cases of mania or psychosis, the woman usually requires hospitalisation, which may cause mother-infant separation during a critical time for early bonding (Brockington, 1996; Raphael-Leff, 2010). Even less severe mood episodes may weaken the mother's capacity for adequate self-care and sensitive parenting of her newborn infant, in addition to affecting her subjective experience of being a mother (Cox & Barton, 2010; Mowbray et al., 1995). In addition, there is substantial evidence that maternal perinatal mental illness is associated with a broad range of negative child outcomes, particularly when the mother suffers severe or chronic illness (Seifer & Dickstein, 2000; Stein et al., 2014). Finally, the father faces a challenging phase if the mother suffers postpartum illness relapse. Expectations of shared happiness and joint parenthood may be replaced by confusion and crisis, and the father may

experience responsibility for both the mother and infant (Ballard, 2008; Davey, Dziurawiec, & O'Brien-Malone, 2006; Doucet, Letourneau, & Blackmore, 2012).

Despite the high risk status of BD, there is a scarcity of studies regarding the perinatal impact and management of BD (Jones et al., 2014; Pope et al., 2014; Sharma & Sharma, 2017; Yatham et al., 2018). Specifically, there is a significant knowledge gap on psychological matters concerning the transition to motherhood and mother-infant interaction. Most studies and guidelines concern the illness course and medication (Sharma & Sharma, 2017; Yatham et al., 2018). These are indeed important issues, but studies have reported an unmet need for a collaborative and psychologically oriented care based on the women's subjective experiences and expectations of becoming a mother when having BD or other SMD (Dolman et al., 2013; Howard & Hunt, 2008; Megnin-Viggars, Symington, Howard, & Pilling, 2015). The need for psychologically oriented care may also be justified from the perspective of the infant's needs. Bipolar offspring are a high-risk group for developing mental disorders (Rasic, Hajek, Alda, & Uher, 2013; Smoller & Finn, 2003). Current research and theoretical models emphasise that developmental outcomes result from additive and interactive effects of biological vulnerability and environmental influences (Chang, Steiner, & Ketter, 2003; McGowan & Kato, 2008; Willcutt & McQueen, 2010). Impaired parent-child interactions may pose an environmental risk that potentiates biological vulnerability (Greenberg, Rosenblum, McInnis, & Muzik, 2014). To date, the characteristics of early mother-infant interactions in the context of maternal BD have yielded little attention in research and the clinical literature.

The aim of the current thesis is to generate knowledge that may inform more comprehensive and psychologically oriented perinatal care for women with BD and their families. The focus of the thesis is the transition to motherhood, from a subjective and dyadic perspective, when a woman has BD. This thesis draws particular attention to the postpartum portion of the perinatal period and investigates how women with BD relate to their postpartum risk of becoming ill, as well as the characteristics of the mother-infant interactions in the first year. Although this thesis rests on both qualitative inductive and quantitative deductive research positions, a key hypothesis is that maternal BD in some ways influences the woman's perceptions of becoming a mother and her interactions with her infant. The main objective of the thesis is to investigate how.

1.1.1 Structure of the thesis

Chapter 1 gives an overview of the empirical and theoretical literature that provides the background and framework for the thesis. Since perinatal mental health and the transition to motherhood is a transgenerational domain in which maternal mental health meets infant development, I find it important to provide a comprehensive overview. I start with an outline of common psychological characteristics in the transition to motherhood. Then, I give a description of BD, followed by a presentation of BD in the perinatal period, which is divided into different relevant subjects. Thereafter, I briefly present the literature concerning infants of mothers with BD, i.e., bipolar offspring, before I end the overview with a summary of mother-infant interactions.

Chapter 2 presents the overarching Bi-sam study, “Mothers with bipolar disorder and their infants: pregnancy and early interaction”, which the current research is part of. The aims and research questions of the current thesis are described.

In chapter 3, I delineate qualitative and quantitative research paradigms and present ontological and epistemological reflections on the research project, followed by a justification of the choice of a mixed methods approach.

Chapter 4 describes the design and procedures, assessments and analyses conducted in the research. Ethical considerations are also included in this chapter.

In chapter 5 I give a synopsis of each of the three papers.

Chapter 6 comprises a discussion and elaboration of the main findings. Additionally, I discuss the quality and credibility criteria of the research, as applied to the mixed methods approach, in a relatively lengthy section on “methodological considerations” in this chapter. This chapter also contains clinical and further research implications.

In the final chapter, chapter 7, I draw conclusions for the current thesis.

1.2 Generic theories on the transition to motherhood

“It is important to regard pregnancy not only as a biological event, but also as an adaptive process.” (Cohen in Brockington, 1996, p.63)

Psychologically, the transition to motherhood is described as a reorganisation process that starts in pregnancy and continues through the first year postpartum (Cohen & Slade, 2000).

The process is anchored in a woman’s experience of choice in deciding whether to have a

child, either through a wanted pregnancy or through the choice of continuing an unplanned pregnancy (Cohen & Slade, 2000). Furthermore, the transition is conceptualised as a process that offers opportunities for psychological growth and transformation (Brockington, 1996; Cohen & Slade, 2000; Nelson, 2003; Raphael-Leff, 1991; Stern, 1995).

1.2.1 The motherhood constellation

Daniel Stern describes the transition to motherhood as psychologically so profound that most women pass into a unique mental organisation in which phase-specific and important concerns regarding self-as-mother and the infant are encountered and processed – the motherhood constellation. Stern situates his model within the Western social-cultural context and argues that the motherhood constellation contains four interrelated themes that most women experience and process in their transition to motherhood (Stern, 1995).

- The first theme is the life-growth theme, concerning whether the mother can maintain the life and healthy growth of her infant. Well-known fears related to stillbirth, malformations, cot death, feeding and protection issues are activated. Stern describes this as a powerful theme of which the mother's capacity to secure the viability of her child forms the core.
- The second theme, primary relatedness, concerns the mother-infant relationship and the psychological development of the infant. A central issue is whether the mother will be socio-emotionally "adequate" in her mothering. Will she develop love and engagement? Will she be able to read and respond appropriately to her infant's needs? Correspondingly, will the infant love her?
- The third theme, the supporting matrix, concerns the mother's ability to create and regulate a support network to help her fulfil the tasks within the first two themes.
- The fourth and last theme is identity reorganisation, which implies that the woman needs to transform and negotiate what is central in her identity: a daughter becoming a mother, a partner becoming a parent, a careerist becoming a caregiver. This process implies altering emotional, as well as behavioural, investments. Stern regards this process as new and profound mental work, especially for PP women, and as a necessity for mastering the tasks in the three aforementioned themes (Stern, 1995).

1.2.2 Transition to motherhood – five evidence-based themes

In a meta-synthesis of nine studies, it is emphasised that for psychological growth and transformation to evolve, the woman must actively engage and commit herself to becoming a mother (Nelson, 2003). The engagement is described as a primary process that, in turn,

enables a secondary process in which the woman is available for a more profound change than merely adding another role to her prior roles. Instead, the woman is prepared to leave some of her prior priorities and investments behind to grow into a new identity (Nelson, 2003).

The meta-synthesis presents five themes that a becoming mother must negotiate in her process of growth and transformation. To some degree, these themes converge with the four themes of Stern (Nelson, 2003; Stern, 1995).

- In addition to the decision to become a mother, a woman's commitment includes accepting and exhibiting the responsibilities of motherhood. For instance, the woman must take care of herself and the foetus/infant, make preparations for the arrival of the infant and experience the mother-infant bond (Nelson, 2003).
- There will be disruptions and changes in daily life to which the woman must adjust, especially postpartum, after the infant is born. These involve the practicalities of mothering (Nelson, 2003).
- Important relationships, particularly with the partner and family of origin, need to be renegotiated and adapted. The new context transforms the couple into a family and the daughter into a mother (Nelson, 2003) and changes the dynamics of the whole family network (Cohen & Slade, 2000).
- Furthermore, the woman has to search for a balance between motherhood and her work commitment and professional goals, which for many women means dealing with conflicts (Nelson, 2003).
- Perhaps most profoundly, and as elaborated by several authors, the woman's sense and representation of self is reworked as she is transformed into a mother (Cohen & Slade, 2000; Nelson, 2003; Raphael-Leff, 1991; Stern, 1995). The woman must face and evaluate herself and her past. An important task is to encounter the "ghosts of mothering received" (Nelson, 2003, p. 475). Consciously and unconsciously, the woman returns to her experiences with own mother. This process may be demanding and even painful, as conflicts and ambivalence are ingredients for most women. Possible experiences of trauma and loss complicate the matter further. Potentially, the reworking process offers an opportunity for relational difficulties to be resolved and reintegrated (Cohen & Slade, 2000; Nelson, 2003; Stern, 1995).

1.2.3 Different phases in transition and adaptation to motherhood

The negotiation and redefinition of the above themes is not a straightforward process. Complexity and contradictions are inherent in the reorganisation and adaptation process. This process is to be viewed more as a dynamic continuous process of contradictions-tensions-resolutions-new contradictions (Cohen & Slade, 2000; Nelson, 2003; Stern, 1995). Most women experience increased emotional lability, worries and ambivalence, especially PP women (Brockington, 1996; Cantwell, 2016).

The reorganisation work is viewed as particularly pronounced in the second trimester of the pregnancy (pregnancy weeks 13-28). This period is characterised by the woman's psychological orientation turning inwards. In the third trimester (pregnancy weeks 29-40), the inner work is complemented by practical preparations for the birth and the infant. In this period, relatively established internal representations of self as mother and of the infant can be perceived (Cohen & Slade, 2000; Raphael-Leff, 1991).

Postpartum, the adaptation process becomes transactional as the mother gradually gets to know her child. The mother's internal preparations meet reality, which brings a new dimension into her adaptive and transformative process. The aim is to "work it out", to become a particular mother to a particular child, recognising the infant as both separate and dependent (Cohen & Slade, 2000; Nelson, 2003; Stern, 1995).

1.2.4. Risk factors for adaptation to motherhood

There are risk factors that may cause difficulties in the transformative process to motherhood, for instance, a conflicted partner relationship, socioeconomic difficulties and lack of social support. A preoccupation with problems in these spheres may interfere with the woman's capacity to orient herself inwards and prepare appropriately.

Specifically, mental health problems and mental illness are regarded as significant risk factors, making the woman vulnerable in her psychological work during pregnancy. Any prior mental instability has the potential to overwhelm a reorganisation process that is, in itself, already destabilising and altering (Brockington, 1996; Cohen & Slade, 2000; Nelson, 2003; Stern, 1995).

Furthermore, complications postpartum, such as negative emotion or lack of emotion for the infant, difficult mother-infant interactions and difficulties in coping with mothering, may further challenge the experience of motherhood (Nelson, 2003).

Risk factors must be identified, understood and addressed to facilitate an adaptive transition to motherhood for vulnerable women (Brockington, 1996; Cohen & Slade, 2000; Nelson, 2003; Stern, 1995). A BD diagnosis causes vulnerability in the perinatal period. Thus, an important motivation for the current research was to explore how the dual demands inherent in having BD and becoming a mother might be experienced and negotiated by women with BD in their transition to motherhood.

1.3 Bipolar disorder – characteristics

BD refers to a group of affective disorders in which the individual experiences recurrent shifts between depressive, hypomanic, manic or mixed mood episodes and states, and periods of more or less normal functioning (APA, 2013; WHO, 1992). Concordant with the fluctuations in mood, there are alterations in energy, activity and cognition, including changes in productivity, sleep, sexual drive, psychomotoric tempo, sociability, patience, judgment, self-esteem and views on self and others. Whereas depression is associated with loss of pleasure and reduced energy, mania is characterised by elevated or irritable mood or both, increased energy and reduced need for sleep. In hypomania these symptoms are less severe and of shorter duration. Mixed mood episodes are characterised by the presence of both depressive and hypomanic or manic symptoms, or rapid shifts between the two polarities (Phillips & Kupfer, 2013).

BD I and II are the main subtypes of bipolar disorders (APA, 2013). BD I is defined by at least one episode of mania or a mixed mood episode (mania and depression) and, usually, at least one episode of depression. BD II is defined by at least one hypomanic episode and at least one episode of depression, but no manic episodes (APA, 2013).

Individuals may experience psychosis during a manic or severe major depression episode. Although hypomania is less severe than mania, BD II and BD I are regarded as equally disabling disorders. Individuals with BD II experience symptoms as least as much as individuals with BD I, and for those with BD II, these are predominantly of depressive character (Yatham et al., 2018).

Worldwide, the lifetime prevalence estimates are 0.6% for BD I, 0.4% for BD II, and 1.4% for subthreshold BD (Merikangas et al., 2011) but some epidemiologic studies report higher prevalences in western countries (Merikangas et al., 2007). Data indicate equal life-time rates for BD I among women and men, whereas BD II appears to show higher rates in women (Merikangas et al., 2007; Merikangas et al., 2011). Generally, women are found to have a more aggravated course of BD, largely due to the impact of reproductive events (DiFlorio &

Jones, 2010; Freeman et al., 2002; Özerdem & Akdeniz, 2014). Comorbidity is common, including anxiety disorders and substance use disorders (Merikangas et al., 2007; Merikangas et al., 2011).

Globally, BD is an important source of lost years of healthy life for women aged 15-44 years. BD is the 7th leading cause of disability in the ranking of all psychiatric and medical conditions for this age group of women (WHO, 2008). It is concerning that while BD has its' typical onset in late adolescence and young adulthood, there is usually a substantial delay between the onset of affective symptoms and an accurate diagnosis and treatment of BD. This discrepancy indicates that many women may experience unnecessary impairment in their reproductive years and when becoming mothers (Freeman et al., 2002; Hirschfeld, Lewis, & Vornik, 2003; Lish, Dime-Meenan, Whybrow, Price, & Hirschfeld, 1994).

Genetic factors are regarded as important in the aetiology of BD, with heritability being the best documented risk factor for the emergence of BD (McGuffin et al., 2003; Smoller & Finn, 2003; Tsuchiya, Byrne, & Mortensen, 2003). Heritability is estimated to explain 60 % to 85 % of the variance in risk of developing BD (Smoller & Finn, 2003). Nevertheless, BD is a heterogenic disorder in regard to both aetiology and clinical presentations (McGowan & Kato, 2008; Tsuchiya et al., 2003; Willcutt & McQueen, 2010).

1.4 Bipolar disorder and the perinatal period

1.4.1 Decision-making on becoming a mother

The decision-making on whether to become a mother may be challenging for women with BD. However, few studies have investigated this topic. In one study, 45 % of women reported that they had been advised not to become pregnant by health professionals and family members (Viguera, Cohen, Bouffard, Whitfield, & Baldessarini, 2002). After specialist pre-conception consultation, 63 % of the women attempted to conceive, whereas 37 % chose to avoid pregnancy (Viguera et al., 2002). Reported reasons to avoid pregnancy included fear of adverse effects on the foetus by medication or mood episodes in pregnancy, fear of illness relapses and concerns of genetic transmission of BD to child (Viguera et al., 2002).

Two recent studies have investigated BD women's thoughts on family planning (Dolman, Jones, & Howard, 2016; Stevens, Daggenvoorde, van der Klis, Kupka, & Goossens, 2017). These studies will be referred to later in the thesis in the discussion of our findings (i.e., chapter 6).

1.4.2 Pregnancy – illness relapse

It is a clinical observation that some women with BD experience increased wellbeing and mood stability in pregnancy. However, the question of whether pregnancy in itself exerts a positive and protective effect on the course of BD is currently unanswered. Findings are inconclusive because of limited data and conflicting results (Jones et al., 2014; Sharma & Pope, 2012; Özerdem & Akdeniz, 2014). There are very few prospective clinic-based studies (Driscoll et al., 2017; Newport et al., 2008; Viguera et al., 2007) and some retrospective (Akdeniz et al., 2003; Blehar, DePaulo Jr, Gershon, & Reich, 1998; Di Florio et al., 2013; Freeman et al., 2002; Grof et al., 2000; Viguera et al., 2000; Viguera et al., 2011).

Moreover, there are large variations in relapse rates in pregnancy across studies. Two recent systematic reviews report a relapse range between 4 % - 73 %, and an average risk of 19 % (Stevens et al., 2019) and 24 % (Salim, Sharma, & Anderson, 2018), respectively. Adding to the overall inconclusiveness, population-based studies suggest a somewhat positive effect of pregnancy on illness episodes (Kendell et al., 1987; Munk-Olsen et al., 2009; Munk-Olsen et al., 2006).

Methodological issues, including varying definitions of relapses, potential confounders such as parity and comorbidity, difficulties in differentiating the effects of medication from the effects of pregnancy, and heterogeneity between samples, may account for some of the variations in the literature. In particular, the shortage of prospective studies on unmedicated women limits the ability to assess the sole impact of pregnancy on the natural course of BD (Sharma & Pope, 2012).

When mood episodes occur in pregnancy, they are more likely to be of depressive or mixed character, than hypomanic or manic (Driscoll et al., 2017; Newport et al., 2008; Viguera et al., 2000; Viguera et al., 2011; Viguera et al., 2007). Psychotic relapses also occur in pregnancy (Brockington, 1996; Viguera et al., 2011), but little research based data exist on the specific nature of these in women with BD (Jones et al., 2014).

1.4.2.1 Risk factors for illness relapse in pregnancy

There is a paucity of data on risk factors for illness relapse in pregnancy. Among different factors associated with an increased rate and duration of relapse, the following have yielded the strongest support: discontinuation of BD medication (Bergink et al., 2012; Newport et al., 2008; Viguera et al., 2000; Viguera et al., 2007), particularly rapid discontinuation (Viguera et al., 2000; Viguera et al., 2007), younger age at illness onset (Akdeniz et al., 2003; Viguera et

al., 2011; Viguera et al., 2007) and a BD II diagnosis (Di Florio et al., 2013; Viguera et al., 2007).

1.4.3 Pregnancy and birth outcomes

Population-based studies suggest that there is a higher risk for adverse pregnancy outcomes among women with BD compared to women without BD. The higher risk includes preterm birth (Bodén et al., 2012; Lee & Lin, 2010; Mei-Dan, Ray, & Vigod, 2015) and induction of labour and caesarean delivery (Bodén et al., 2012). Additionally, women with BD are more likely to have obstetric complications as antepartum haemorrhage, placental abnormalities (Jablensky, Morgan, Zubrick, Bower, & Yellachich, 2005) and gestational hypertension (Lee & Lin, 2010).

As a group, infants of mothers with BD have been linked to a heightened risk for negative birth outcomes, such as low birth weight (<2500 g) (Lee & Lin, 2010) and small for gestational age (SGA <2nd-3rd percentile) (Rusner, Berg, & Begley, 2016) but also large for gestational age (LGA >97th percentile) (Mei-Dan et al., 2015). An increased rate of neonatal readmissions and morbidity has been demonstrated (Mei-Dan et al., 2015). There is an elevated risk for congenital malformations in infants of BD women on medication (Bodén et al., 2012; Mei-Dan et al., 2015).

Notably, it cannot be ruled out that factors more prevalent among women with SMD, such as, for instance, smoking, overweight, poor nutrition and substance abuse, may explain some of the reported increased risk of adverse pregnancy and birth outcomes for the women and their newborns. The inclusion of possible confounders in analyses varied in the referred studies. Furthermore, the reason for the increased risk is likely multifactorial, plausible hypotheses for which include maternal psychophysiological changes related to mood episodes in pregnancy, consequences of BD medication, and a possibility of shared genetic susceptibility to adverse pregnancy outcomes and SMD (Mei-Dan et al., 2015).

1.4.4 Postpartum – illness relapse

In contrast to the inconclusiveness on how pregnancy may impact the course of BD, there is substantial evidence that childbirth and the postpartum period entail a high risk for illness relapse (Jones et al., 2014; Wesseloo et al., 2016). Currently, there is no consensus on what time frame to use when labelling illness relapses as occurring in relation to childbirth.

Episodes with onset within four weeks after childbirth can be recorded with a peripartum-onset specifier in DSM-5. In ICD-10, there is a category of mental and behavioural disorders associated with the puerperium, not elsewhere classified, for episodes with an onset within six

weeks after childbirth. However, four and six weeks may be overly narrow time frames for postpartum depressive episodes since these have a wider time distribution for both women with BD I and BD II. Thus, illness relapses occurring within six or even 12 months after childbirth are commonly considered as postpartum relapses (Di Florio et al., 2013).

A recent meta-analysis of 25 studies (5105 deliveries, 3495 patients) found an overall relapse risk of 37 % within the first year postpartum and most relapses occurred within six months. The overall relapse rate for severe episodes (i.e., psychosis, mania, mixed episode and/or psychiatric hospitalisation) was 17 %. Relapse was less common among women on prophylactic medication during pregnancy (23 % vs. 66 %) and among women on medication in the postpartum period (29% vs. 65%). No significant differences were found in relapse rates between women with BD I or BD II. Furthermore, the meta-analysis revealed that most postpartum episodes were depressive (Wesseloo et al., 2016).

Why childbirth is a strong trigger for mood episodes in BD is not completely understood, but puerperal hormone changes, immunological and genetic factors may activate illness pathways (Bergink et al., 2013; Jones et al., 2014; Jones et al., 2007; Pope et al., 2014). As a consequence of the high relapse occurrence, women with BD are more likely to experience postpartum psychiatric hospitalisation compared with women with any other mental disorder (Kendell et al., 1987; Munk-Olsen et al., 2009; Wesseloo et al., 2016).

1.4.4.1 Postpartum psychosis

Hospitalisations are primarily due to episodes of postpartum psychosis. It is the most severe and dramatic psychiatric condition following childbirth and requires immediate mental health care and prompt medication (Bergink et al., 2012). BD is established as the strongest predictor for susceptibility to postpartum psychosis, alongside with having had previous postpartum psychosis (Chaudron & Pies, 2003; Jones et al., 2014; Munk-Olsen et al., 2009). While 1-2 per 1000 births in the general population are estimated to result in postpartum psychosis, data suggest that the estimate is one in five births among women with BD (Di Florio et al., 2013; Jones et al., 2014; Munk-Olsen et al., 2009). In addition, if the BD woman has a family history of postpartum psychosis or has had previous experiences with it, then the risk is estimated to be as high as one in two births being affected (Jones & Craddock, 2001; Munk-Olsen, Laursen, Pedersen, Mors, & Mortensen, 2007; Robertson, Jones, Haque, Holder, & Craddock, 2005).

Postpartum psychosis can take the form of mania, severe depression or mixed episode, with core psychotic features such as delusions, hallucinations, disorganised behaviour and confusion. In the majority of cases, the psychosis begins within two to four weeks after childbirth, often with a sudden onset and rapid deterioration (Bergink et al., 2012; Jones et al., 2014; Sit, Rothschild, & Wisner, 2006). Studies have even reported beginning symptom onset within the first three days postpartum for more than 50 % of women (Heron, Blackmore, McGuinness, Craddock, & Jones, 2007; Heron et al., 2008).

Qualitative studies describe how the experience of postpartum psychosis is deeply distressing for women. In particular, fear and a feeling of incompatibility between the severity of the illness episode and new motherhood is predominant (Edwards & Timmons, 2005; Glover, Jomeen, Urquhart, & Martin, 2014; Robertson & Lyons, 2003).

Attention to postpartum psychosis is important with regard to maternal suicide (Khalifeh, Hunt, Appleby, & Howard, 2016; Oates, 2003a, 2003b). While suicide in the perinatal period has an estimated rate of 1-5 deaths per 100 000 livebirths in high-income countries (Khalifeh et al., 2016), the estimated rate is 2 deaths per 1000 sufferers of postpartum psychosis (Oates, 2003a, 2003b). The same careful attention is necessary for the infant's safety, as postpartum psychotic delusions and hallucinations may involve the infant (Friedman & Sorrentino, 2012; Porter & Gavin, 2010).

1.4.4.2 Risk factors for postpartum illness relapse

The current literature points to several factors that may increase the risk for postpartum illness relapse among women with BD. Some factors have demonstrated particular association with postpartum psychosis, whereas others appear to be risk factors across severity of illness relapse.

Primiparity has been found to have a strong association with postpartum psychosis (Blackmore et al., 2006; Florio et al., 2014; Kendell et al., 1987; Munk-Olsen, Jones, & Laursen, 2014). There is some evidence pointing to this association being especially linked to BD I (Florio et al., 2014). There may also be genetic factors in familial forms of BD that make some women especially susceptible to postpartum psychosis (Jones et al., 2014).

General risk factors for postpartum illness relapse include no medication or changes in medication (Bergink et al., 2012; Maina, Rosso, Aguglia, & Bogetto, 2014; Viguera et al., 2000; Wesseloo et al., 2016), obstetric complications (Akdeniz et al., 2003; Blackmore et al., 2006; Hellerstedt et al., 2013), mood episodes in current pregnancy or previous postpartum

periods (Akdeniz et al., 2003; Bergink et al., 2012; Doyle et al., 2012; Freeman et al., 2002; Maina et al., 2014; Viguera et al., 2011), young age at illness onset or delivery (Akdeniz et al., 2003; Doyle et al., 2012; Viguera et al., 2011), high lifetime relapse rate (Viguera et al., 2011), unplanned pregnancy and family history of BD (Doyle et al., 2012).

Current evidence does not support negative life events (in the perinatal period or in childhood) as predictors for postpartum psychosis (Brockington, Martin, Brown, Goldberg, & Margison, 1990; Dowlatshahi & Paykel, 1990; Perry et al., 2016). Several studies show the importance of negative psychological and social factors for perinatal unipolar depression (Howard, Molyneaux, et al., 2014). The interaction of psychological and biological factors in illness pathways to BD postpartum depression is not known.

When the current research was planned, there were no studies that had investigated how women with BD perceive and relate to the increased risk of illness relapse postpartum.

1.4.5 Perinatal management of bipolar disorder

Perinatal management of BD is regarded as complicated and challenging (Jones et al., 2014; Sharma & Sharma, 2017). The main complication, particularly in pregnancy, is to avoid risk of illness relapse in the woman while avoiding risk of foetal exposure to teratogenic medication. There are collaborative and consensus-based guidelines and recommendations for perinatal medical management (Yatham et al., 2018).

It is beyond the scope of the thesis to describe medication of BD in the perinatal period.

Nonetheless, it may be mentioned that medication usually includes lithium, mood-stabilising anti-epileptics, antipsychotics and anti-depressants, in mono- or polytherapy (Driscoll et al., 2017; Jones et al., 2014; Viguera et al., 2007; Yatham et al., 2018). Electroconvulsive therapy may also be a treatment option in episodes of severe mood disorder, although it is not common in pregnancy (Jones et al., 2014).

In addition, perinatal women with BD are advised to obtain adequate sleep (Meltzer-Brody & Jones, 2015; Pope et al., 2014; Özerdem & Akdeniz, 2014). These women may be particularly susceptible to the effects of altered and poor sleep, and sleep loss may both serve as a marker of impending mood episode and play a triggering role in illness relapse (Bilszta, Meyer, & Buist, 2010; Lewis et al., 2018; Ross, Murray, & Steiner, 2005; Sharma & Mazmanian, 2003; Sharma, Smith, & Khan, 2004; Wehr, Sack, & Rosenthal, 1987).

1.5 Bipolar offspring – infants of mothers with bipolar disorder

1.5.1 Bipolar offspring – risk of developing mental disorder

Children of parents with BD, i.e., bipolar offspring, are at increased risk of developing mental disorders. Estimates indicate a specific risk of between 6 to 9 % of developing BD (Rasic et al., 2013; Smoller & Finn, 2003) and a broader risk of 60 % for any mental disorder when one of the parents has BD (Rasic et al., 2013). Correspondingly, literature on psychosocial functioning (Bella et al., 2011; Chang et al., 2003; Radke-Yarrow, Nottelmann, Martinez, Fox, & Belmont, 1992) and psychopathology (Chang et al., 2003; Duffy, Alda, Crawford, Milin, & Grof, 2007; Ellersgaard et al., 2018; Hafeman et al., 2016; Hammen, Burge, Hamilton, & Adrian, 1990; Hirschfeld et al., 2003; Mesman et al., 2016; Van Meter et al., 2016) documents elevated levels of disturbances among bipolar offspring in the age range from preschool to young adulthood, although there are also contrasting findings of no differences in psychosocial functioning between bipolar offspring and children of healthy women (Anderson & Hammen, 1993). Given the focus of the thesis on the perinatal period, I will not elaborate this literature here, although it may serve as a background for the studies referred to below on bipolar offspring as infants and young toddlers.

1.5.2 Biomedical and psychophysiological vulnerability in infants

In the section on pregnancy outcomes (1.4.3), it was described that infants of mothers with BD have been linked to an increased risk for negative birth outcomes (Bodén et al., 2012; Lee & Lin, 2010; Mei-Dan, Ray, & Vigod, 2015; Rusner, Berg, & Begley, 2016), which may result in a vulnerable biomedical status of the newborn infant.

Preliminary findings suggest that infants of mothers with BD have disruptions in their physiological stress responsivity and regulation (Johnson, Brennan, Stowe, Leibenluft, & Newport, 2014). In measurements of infant respiratory sinus arrhythmia (RSA), six-month-old infants of mothers with BD were found to deviate in their psychophysiological regulation compared to infants of mothers with recurring major depression or no mental health problems. The deviations were not associated with infant behaviour, birth outcome, maternal prenatal or concurrent symptoms, or infant exposure to stressful life events. The baseline RSA was normal, whereas RSA reactivity in response to stressors was abnormal, corresponding with findings on RSA patterns in adults with BD. The authors propose that disruptions in infant RSA reactivity may reflect endophenotypic markers of dysregulation (Johnson et al., 2014).

1.5.3 Cognitive development

To date, no deficits in cognitive performances have been found among infants of mothers with BD (Santucci et al., 2017; Zahn-Waxler, Chapman, & Cummings, 1984). When comparing the effect of prenatal exposure to maternal BD either with or without medication, no effect was found on overall psychomotor, mental or behavioural development as measured by the Bayley Scales of Development at 12, 26 and 52 weeks of age (Santucci et al., 2017), nor were there any associations between infants' results on these outcome scales and maternal postpartum depressive or hypomanic/manic symptomatology. However, there was a significant effect of prenatal exposure to maternal BD with medication on the quality of infant motor skills at 52 weeks, although the majority of infants were within normal range (Santucci et al., 2017).

1.5.4 Affect regulation, social and attachment behaviour

Two small longitudinal studies observed developmental disturbances in affect regulation, social behaviour and attachment patterns among bipolar offspring in their second and third years (Gaensbauer, Harmon, Cytryn, & McKnew, 1984; Zahn-Waxler et al., 1984). Since the bipolar offspring sample was very small in the studies (N=7), the findings must be interpreted with caution. However, correspondingly, other studies have demonstrated that bipolar offspring are more likely to have insecure attachment patterns to their mothers in infancy and toddlerhood than offspring of well and unipolar depressed mothers (DeMulder & Radke-Yarrow, 1991; Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985).

1.6 Mother-infant interaction

1.6.1 The importance and impact of mother-infant interactions

The development of a relationship and interaction with the infant is a core process in the transition to motherhood. On the one hand, well-functioning interactions reinforce the mother's sense of competence and maternal identity (Raphael-Leff, 2010; Stern, 1995; Weatherston et al., 2010). On the other hand, the infant's development occurs within the mother¹-infant dyad (Weatherston et al., 2010). Furthermore, it is suggested that the quality of mother-infant interactions is an important environmental mediator between maternal perinatal mental illness and infant development (Harder et al., 2015; Stein et al., 2014). Numerous studies demonstrate the profound impact that mother-infant interactions have on the infant's neurobehavioural and social-emotional development (Champagne & Curley,

¹ Since this thesis is on motherhood and mothers with BD, I use the word "mother" instead of the inclusive terms "parent" or "care-giver".

2005; Feldman, 2007b; Fox, Levitt, & Nelson, 2010; Nelson & Bosquet, 2000; Tronick, 2007). From a developmental psychopathological perspective on BD, mother-infant interactions may thus be viewed as early environmental factors interacting with the infant's biological vulnerability, potentially enhancing or reducing developmental risk (Bronfenbrenner & Ceci, 1994; Cicchetti, 2010; Masten, 2006; Willcutt & McQueen, 2010).

1.6.2 Definition and characteristics of mother-infant interactions

Within a dyadic system approach, interaction is defined as a dynamic and transactional process consisting of three domains: 1) maternal behaviour, 2) infant behaviour, and 3) dyadic coordination (Beebe et al., 2010; Sameroff, 2010; Tronick, 2007). Attentiveness, sensitivity to infant cues and contingent responsiveness are underscored as crucial maternal components (Ainsworth, Blehar, Waters, & Wall, 1978; Bigelow et al., 2010; Tronick, 2007). Infants' contributions include their early capacities of attention, signalling their needs and giving social cues, their self-regulatory capacities, and their responses to maternal initiatives (Beebe et al., 2010; Crockenberg & Leerkes, 2000; Papousek, 2011; Tronick, 2007; Weatherston et al., 2010). The third domain, dyadic coordination, concerns whether the interactional behaviours of mother and infant are mutual and synchronised. Based on empirical findings, dyadic coordination is considered particularly indicative for child development (Beebe et al., 2010; Evans & Porter, 2009; Feldman, 2007b; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001; Tronick, 2007).

Importantly, the transactionality of this relationship does not assume symmetry. Although both partners contribute to the interactional exchanges, the mother has greater range, control and flexibility in the interactions than the infant (Beebe et al., 2010).

In many dyads, the dynamic process of a sufficiently good interaction works intuitively, supported by the mother's implicit ability to be sensitive and responsive to infant cues (Papoušek & Papoušek, 2002; Papousek, 2011). However, studies have demonstrated difficulties in mother-infant interactions related to maternal mental disorders such as depression, schizophrenia and borderline personality disorder (see for example Crandell, Patrick & Hobson; 2003; Field, 2010; Hobson et al., 2009; Stein et al., 2014; Tronick & Reck, 2009; Wan et al., 2007; Wan, Warren, Salmon & Abel, 2008).

1.6.3 Studies on mother-infant interactions in the context of maternal bipolar disorder

There is little research on mother-infant interactions in the context of maternal BD.

One study investigated maternal interaction behaviour among mothers with BD who were admitted to a Mother and Baby Unit (MBU) within 1-36 weeks postpartum (Hipwell & Kumar, 1996). MBUs are specialised perinatal psychiatric units where women with mental illness episodes receive mental health care and support in their relationship with their infant. Mothers with BD and schizophrenia were found to deviate more from the normal range in their interaction behaviour than mothers with unipolar depression (Hipwell & Kumar, 1996). Subsequent to the MBU study (Hipwell & Kumar, 1996), ten mothers with BD and nine with unipolar depression were reassessed at 12 months postpartum (Hipwell, Goossens, Melhuish, & Kumar, 2000). All had recovered from their prior postpartum episodes, but the mothers with BD and unipolar depression were evaluated as less sensitive and appropriate in their behaviour, displaying more negative affect than healthy controls (Hipwell et al., 2000). When maternal sensitivity and mother-infant reciprocity at 12 months postpartum was compared among three groups of mothers (bipolar depression, unipolar depression and non-depression), mothers with bipolar depression obtained poorer scores than the other two groups, although the differences were not significant (Logsdon et al., 2015).

Moreover, the above-mentioned studies on attachment patterns among bipolar offspring (in Section 1.5.4) (DeMulder & Radke-Yarrow, 1991; Gaensbauer et al., 1984; Radke-Yarrow et al., 1985) indicate that there have been ongoing deviations in mother-infant interactions since infant attachment behaviours are associated with quality in preceding mother-infant interactions (Weinfield, Sroufe, Egeland, & Carlson, 2008). Difficulties in dyadic cooperation and conflict resolution have also been demonstrated in mother-infant interactions (ages 15 – 51 months) (Kochanska, Kuczynski, Radke-Yarrow, & Welsh, 1987).

When the current research was planned, there were no studies that had simultaneously examined all three interaction domains, 1) maternal behaviour, 2) infant behaviour, and 3) dyadic coordination, and in particular, no studies had examined the longitudinal development of the three interactional domains in the first year postpartum when the mother has BD.

Further, little was known about how variations in maternal postpartum symptom load may affect interaction, apart from one study where illness relapse requiring hospitalisation was associated with clear deviations in maternal behaviour (Hipwell & Kumar, 1996). Potentially, BD symptoms with marked alterations in affect, energy, activity and cognition may impact maternal interaction behaviours.

2. The Bi-sam Study: Aims and research questions

The current thesis is part of the overarching Bi-sam study, “Mothers with bipolar disorder and their infants: pregnancy and early interaction”. That study is a prospective investigation of early family life in the context of maternal BD. The overall aim of the Bi-sam study is to generate knowledge that may inform more comprehensive and psychologically oriented perinatal care for women with BD and their families. Participants in the Bi-sam study were women with a clinically established BD diagnosis (BD I or II), their infant and cohabitating partner (i.e., infant’s father). The families were followed up from pregnancy/newborn period (i.e., maximum three months postpartum) to 12 months postpartum, with several assessments involving the women, infants and fathers.

2.1 Aims of the thesis

The overall aim of the current thesis corresponds with the aim of the Bi-sam study: to generate knowledge that may inform more comprehensive and psychologically oriented perinatal care for women with BD and their families.

The main objective was to investigate the transition to motherhood, from a subjective and dyadic perspective, for women with BD.

The more specific research questions investigated were:

2.1.1 Paper I:

Main question:

1. How do women with BD relate to the increased risk of illness relapse postpartum?

Subquestions:

- 1.1 How do the women perceive the risk?
- 1.2 What are the women’s concerns regarding the possible impact of their BD for mothering and their families?
- 1.3 What resources do they make use of in preparing for the dual demands of illness and motherhood?

2.1.2 Paper II:

Main question:

2. What characterises mother-infant interactions at three months postpartum in dyads in which the mothers have BD compared to dyads in which the mothers have no mental disorder?

Subquestions:

- 2.1 Are there any group differences in the three interactional domains: maternal behaviour, infant behaviour and dyadic coordination?
- 2.2 Is maternal concurrent symptom load associated with interaction quality in the dyads in which the mothers have BD?

2.1.3 Paper III:

Main question:

3. What characterises developmental trajectories of mother-infant interactions in the first year when the mothers have BD?

Subquestions:

- 3.1 Are there any group differences in the three interactional domains (maternal behaviour, infant behaviour and dyadic coordination) at infant age 12 months in dyads in which the mothers have BD compared to dyads in which the mothers have no mental disorder?
- 3.2 What are the patterns of change in the three interactional domains (maternal behaviour, infant behaviour and dyadic coordination) within and between the groups from infant ages 3 to 12 months?

3. Position within the philosophy of science paradigms.

To answer the above research questions, we employed both qualitative and quantitative methodologies. These originate from different positions within the philosophy of science paradigms. Therefore, I find it suitable to reflect on the ontological and epistemological perspectives of the current research project, followed by a discussion and justification of the choice of a mixed methods approach. However, I begin with a short outline of research paradigms.

3.1 Research paradigms

“All research is rooted in a point of view, and being conscious of this focus is critical to understanding how to use any research methods tools (...)” (Hesse-Biber & Johnson, 2015, p. xiii).

In philosophy of science terms, the “point of view” is conceptualised as a research paradigm, i.e., “(...) a set of beliefs, values, and assumptions that a community of researchers has in common regarding the nature and conduct of research. The beliefs include, but are not limited to, ontological beliefs, epistemological beliefs, axiological beliefs, aesthetic beliefs, and methodological beliefs. (...) a research paradigm refers to a research culture” (Johnson & Onwuegbuzie, 2004, p. 24). Furthermore, these beliefs are “ (...) basic in the sense that they must be accepted simply on the faith (however well argued); there is no way to establish their ultimate truthfulness” (Guba & Lincoln, 1994, p.107).

Historically, the major research paradigms or positions have been represented by quantitative-based paradigms (logical positivism, post-positivism) and qualitative-based paradigms (constructivism, critical theory, participatory) (Johnson & Onwuegbuzie, 2004; Onwuegbuzie, Johnson, & Collins, 2009). These positions have different paradigmatic assumptions and beliefs and have mainly been regarded as incompatible by their advocates (Guba & Lincoln, 1994; Schrag, 1992). In psychological research, post-positivism and constructivism are considered as the most common paradigmatic positions.

Post-positivism is a modification of the logical positivist paradigm. Both paradigms are joined in the belief in an independent materialistic reality that can be studied and measured, where social science inquiry should be objective. Post-positivism, however, recognises observations as theory-laden and fallible and regards people as always partially biased in their *objective* perceptions of reality. According to post-positivism, we can only approximate the truth of reality; we can never explain it perfectly or completely. Originating from the natural sciences,

this perspective emphasises the hypothetic-deductive model of logic, implementing statistical analysis to identify potential relationships between independent and dependent variables. Post-positivism aims to generalise findings (nomothetic perspective) with a goal of prediction and explanation (Bisman, 2010; Collins, 2015; Onwuegbuzie et al., 2009).

The constructivist paradigm includes the belief that multiple, contradictory – but equally valid – accounts of the same phenomenon representing multiple realities can exist. According to constructivism, social reality and knowledge of the world is subjective and constructed within a context. Constructivism has an aim of specifying phenomena (idiographic perspective) with a goal of understanding insiders' views, meanings and perspectives, thus implementing an interpretive, intersubjective and naturalistic research approach. This paradigm uses inductive research logic for exploration and generation of hypotheses and theory (Bisman, 2010; Hesse-Biber, Rodriguez, & Frost, 2015; Johnson & Onwuegbuzie, 2004; Onwuegbuzie et al., 2009).

3.2 Ontological and epistemological reflections on the current research project

A useful starting point in examining research philosophy and paradigms is the consideration of the particular research questions (Bisman, 2010).

3.2.1 Paper I

The research questions in Paper I focus on the maternal subjective perspectives: how the women relate to and perceive the risk of illness relapse postpartum, including their concerns and preparations.

Ontologically, i.e., “What is the nature of reality?” (Hesse-Biber et al., 2015), these research questions refer to an experiential reality in the minds of the women. Hence, it is not an external singular entity that we can objectively verify and measure, consistent with a post-positivist paradigm. Furthermore, the experiential reality of each woman may be influenced by immeasurable factors (Smedslund & Ross, 2014). Consequently, multiple, perhaps even contradictory, but equally valid realities of women's subjective perceptions, concerns and preparations are expected to exist. Given the women's shared contexts of having BD and becoming mothers, I anticipated some commonalities in this “reality”, even though I do not believe in a “single absolute truth” about this reality. These recognitions point to a relativistic position, in concordance with a constructivist paradigm.

Epistemological issues concern questions such as “What can we know about reality?”, “How is knowledge acquired?” and “Who can know?” (Hesse-Biber et al., 2015).

Since the phenomena of the women's perceptions, concerns and preparations do not constitute worldly objects, there are essential boundaries with regard to "knowing" these realities. The women are the "knowers" of their respective subjective reality, whereas I (as a researcher) can only know that reality imperfectly and indirectly by means of some kind of representation. For instance, I may acquire knowledge about this reality as conveyed by language. Since there is little research-based knowledge on BD women's perceptions, concerns and preparations for the transition to motherhood, we wanted to conduct an exploratory investigation of the subject matter. For this purpose, interviews are a better method to use than questionnaires. Knowledge from the women's answers on a questionnaire would be more restricted and influenced by the presuppositions underlying the questionnaire, thereby counteracting inductive research logic. The knowledge that results from an interview, in an intersubjective researcher-participant dialogue, has the potential to be more detailed and rich and, therefore, better represent multiple subjectivities (Brinkmann & Kvale, 2015). We searched for case-specific and unique phenomena (ideographic perspective), as well as patterns across cases, that correspond with a constructivist paradigm. The goal was to describe and understand the various, and perhaps even some common, ways in which the transition to motherhood is perceived in the context of BD, consistent with the ontological assumptions above.

3.2.2 Papers II and III

The research questions in Papers II and III focus on the dyadic mother-infant interactions and concurrent maternal symptom load.

The behaviours that mothers and infants display in their dyadic interactions can be materially observed and verified. These behaviours can thus be considered as "concrete objects in the world", ontologically in line with a post-positivist paradigm. In the current research, we chose to delimit the investigations of mother-infant interactions to this verifiable, objective aspect – the behaviours – excluding possible meanings and motives underlying and guiding the actual behaviours. However, I do not believe that the verifiable objective aspect covers the full "truth" of what the reality of mother-infant interaction "is".

In essence, in Papers II and III, we searched for the following knowledge: Are there characteristic behavioural patterns in the early interactions between mothers with BD and their infants? Do these dyads differ in interactions compared to those between healthy mothers and their infants? In Paper II, we also included a question asking whether interactions

in the dyads in which the mothers have BD are influenced by concurrent maternal symptom load. Thus, we wanted to investigate a possible association between an independent variable (primary: mother's condition, BD or not BD; secondary: concurrent maternal BD symptom load) and a dependent variable (interaction behaviours). These aims move towards a position of attempting to find something general about interaction behaviours when mothers have BD (nomothetic perspective), in agreement with a post-positivist paradigm.

From a post-positivist paradigm follows an objective epistemology. Coherent with this epistemology, a standardised measure was chosen to acquire knowledge about interaction behaviours in Papers II and III. In the measure, various aspects of mother-infant interactions are differentiated in behavioural, affective and communicative variables that are operationalised and rated numerically (based on observed frequency, duration and intensity), with an attempt to produce "objective" knowledge about interaction characteristics.

Nevertheless, despite the attempt to exercise an objective epistemology, there are particular boundaries and biases in the interaction observations that yield consequences for the knowledge produced. I allow myself some reflections on this matter.

For instance, most standardised measures use interaction observations of 3-10 minutes in length (Lotzin et al., 2015), based on the assumption that the behaviours observed bear a relationship to the participants' natural and general behaviours in everyday settings (Gardner, 2000). However, there is a paucity of research on the extent to which observational findings reflect natural behaviours and can be generalised across settings. Current knowledge indicates that the consistency and generalisability of interaction behaviours is better within a setting across time than across settings. Notably, the younger the child is, the less reactivity is found to observation and setting, indicating that their observed behaviours reflect typical behaviours more validly than for older children and adults (Gardner, 2000).

In the measures, the compilation of behavioural variables and the instructions for their rating are typically based on an integration of theory and developmental studies (Lotzin et al., 2015). Rating norms and classifications guiding interpretations and inferences of the interactions are based on the same premises. This approach creates the possibility of theory-laden and potentially fallible knowledge.

Furthermore, by means of the ratings, interaction behaviours are transformed into numerical values to make statistical analyses possible. Valsiner (2012) challenges the axiom of the quantifiability of psychological phenomena. Such quantification creates distance between the data and the original phenomena, especially in the assumption of the formal summativity of variables (Valsiner, 2012). I follow Valsiner in his discussion and observe the ontological and

epistemological dilemma in our investigation, built on the assumption that “the “score” of summed up artifactual assigned numbers” (Valsiner, 2012, p. 17), do represent the actual quality (the “truth”) of the behaviours and interaction characteristics in a valid and reliable way.

In principal, these boundaries and biases urge us to be cognisant of the approximate nature of truth regarding the mother-infant interaction reality about which we seek knowledge. Despite this limitation, however, it would make little sense to conduct interaction observations if the behaviours observed in the observation setting had little relation to natural behaviours.

Longitudinal studies have demonstrated that people demonstrate rather stable tendencies in their interaction behaviours (Gardner, 2000). Moreover, there is substantial evidence for the validity of interaction observations in discriminating between different groups and in predicting outcomes (Gardner, 2000). Therefore, I argue that even if our interaction observations provide a limited window into the reality of mother-infant interactions, the observations still offer important and valid knowledge about this reality.

As mentioned above, in Paper II, we also included a question on whether interactions in the dyads in which the mothers have BD are influenced by concurrent maternal symptom load. I believe that the BD symptoms the women experience are worldly “objects” at their core, though imperfectly perceived. Some of the symptoms are more internally and subjectively apprehended, while others can be objectively and behaviourally observed. To acquire knowledge on symptoms, standardised questionnaires were used in which symptoms are differentiated in variables and rated numerically. Again, this approach is an attempt to produce “objective” knowledge about the “reality” of symptoms while recognising the corresponding biases and limitations discussed above when transforming psychological phenomena into numerical values (Valsiner, 2012).

My reflections demonstrate that the current research project diverges regarding its ontological and epistemological positions. This project does not neatly fit within either a qualitative-based paradigm (constructivism) or a quantitative-based paradigm (post-positivism). On the one hand, the incompatibility axiom poses a challenge: How can researchers mix methods when the paradigms on which they are based have vastly different ontological, epistemological and methodological assumptions (Doyle, Brady, & Byrne, 2016)? On the other hand, it is a fundamental principle of “good” research that the methods chosen in a study should be driven by, and appropriate to, the research questions posed (Bisman, 2010). Therefore, a significant question in the planning of the research was: Where does the research fit within the

paradigmatic positions? How can agreement and integration be attained when there are differing paradigms?

3.3 The choice of a mixed methods approach

In the last decades, a philosophical framework and research paradigm – multimethod and mixed methods research (MMMR) – has developed as a complement to traditional qualitative and quantitative positions (Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2010). This conceptualisation is described as the “third wave”, philosophically, a research movement that offers a logical and practical alternative to the paradigm wars (Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007; Tashakkori & Teddlie, 2010). Advocates of mixed methods research reject a position of dogmatism towards the paradigms that insists on their incompatibility, and strive for a more pluralistic and eclectic position (Hesse-Biber & Johnson, 2015). Such researchers prefer more moderate and common-sense versions of philosophical dualism and argue that both qualitative and quantitative methodology and research offer advantages and disadvantages (Johnson & Onwuegbuzie, 2004). Different methodologies offer different tools for answering different questions. Hence, MMMR may be defined as “(...) the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study or set of related studies” (Johnson et al., 2007, p.120).

The mixed methods philosophical framework acknowledges the existence and importance of the physical and objective world, as well as the emergent social and psychological world (Johnson & Onwuegbuzie, 2004). The researcher attempts to maintain subjectivity in his/her own reflections on research and objectivity in data collection and analysis (Shannon-Baker, 2016). The goal of mixing methods is to expand the interpretations and explanations regarding the subject matter beyond what is possible when using a monomethod approach, thus facilitating the acquisition of more complex knowledge from different perspectives (Collins, 2015).

However, there is a concern that philosophical pragmatism can become an indulgent practical pragmatism in which a focus on “what works” may lead to unreflective research practices (Brinkmann & Kvale, 2015; Hesse-Biber, 2015; Johnson & Onwuegbuzie, 2004). Therefore, within MMMR it is emphasised that researchers consider the philosophical substructures in any given research project and that they be transparent about these paradigmatic perspectives (Collins, 2015; Hesse-Biber, 2015; Shannon-Baker, 2016). I have attempted to comply with

this recommendation in the above section, in which I reflect on the ontological and epistemological perspectives in my research project.

3.3.1 What qualifies as mixed methods research?

There is a continuing debate over what constitutes and qualifies as mixed methods research (Hesse-Biber, 2015). A common principle says that to be truly mixed, not just “multiple”, the mixing must extend beyond data collection and the use of different methods and methodologies (Collins, 2015; Onwuegbuzie et al., 2009). Thus, from a narrow, “purist” perspective, whether the current research has a mixed methods approach may be questioned. I argue that the answer to this question depends on whether one considers each single study – Papers I, II and III – separately, or whether one considers the research as a whole. The overarching focus of the thesis is the transition to motherhood, from a subjective and dyadic perspective, when a woman has BD. Integrating the three single studies as contributing to this overarching focus, I argue that the research qualifies as a mixed methods approach.

Doyle and co-workers list different rationales for justifying a mixed methods approach, depending on the particular research (Doyle et al., 2016) (see Table 1.).

Table 1. Rationales for mixed methods research (from (Doyle et al., 2016, p. 624).

- Triangulation (convergence):	Using quantitative and qualitative methods so that findings may be mutually corroborated.
	This may also be an unanticipated outcome of the study where a mixed methods study was undertaken for another reason, but convergence was evident.
- Expansion:	The first phase has findings that require explanation qualitatively.
	Unexpected findings that need to be explained.
- Exploration:	An initial phase is required to develop an instrument or intervention, identify variables to study or develop a hypothesis that requires testing.
- Completeness:	Provides a more comprehensive account of phenomena under study.
- Offset weaknesses:	Ensures that weaknesses of each method are minimised (Creswell, 2015a).
	Caution is required when identifying this as a primary rationale as each method should be sufficiently rigorous in its own right (O’Cathain, 2010)
- Different research questions:	Both quantitative and qualitative questions may be posed at the beginning of the study in addition to mixed methods questions (Creswell, 2015b)
- Illustration:	Qualitative data are used to illuminate quantitative findings.
	Putting “meat on the bones” of dry quantitative data (Bryman, 2006)

The rationales pertaining to “completeness”, “offsetting weaknesses” and “different research questions” are, I argue, applicable to the overall research and thesis. A qualitative interview inquiry into the women’s subjective perceptions and a quantitative assessment of mother-infant interactions provide a more comprehensive account of the phenomenon of “transition to motherhood in the context of maternal BD” than would have been possible with either methodology alone (i.e., completeness). As argued above in this chapter, by conducting an interview to ascertain the women’s perceptions, we offset the weaknesses in a questionnaire. Through standardised observations and assessments of mother-infant interactions, we offset the weaknesses embedded in merely asking the mothers about how they perceive the interactions (Logsdon, Wisner, & Hanusa, 2009; Weinberg & Tronick, 1998). Further, integration of mixed methods findings is a key component in mixed methods research, where the “whole is greater than the sum of its parts” (Collins, 2015; Doyle et al., 2016). The research as a whole represents integration at the design level with “different research questions”, both qualitative and quantitative. The study group (i.e., perinatal women with BD) participated in both the qualitative and quantitative phases of the current study, thus enabling sample integration and allowing us to address the entirety of the overarching research objective (Collins, 2015). There is also integration at the reporting level, where qualitative data are quantified in Paper I (Maxwell, 2010; Shannon-Baker, 2016). Finally, within the discussion section of the thesis, inferences are developed as integrated understandings derived from both the qualitative and quantitative data (Tashakkori & Teddlie, 2008). Such inferences extend beyond what is learned from the quantitative and qualitative findings separately and provide a sense of the overall findings, thus answering the overarching research questions and contributing to the integration of knowledge (Collins, 2015; Doyle et al., 2016).

To conclude, I argue that our use of different methodologies is justified by the research questions and that the research as a whole satisfies the criteria for mixed methods research.

4. Methods

4.1 Design

The current research project is a prospective mixed methods study.

Women with BD and their infants were followed up from pregnancy/maximum three months postpartum to 12 months postpartum. As noted above (Chapter 3), the first investigation (Paper I) applied a qualitative methodology, and the women with BD formed the study group, whereas the second and third investigations (Papers II and III) applied a quantitative methodology. To answer the research questions for the two latter investigations, existing data from a group of mothers without mental disorders and their infants was utilised as comparison for the study group of mothers with BD and their infants.

4.2 Recruitment procedures and participants

4.2.1 Inclusion criteria bipolar disorder sample

Inclusion criteria for the Bi-sam study were women in stable partner relationships with a clinically established BD diagnosis (BD I or II) (APA, 2013) who were either pregnant or had recently given birth (maximum three months postpartum). A cohabitating partner who was willing to participate was an inclusion criterion because of the aims of the overarching Bi-sam study. The cohabitating partner could either be the infant's biological father or another partner living with the woman (including a partner of same sex²). The participants had to speak Norwegian or English fluently. Exclusion criteria were parental substance abuse; multiple childbirth; premature birth before pregnancy week 35; or an infant with a known serious medical condition or syndrome. These parental and child conditions are independently or together associated with challenges in the early parent-child relationship and interactions (see, for example, (Faugli, Emblem, Veenstra, Bjørnland, & Diseth, 2008; Muller-Nix et al., 2004; Robin, Josse, & Tourette, 1988; Siqveland, Haabrekke, Wentzel-Larsen, & Moe, 2014)). Such conditions could thus bias the interaction observations in the research study.

We expected the recruitment to be difficult, mainly because of the relatively low number of eligible participants in the primary recruitment area and the likelihood of many women and

² We are aware of that the current literature describes that the transition to motherhood and co-parenting in same-sex couples may entail certain different adaptive processes and dynamics than in heterosexual couples. These matters would have been considered in the current research in cases of same-sex couples.

partners declining to participate in a potentially stressful and sensitive phase of life. Thus, we applied a convenience sampling strategy, meaning that all eligible participants who consented to participate were included. Because of the current scarcity of research on the subject matter, we had no desire or rationale to limit the inclusion criteria to women with certain demographic or clinical characteristics besides having a BD diagnosis.

4.2.2 Recruitment bipolar disorder sample

Recruitment took place between September 2014 and July 2016. The main recruitment area was the geographic area of Vestre Viken Hospital Trust (i.e., the county of Buskerud and the municipalities Asker and Bærum in the county of Akershus), with a population of 490,000. The remaining participants were recruited from nearby counties in the south-eastern part of Norway.

We provided oral and written information about the study to approximately 400 health professionals at health service sites likely to come into contact with pregnant women with BD. The health service sites included specialist mental health outpatient clinics and wards, infant mental health teams at child specialist mental health services, community well-baby clinics, pregnancy care and maternity wards. In all, I held 32 informational meetings for health professionals between March 2014 and April 2016.

The health professionals distributed information leaflets and asked eligible women whether I, as a clinical psychologist and researcher, could contact them by phone to provide more details about the study.

Additional recruitment strategies included advertising the study on the website of the national BD association, the Facebook pages for the Nordic Marcé Society and for Norwegian psychologists, and at Vestre Viken Hospital Trust group psychoeducation courses for patients with BD (Skjelstad, Norheim, Reiersen, & Mjosund, 2015). The advertisements encouraged eligible women to contact me directly.

Women and partners who were willing to participate gave oral and written consent on behalf of themselves and their infant at an informational meeting with me. The consent allowed me to verify the women's clinical BD diagnosis by examining their specialist mental health patient records and/or by contacting their specialist mental health worker. All participants had received their diagnosis in the specialist mental health service.

It was also anticipated that there could be cases with uncertainty regarding the diagnosis. The M.I.N.I 5.0 PLUS Modules A, C and D of the Mini International Neuropsychiatric Interview version 5.0 PLUS (Sheehan et al., 1998) were therefore intended to verify BD diagnosis in

these cases, before participants' inclusion in the study. This approach, however, was not employed. In two cases, it was considered. In one of these cases, it turned out that the instrument had been employed clinically only one month before inclusion in the study, and the diagnosis was confirmed. In the other case, the woman was clearly afraid of becoming destabilised by the study interview and eventually the M.I.N.I. Since she was pregnant and her worry was so obvious, there were no attempts to make her change her mind. Her BD diagnosis was considered confirmed by examination of her illness history and medications, in combination with a statement from her general practitioner.

Thirty-five women were interested in more information about the study. In three cases, the partner declined to participate. Three women turned out not to have a formal BD diagnosis. One woman did not respond to my calls to set up a meeting. Two women changed their minds: one said that "everyday life is too much as it is", whereas the other gave no reason.

Thus, 26 women (13 primiparous (PP) and 13 multiparous (MP)) diagnosed with BD I or II were included in the study. Nine women (34.6 %) were included in the second trimester of pregnancy, ten (38.5 %) in the third trimester and seven women (26.9 %) were included together with their infants within one to 16 weeks postpartum. None of the BD participants withdrew from the study.

Due to the large number of health professionals informed, we have no record of the number of eligible women who declined to participate when informed about the study, nor do we know how many potential participants the health professionals did not inform about the study.

Table 2 shows the distribution of the BD participants recruited from the different recruitment sites.

Table 2. Distribution of BD participants from the different recruitment sites.

Recruitment sites	n	%
Specialist mental health outpatient clinics	2	7.7
Infant mental health teams at child specialist mental health services	6	23.1
Community well-baby clinics	3	11.5
Community pregnancy care	2	7.7
Hospital pregnancy care	9	34.6
Maternity wards	1	3.8
Website of the national BD association	2	7.7
Group psychoeducation courses for patients with BD	1	3.8
Specialist mental health wards	0	
Facebook pages for the Nordic Marcé Society and for Norwegian psychologists	0	
	26	99.9

4.2.2.1. Characteristics of participants, bipolar disorder sample

Most participants, n=15, 57.7 %, lived in the geographic area of Vestre Viken Hospital Trust. Four (15.4 %) came from Oslo, another four (15.4 %) from Vestfold and one each from Østfold, Telemark and Oppland (in total 11.5 %). The BD sample thus represented participants from large and smaller cities, as well as district areas.

Further information on demographic and clinical characteristics of the BD sample is as follows:

- Paper I: Demographic and clinical characteristics of the BD women.
- Paper II: Characteristics of the infants in the BD sample.
Presentation of affective symptom load among the BD women at three months postpartum, and proportion of BD women with at least one affective episode in the 0-3 months postpartum.
- Paper III: Presentation of affective symptom load among the BD women at 12 months postpartum.

Information on the BD women's medication and contact with specialist mental health services in pregnancy is presented in Paper I (i.e., clinical characteristics). Here, I present additional

details and supplement them with information for 3 and 12 months postpartum (see Tables 3 and 4). The data are based on maternal reports at each time point for data collection.

Table 3. Number of BD women (N=26) on BD medication and types of medications used.

Total sample N=26	Pregnancy		3 months postpartum		12 months postpartum	
	n	%	n	%	n	%
<i>BD women on medication</i>	17	65.4	19	73.1	17	65.4
<i>Type of medication</i>						
Lithium: monotherapy	1	3.8	1	3.8	1	3.8
Lithium: polytherapy	2	7.7	5	19.2	4	15.4
Antipsychotics: monotherapy	2	7.7	2	7.7	2	7.7
Antipsychotics: polytherapy	1	3.8	1	3.8	1	3.8
Lamotrigine: monotherapy	6	23.1	5	19.2	4	15.4
Lamotrigine: polytherapy	3	11.5	5	19.2	5	19.2
Antidepressants: monotherapy	2	7.7	0		0	

Table 4. Number of BD women (N=26) in contact with mental health services and types of mental health services.

Total sample N=26	Pregnancy		3 months postpartum		12 months postpartum	
	n	%	n	%	n	%
<i>BD women in contact with mental health services</i>	20	76.9	15	57.7	10	38.5
<i>Type of mental health service</i>						
Specialist adult mental health (includes private practicing psychiatrists)	14	53.8	7	26.9	6	23.1
Specialist infant mental health	2	7.7	4	15.4	3	11.5
Specialist adult + specialist infant mental health	2	7.7	2	7.7	0	
Specialist adult + specialist infant mental health + community adult mental health	0		0		1	3.8
Specialist infant mental health + community adult mental health	1	3.8	2	7.7	0	
Community adult mental health	1	3.8	0		0	

4.2.3 Recruitment procedures and inclusion criteria, non-clinical sample

To save time and labour – given the time frame for a PhD and that all recruitment and data collection was performed by me – it was decided to include existing data for comparison of mother-infant interactions from another Norwegian study.

The comparison group consisted of 30 mother-infant dyads recruited from local well-baby clinics in Oslo, Norway, between December 2004 – January 2009 (Siqueland et al., 2014). Inclusion criteria for the comparison group were being pregnant and having no substance abuse or mental health problems.

All women in the comparison group also had a cohabitating partner.

4.2.3.1 Characteristics of participants, non-clinical sample

Characteristics of the mothers and infants in the non-clinical sample are presented in Papers II and III.

4.2.4 Participants in the different investigations

The number of participants varied across the three papers. In Paper I, 26 women with BD were included. In Paper II, 26 mother-infant dyads in which the mother had BD and 30 mother-infant dyads with mothers without mental disorder were included.

In Paper III, 26 mother-infant dyads in which the mother had BD were included. As there were no data on mother-infant interaction in two dyads in the non-clinical sample at 12 months, 28 mother-infant dyads with mothers without mental disorder were included.

4.3 Data collection

4.3.1 Bipolar disorder sample

The “Bi-sam study” as a whole comprises more data than are included in this thesis. Only data collection and measures relating to this thesis are presented.

The protocol for data collection was four time points: pregnancy and one, three and 12 months postpartum. This protocol was followed for participants who were included in pregnancy (n=19, 73.1%). For participants included postpartum (n=7, 26.9 %), the time points were adjusted, except for collection of mother-infant interaction data (see Table 5).

The data collection was conducted from September 2014 to January 2017, by me, either at the participants’ homes (76.9 % in pregnancy or early postpartum; 96.2 % at three months; 92.3 % at 12 months) or at my office, as chosen by each woman. The data collection sessions lasted approximately 1½ – 2½ hours each.

4.3.2 Non-clinical sample

To ensure that the comparison group fulfilled the criteria of no mental health or substance abuse problems, data on the mothers' mental health status were collected in pregnancy with the European Addiction Severity Index (McLellan et al., 1992), Millon's Clinical Multiaxial Inventory-III (Millon, Millon, Davis, & Grossman, 1997) and the Hopkins Symptom Check List, SCL-25 (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974).

At three months postpartum, the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden, & Sagovsky, 1987) was administered to collect data on potential presence of depressive symptoms. The maximum score on the EPDS is 30, and a score ≥ 10 indicates a risk for postpartum depression, and >12 indicates depression. The EPDS mean score in the comparison group was 3.16 (SD 3.20, range 0-12), corresponding to a low depression risk. Data on mother-infant interactions were collected at 3 and 12 months. All data collection for the non-clinical sample was conducted in a professional setting.

4.4 Measures

4.4.1 Measures in pregnancy and early postpartum (0 – 3 months), bipolar disorder sample

Interview

The interview is the core measure in Paper I.

I conducted individual semi-structured interviews with the mothers using an interview guide developed for the overarching Bi-sam study (see Appendix 1). The first part of the interview investigated the BD per se: illness history, characteristic mood episodes and treatment. In the second part, the women were asked to describe their experiences in the current pregnancy, and MP women were allowed to refer to previous pregnancies and postpartum periods when they felt it natural. Thoughts on becoming a mother, the impact of BD and perceived resources were also explored.

The interview guide was used to ensure that relevant topics were covered across all interviews. The order in which questions were presented was adapted to the natural development of each interview. First, the questions were posed in an open-ended manner to invite in-depth descriptions. Probing questions were then used to encourage elaborations. The interview guide also contained some questions with fixed responses. These topics were also elaborated.

The interviews lasted approximately 1 hour (mean 70 minutes, range 35 – 109). Audio was recorded and transcribed.

Maternal socio-demographic information

Maternal sociodemographic factors such as age, marital status, educational level, profession, employment status when non-pregnant, and number of children (parity) were registered with a questionnaire.

Infant information

Information about the infants – birth date, gender, gestational age, birth weight, head circumference, Apgar score, nutrition (fully breast fed, partly breast fed, full infant formula) and obstetric complications in pregnancy and/or birth – was registered using a questionnaire.

4.4.2 Measures at three and 12 months postpartum, both samples

Parent-Child Early Relational Assessment (PCERA)

The PCERA is the core measure in Papers II and III.

The mother-infant interactions at three and 12 months were assessed with the Parent-Child Early Relational Assessment (PCERA) (Clark, 1985, 2006, 2009, 2010). This instrument is a standardised assessment method that has demonstrated good content, construct and factor validity, discriminant validity between clinical and non-clinical groups, as well as sensitivity to change (Clark, 1985, 2006, 2009, 2010, 1999; Lotzin et al., 2015). The method is used in both research and clinic.

The PCERA is developed to examine strengths and concerns in parental and infant behaviour separately and in their dyadic interactions. This instrument contains 65 behavioural, affective and communicative variables. These variables are operationalised in a manual and rated numerically based on observed frequency, duration and intensity. Rating is performed on a five-point Likert scale. The five points are categorised into three areas of concern/strength according to PCERA: 1-2 = area of concern, 3 = area of some concern and 4-5 = area of strength (Clark, 1985, 2006, 2009, 2010).

PCERA variables may be organised into parental, infant and dyadic subscales when conducting analyses of the interaction data (see Papers II and III for subscales used in the current research).

The mother-infant interactions were video-recorded. At the end of the video-recording sessions, the mothers in both samples were asked to evaluate the representativeness of the interactions.

The assessed session for both samples at both time-points was a 5-minute free-play interaction. The mothers were asked to interact with their infant as they typically did and as they pleased. At three months, there was an optional use of toys. At 12 months, the mothers were asked to actively use a selection of provided toys in the interaction.

4.4.2.1 Inter-rater reliability

All interactions in the BD sample were rated by an independent, certified main coder. A second independent, certified coder double-rated a random selection of 31 % of the interactions for calculation of inter-rater reliability.

A good inter-rater reliability was found using absolute agreement on ratings. Intra-class correlation was 0.75 for 3-month ratings and 0.85 for 12-month ratings. The coders were aware of the women's BD diagnosis but were blinded to all other information.

The main coder of the BD sample also rated the interactions for the comparison group together with a second independent, experienced coder. Twenty percent of randomly selected interactions were double-rated, and inter-rater reliability was calculated using categorical agreement (1-2, 3, 4-5). Intra-class correlation varied between 0.80 and 0.97 at 3 months and between 0.73 and 0.94 at 12 months for the different subscales used in the study (Siqueland et al., 2014). All information, including group status (no mental health problems vs. substance abuse or mental health problems), was unknown to the coders.

4.4.3 Measures at three and 12 months postpartum, bipolar disorder sample

Inventory of Depressive Symptomatology (IDS)

The presence of maternal depressive symptom load was assessed with the IDS (Rush, Gullion, Basco, Jarrett, & Trivedi, 1996) at three and 12 months postpartum. The IDS is a recognised and frequently used instrument for measuring the severity and amount of depressive symptoms in clinic and research. The instrument contains 30 questions regarding depressive symptomatology and common additional symptoms (anxiety, irritability). I administered the IDS as an interview, which usually took approximately 30 minutes.

Young Mania Rating Scale (YMRS)

The YMRS (Young, Biggs, Ziegler, & Meyer, 1978) was used to assess the mothers' potential hypomanic/manic symptoms at three and 12 months postpartum. The YMRS has been found to be valid and reliable in measuring the severity and amount of manic symptoms and is extensively used in clinic. Scores are based on the patient's reports in interview combined

with clinical observation in the situation. The YMRS usually took 10-15 minutes to administer.

Scores from the IDS and YMRS are described and utilised in analyses in Paper II and described in Paper III.

Table 5. Measures and time-points for data collection, BD sample.

	<ul style="list-style-type: none"> • Interview • Maternal socio-demographic information 	<ul style="list-style-type: none"> • Infant information 	<ul style="list-style-type: none"> • Mother-infant interaction (PCERA) • IDS • YMRS 	<ul style="list-style-type: none"> • Mother-infant interaction (PCERA) • IDS • YMRS
Women recruited in pregnancy, N=19	Pregnancy weeks 21-39 (mean: week 32)	1 month postpartum	3 months postpartum	12 months postpartum
Women recruited postpartum, N=7	1 – 3 months postpartum	1 – 3 months postpartum	3 months postpartum	12 months postpartum

4.4.4 Additional registrations, bipolar disorder sample

We collected information about the women’s postpartum affective symptoms and episodes at least once at 1-2 months postpartum.

For 19 women, this collection was performed by at least one home visit, during which they were interviewed about their mood symptoms and episodes, ± phone contact with their respective specialist mental health professionals. Two women were hospitalised with verified severe mood episodes. For another two women, their specialist mental health professionals provided thorough information about their postpartum mood states in conjunction with recruitment. There was phone contact with one woman at one month postpartum, during which she was interviewed about mood symptoms. Two women joined the study at three months postpartum and had not been in contact with any mental health care system postpartum.

The presence of postpartum mood symptoms and episodes was additionally examined retrospectively in an interview with all women at three months, in conjunction with the interaction session and assessment with the IDS and YMRS.

In addition, registration of mothers' medications and possible other treatments was performed at each meeting for data collection.

4.5 Analyses

4.5.1 Qualitative analysis, Paper I

The principles for thematic analysis were followed (Braun & Clarke, 2006, 2013) (see Table 6) to identify recurrent themes linked to the research topic. In line with our research aims, the main purpose of the analysis was to illustrate a broad reflection of predominant themes rather than to conduct an in-depth analysis of particular aspects. Thematic analysis fits this exploratory focus well, and the chosen broad approach is suitable for research on understudied topics (Braun & Clarke, 2006). The analysis took an inductive approach, in which the themes are data driven. Furthermore, the themes were identified at a semantic explicit level, not a latent or interpretative level (Braun & Clarke, 2006). In essence, we conducted a pattern-based descriptive analysis (Braun & Clarke, 2013).

I listened to and read each interview repeatedly. With the research questions in mind, initial codes were generated case by case (Braun & Clarke, 2013, p. 206). The codes reflected salient features in text segments. Notably, the interview contained questions that were not relevant for the current study and thus produced more data than used for the current analysis (Braun & Clarke, 2013, p. 210). After the initial coding, the next step was to look for patterns and similarities among the different codes to organise them into candidate themes. The texts were read several times throughout the analysis, and codes and candidate themes were created and modified in a flexible "dialogue" with the data (Braun & Clarke, 2013, p. 224). My main supervisor read all the transcripts and supervised the analysis. Interpretations and candidate themes were discussed throughout the analytic process and revised until agreement was reached. Distinct themes were named and organised hierarchically in collaboration. My second supervisor, who has extensive knowledge and experience in perinatal mental health, addressed possible omissions and contradictions in the analytic process. Interpretations were also discussed in peer groups. Finally, the material was analysed across the cases with the purpose of identifying similarities and variations between subgroups. We looked for similarities and variations particularly between PP and MP women and women with BD I and

BD II within the distinct themes. Additionally, we identified subgroups in how women related to the postpartum risk for illness relapse and in distributions of resources and preparations. A respondent validation was performed in a second interview at 12 months postpartum. The participants were presented with verbal summaries of their first interviews. All participants confirmed that their viewpoints were portrayed accurately.

The qualitative software NVivo 10 was used as a coding and organising tool.

Table 6. Phases of thematic analysis, from (Braun & Clarke, 2006, p. 87).

Phase	Description of the process
1. Familiarising yourself with your data	Transcribing data, reading and re-reading the data, noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic “map” of the analysis.
5. Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

4.5.2 Statistical analyses, Papers II and III

Data were analysed using IBM SPSS Statistics for Windows version 23 (Paper II) and version 25 (Paper III) (Armonk, NY, USA: IBM Corp). Median regression was performed using STATA version 15 (Paper III) (StataCorp, College Station, Texas, USA).

Demographic and clinical data are presented as proportions, means with their standard deviations (SD) and range (Papers II and III), or medians with the 25th and 75th percentiles (Paper III).

When conducting statistical analyses on interaction data, PCERA variables were organised into different subscales. For detailed descriptions and rationales for the variables and subscales chosen, I refer to the methods sections in Papers II and III.

Group differences, using the PCERA mean scores on the subscales, were analysed using two-tailed independent-samples t-tests. The chi-square test for contingency tables or Fisher's exact test was used to detect associations between categorical variables and BD vs. the non-clinical sample. Correlation analyses were performed separately for the BD and non-clinical samples using Pearson's correlation coefficient (r).

To identify possible confounders, we studied variables that could influence the outcome, such as maternal age, education, employment status, parity, infant gestational age, infant gender, birth weight and infant exact age at interaction sessions. Only variables with significant relationships with both the exposure (BD vs non-clinical) and the outcome variables (PCERA maternal, infant and dyadic subscales) were considered possible confounders and were included in the multiple linear regression analysis.

Overall, a significance level of 0.05 was used. Effect sizes were calculated by Cohen's d or the correlation coefficient r . For Cohen's d , small effect sizes were defined as 0.20, medium as 0.50 and large as 0.80 and higher (Ellis, 2010). For the correlation coefficient r , small effects were defined as 0.1, medium effects as 0.3, and large effects as 0.5 (Ellis, 2010).

The internal consistency of the subscales was examined using Cronbach's α . An α value > 0.70 was considered satisfactory, and α values ≥ 0.90 were considered excellent.

4.5.2.1 Additional analyses, Paper II

Within the BD sample, an independent-samples t-test was used to investigate whether infant exposure to maternal BD medication in pregnancy and postpartum was associated with PCERA mean scores. The same test was used to analyse whether maternal "low" and "high" symptom load (i.e., symptom load treated as a categorical variable) was associated with PCERA mean scores. (A description of the dichotomisation of symptom scores to obtain categorical variables may be found in Paper II.) Pearson correlation analyses and linear regression analyses were used to examine the association between maternal symptom load as a continuous variable and the PCERA mean scores.

4.5.2.2 Additional analyses, Paper III

The Mann-Whitney U test was used to investigate group difference on one PCERA subscale where the data distribution was skewed. Median regression was applied to adjust for confounding factors on the same subscale.

Paired sample t-tests were used to estimate the mean change from 3 months to 12 months within the BD and the non-clinical sample on the clustered subscales (a description of and rationale for clustered subscales may be found in Paper III). Independent-samples t-tests were conducted to test whether the mean change on any clustered subscale measures from 3 to 12 months differed between the BD and the non-clinical sample. Multiple linear regression analyses were performed to test for differences in the mean change between groups while adjusting for confounding factors.

4.5.3 Statistical considerations

4.5.3.1 Missing data

There were no missing data in the BD sample at either three or 12 months. In the non-clinical sample, six PCERA ratings (two maternal, four infant) out of 1500 were missing at three months. At 12 months, five PCERA ratings (three maternal, two infant) out of 1344 were missing when using the standardised validated scale, and seven PCERA ratings (five maternal, two infant) out of 1372 were missing when using the clustered subscales. Since the missing data were evaluated to be completely at random, were minimal, and group differences were analysed by performing means, no strategies were employed for handling the missing data.

4.5.3.2 Causality

The investigations in Papers II and III had a non-experimental design. Therefore, causality cannot be inferred with certainty between a chosen independent variable (e.g., BD diagnosis) and a dependent variable (e.g., scores on PCERA) (Shadish, Cook, & Campbell, 2002).

Although we adjusted for possible confounding variables, the possibility of other unidentified factors affecting the results cannot be excluded.

4.5.3.3. Small sample size and statistical power

Sample size determination is an important part of study planning. However, with the PCERA (consisting of 65 different variables), there were no good estimates of the parameters necessary for a sample size calculation, and we did not want to include assumptions since

calculations are sensitive to the parameter values (Noordzij et al., 2010). Therefore, an a priori sample size calculation was not conducted for the study. We estimated that N=26 in the study group was sufficient, based on other studies that have used the PCERA as a measurement with sample sizes in the range of N=14 – N=30 and found evidence for group differences (Faugli, Aamodt, Bjornland, Emblem, & Diseth, 2005; Haabrekke et al., 2015; Misund, Bråten, Nerdrum, Pripp, & Diseth, 2016; Savonlahti et al., 2005; Siqveland, Smith, & Moe, 2012).

Instead of conducting post hoc power calculations, which are not recommended (Hoenig & Heisey, 2001; Noordzij et al., 2010), we have presented 95 % confidence intervals in Papers II and III, which provide the precision of the effect estimates (Hoenig & Heisey, 2001; Noordzij et al., 2010).

4.5.3.4 Multiple comparisons

A large number of statistical tests increases the likelihood of one or more false positive findings. However, no formal control for multiple testing was performed in either Paper II or III, owing to highly correlated endpoints. Furthermore, all group comparisons were pre-planned and related to the stated aims of the research.

In Paper II, the main analyses were group comparisons of six validated PCERA subscales at three months postpartum. In Paper III, the primary analyses were group comparisons of eight validated PCERA subscales at infant age 12 months. With significant group differences on these eight subscales, we found it justified to continue with analyses of patterns of change between 3 to 12 months on nine clustered PCERA subscales.

We have stated p-values for these six and eight comparisons, respectively, on the validated subscales, as well as on the nine clustered subscales, and no endpoints have been omitted. We find the number of tests we have conducted to be within the generally recognised rules in Papers II and III and have therefore chosen to present our results without adjustments for multiple comparisons (Schulz & Grimes, 2005). Additionally, adjusting for multiple comparisons in correcting for type I errors cannot be performed without inflating type II errors (Perneger, 1998).

4.6 Ethical considerations

The study was approved by the Regional Committee for Medical Research Ethics (2014/388) and was carried out in accordance with the Declaration of Helsinki.

4.6.1 Data handling

All information obtained during the study was treated confidentially. Sensitive physical research data were stored in the archives at the Child and Adolescent Mental Health Outpatient Clinic in Drammen, Division of Mental Health and Addiction, at Vestre Viken Hospital Trust.

Sensitive digital data were stored in files on hospital research data servers with enhanced restricted access. Other data, including interview transcripts, were anonymised.

4.6.2 Informed consent

As reported in the recruitment section, all women and their partners received information in a separate meeting with me. Here, the aims of the study, the procedure and measures, confidentiality, etc., were thoroughly described. In addition, the participants received a detailed written information sheet and were encouraged to ask questions and raise concerns related to the participation. Further, the participants were explicitly informed that they had the opportunity to withdraw from the study at any time.

Since children are not able to give informed consent to participate in research, it is crucial to ensure the protection of their interests (NESH, 2016). In giving both oral and written information to the parents, we strove to comply with this. I also informed the parents about my duty to potentially contact the child protection services under specified circumstances, according to Norwegian legislation on child welfare (Barnevernloven, 1992).

All participants gave oral and written consent prior to participation on behalf of themselves and their infant.

4.6.3 Particular ethical considerations and implications in the current research project

A central ethical consideration in the study has been that the participants represent a vulnerable group in a sensitive phase of life. Given these premises, intervening with a research purpose requires distinct ethical awareness and caution. To reduce the practical burdens connected to participation, I offered to conduct data collection at participants' homes. Having this opportunity was a necessity for several participants, without which they would have declined to join the study or withdrawn in the follow-up period.

Of the different measures used, the interview in pregnancy or early postpartum was evaluated to be potentially the most demanding experience, perhaps even causing some distress. Thus, when conducting the interviews, it was important to reduce the risk of destabilising the

women's mental health. As a specialist in clinical psychology, I had a clear awareness of the need to be sensitive to the state of each woman in the interviews. If I sensed signs of dysregulation in a woman, I thematised this and was supporting and regulating. I let each woman decide whether we should pursue the given topic. Additionally, based on my own clinical judgement, I did not probe and pursue themes as much as would have been optimal for the research purpose in three cases.

In ending the interviews, I asked the women how they had experienced the interview to help them to process any negative reactions. The women also had an opportunity to contact me by phone in case they experienced reactions subsequent to the interviews. However, most women expressed they considered the interview to be a meaningful conversation. Even if the interview was challenging and evoked reactions, it primarily stimulated reflection.

At the discretion of the participants, I shared clinically relevant information with the participant's health professional in eight cases. Additionally, in three cases, I referred the woman to a specialist mental health service, as a need for treatment was revealed during the data collection.

4.6.4 Compensation

At the last data collection at 12 months, the BD participants received a gift voucher of 500 NOK as a small compensation for their time and contribution throughout the participation.

4.6.5 Ethical approvals in comparison group study

The study from which the comparison data were derived was also conducted in accordance with the Declaration of Helsinki. All parents gave informed oral and written consent on behalf of themselves and their infant. The study was approved by the Norwegian Centre for Research Data (11724) and the Norwegian Regional Committee for Medical Ethics (2016/1300).

5. Results

5.1 Summary of Paper I

“What if I get ill?” Perinatal concerns and preparations in primi- and multiparous women with bipolar disorder.

5.1.1 Aims

The aim of the study was to explore how perinatal women with bipolar disorder relate to the increased risk of illness relapse postpartum: How do they perceive the risk? What are their concerns regarding the possible impact of BD for mothering and their families? What resources do they make use of in preparing for the dual demands of illness and motherhood? The overarching aim was to gain knowledge that may inform prevention planning and counselling for perinatal women with BD.

5.1.2 Methods

A qualitative study was conducted. The women (N = 26) were individually interviewed in pregnancy (n = 19) or the early postpartum period (n = 7). The textual data of transcribed interviews were analysed with inductive thematic analysis. In addition to identifying themes corresponding to the research questions, data were analysed across cases with the purpose of identifying similarities and differences between PP (n = 13) and MP (n = 13) women.

5.1.3 Main Results

Across parity, concerns for illness relapse included concerns for depression and psychosis. PP women worried about “the unknown” in relation to postpartum reactions. Overall, the most significant concerns were the impact of mood episodes on mothering and on the partner. Concerns regarding the infant were maternal medication, mood episodes affecting the child, and heredity. Resources and preparations included: support from the partner, the family, and health services; adjustment of daily life; and mental strategies. Women were aware of the postpartum risk, but their levels of personal concern varied between low, moderate and high. Women with a low level of concern for illness relapse had made the least deliberations and preparations. A subgroup of women with a high level of concern also had limited resources and preparations.

5.1.4 Conclusions

The findings highlight the importance of including a psychological and psychosocial focus in perinatal prevention planning and counselling. Even if women with BD are informed about the increased risk of illness relapse postpartum, they relate to it differently. Their level of

personal concern impacts their perinatal deliberations and preparations, which in turn, may impact postpartum adjustment. When counselling these women, it is important to assess their personal risk recognition, perinatal concerns and available resources and preparations and to support them accordingly. Extra attention should be given to women with a low level of concern and to women with a high level of concern who have limited resources and preparations. These women represent particularly vulnerable subgroups whom it is critical to identify and to offer comprehensive follow-up.

5.2 Summary of Paper II

Mothers with and without bipolar disorder and their infants: Group differences in mother-infant interaction patterns at three months postpartum.

5.2.1 Aims

The aim of the study was to compare mother-infant interactions at three months postpartum in dyads in which the mothers have BD with dyads in which the mothers have no mental disorder. All three interactional domains – maternal behaviour, infant behaviour and dyadic coordination – were assessed. Further, the study aimed to investigate the association between concurrent affective symptoms of BD mothers and the quality of interaction with their infants.

5.2.2 Methods

Twenty-six women with BD and 30 comparison women with infants were video-recorded in a 5-minute free-play situation. The mother-infant interactions were assessed using the Parent-Child Early Relational Assessment (PCERA). PCERA variables were organised into maternal, infant and dyadic subscales, appropriate for infant age 3-4 months. Group differences, using PCERA mean scores on the subscales, were analysed with independent-samples t-tests. The Inventory of Depressive Symptomatology and Young Mania Rating Scale were used to assess affective symptoms of BD mothers at the time of interaction. Within the BD sample, Pearson correlation analyses and linear regression analyses were used to examine the association between maternal symptom load as a continuous variable and PCERA mean scores. Group differences in PCERA mean scores between BD women with “low” and “high” symptom load were analysed with independent-samples t-tests.

5.2.3 Main Results

There were significant group differences with medium to large effect sizes (0.73 – 1.32) on five of six subscales within the three interactional domains. Most interactional concerns were

identified in dyadic coordination. No significant associations were found between maternal symptom load and interaction quality within the BD sample. Forty-six percent of the BD mothers experienced a mood episode within 0-3 months postpartum.

5.2.4 Conclusions

The study identified challenges for mothers with BD and their infants in “finding” each other in interaction at three months postpartum. If sustained, this interaction pattern may have a long-term impact on children’s development. To achieve dyadic coordination and synchrony, the interaction partners need to be familiar with each other’s behavioural repertoire and interaction rhythms. We suggest interventions specifically focusing on sensitising and supporting mothers to read infants’ cues on a micro-level. This may help them to respond contingently and improve dyadic coordination and synchronicity.

5.3 Summary of Paper III

Bipolar offspring and mothers: Interactional challenges at infant age 3 and 12 months - a developmental pathway to enhanced risk?

5.3.1 Aims

The aim of the study was to compare the developmental trajectories of dyads in which the mothers had BD to dyads in which the mother had no mental disorder. First, we assessed mother-infant interaction patterns at infant age 12 months. Second, we explored patterns of change in the interactions within and between the groups from infant ages 3 to 12 months. All assessments included the three interaction domains: maternal behaviour, infant behaviour and dyadic coordination.

5.3.2 Methods

Data on mother-infant interactions in dyads in which the mother had BD (N=26) and dyads in which the mother had no mental disorder (N=28) were collected at 3 and 12 months. All interactions were video-recorded and assessed using the Parent-Child Early Relational Assessment (PCERA). When conducting statistical analyses of interaction data, PCERA variables were organised into different maternal, infant and dyadic subscales. First, we used a validated scale for a free-play recording at 12 months and investigated group differences with independent-samples t-tests and the Mann-Whitney U test. Second, PCERA variables that are rateable at both 3 and 12 months were clustered into subscales equivalent to behavioural, affective and communicative categories in the manual. Patterns of change in the three

interaction domains within and between the groups from 3 to 12 months were examined with paired samples t-tests and independent-samples t-tests.

5.3.3 Main Results

BD dyads demonstrated significantly more challenges in all three interaction domains at infant age 12 months compared to the healthy dyads. This was in line with the findings at infant age 3 months. Subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours in the BD dyads. Continuous difficulties with dyadic coordination and reciprocity were the most concerning interaction behaviours throughout the first year.

On the positive side, there was little expression of negative affect or tension in maternal, infant and dyadic behaviour, and some positive changes were observed in infant behaviour from 3 to 12 months.

5.3.4 Conclusions

Findings suggest that mother-infant interaction patterns in the first year of life may enhance developmental risk for bipolar offspring. Clinical interventions should address both the BD mothers' needs in relation to postpartum mood deviations and also mother-infant interactions. We suggest interaction interventions that help sensitise mothers to their infant's cues and provide attuned contingent responses to promote dyadic coordination and reciprocity.

6. Discussion

6.1 Discussion and elaboration on findings

The findings of the respective investigations are discussed in the discussion sections of Papers I – III. In this section, I want to further elaborate on issues that could not be addressed in-depth in the separate papers.

Concurrent with our work with Paper I, two qualitative studies focusing on BD women's considerations and decision-making regarding pregnancy and family planning were published (Dolman et al., 2016; Stevens et al., 2017). It is promising that literature regarding perinatal matters from BD women's viewpoints has begun to emerge. Therefore, I first compare and discuss some of our main findings in Paper I with the two corresponding studies.

I then add some reflections on our findings in relation to generic theories of the transition to motherhood. Then, I comment on postpartum illness relapse and symptom load among women in our BD sample. Finally, I discuss and elaborate on dyadic coordination and synchrony since the most concerning interaction patterns in Papers II and III were found in these behaviours.

Hence, in this section, I attempt to integrate the subjective (i.e., qualitative findings) and dyadic (i.e., quantitative findings) perspectives in the transition to motherhood for women with BD, complying with the goal of mixed methods research.

6.1.1 Considerations on becoming a mother with bipolar disorder – a comparison of three qualitative studies

Comparable to our research in Paper I, Dolman (2016) and Stevens (2017) and co-workers conducted descriptive qualitative studies. Both explored considerations and decision-making related to pregnancy and family planning among women with BD. These topics are associated with those we studied. In their studies, only women with BD I participated, and the majority of women interviewed were in the pre-conception phase considering a possible first pregnancy. Thus, our study complements those findings with interview data from women with BD II and comparisons between PP and MP women who were pregnant or in early postpartum. In addition, Dolman et al. (2016) supplemented interviews with data from an online forum.

In the two abovementioned studies, the women's decision-making regarding a potential pregnancy and family planning was identified as an essential and thoughtful process in which the desire to become a mother was weighed against risk factors related to having BD (Dolman

et al., 2016; Stevens et al., 2017). Our findings extend the notion of a thoughtful process of weighing risk, as we identified within-group variations in perinatal risk perception and deliberations. Although our study had a particular postpartum focus, it is reasonable to believe that corresponding variations may apply to other domains of perinatal management of BD. These variations warrant clinical attention. The women in our study demonstrated low, moderate or high levels of concern for BD illness relapse postpartum, which were associated with different levels of perinatal preparations.

A low level of concern may manifest in denial of thoughts about risk, minimisation and indifference. Since women with a low level of concern had made the fewest deliberations and postpartum preparations, we argue that they are particularly important to identify for proactive perinatal counselling. Women with a moderate level of concern explicitly acknowledged being at risk because of their BD but balanced this recognition with descriptions of resources and preparations. The narratives of the women with a high level of concern were characterised by emotional activation and recurrent and elaborate descriptions of becoming ill with the use of strong emotional words, such as “fear”, “frightening” and “horror”. We argue that these women are also very important to identify as they experience anxiety at a time when they need to be stress regulated. On the one hand, some women with a high level of concern had made the most thorough deliberations and comprehensive preparations in our sample. On the other hand, we identified women with a high level of concern with very limited resources and preparations. This subgroup of women represents a particularly vulnerable subgroup in need of extensive and supportive perinatal care (Paper I).

Characteristics of women with different levels of concern are described in Paper I. In our sample, we found no indications that being medicated or not, or having a diagnosis of BD I or BD II, influenced the level of concern and deliberations. However, high disorder severity seemed to be an illness factor relatively indicative for level of concern. Most women with high disorder severity expressed a high level of concern. However, high disorder severity was also present among some women with moderate and even a low level of concern (Paper I). Taken together, our identification of different levels of concern and deliberations may be viewed as a valuable supplement to the findings of Dolman et al. (2016) and Stevens et al. (2017).

Furthermore, a minority (38 %) of the PP women in our sample had planned their pregnancies, in comparison with 85 % of the MP women (Paper I). This finding supports a

main message from Dolman et al. (2016) and Stevens et al. (2017) that pregnancy and family planning are critical pre-conception topics in counselling women with BD of childbearing age.

Several themes recurred across the three studies, thus confirming them as central perinatal matters for women with BD. Understandably, women's concern for illness relapse was a repeated and salient theme. Whereas Stevens et al. (2017) primarily reported a fear of pregnancy relapse, Dolman et al. (2016) described a postpartum fear, in line with our findings. Some women in the study by Dolman et al. (2016) portrayed a possible relapse as something barely thinkable and as "terror", thus echoing the fear of women with a high level of concern in our study (Paper I). Dolman et al. (2016) found that a few women had considered elective Caesarean section, adoption or surrogacy in attempts to avoid a possible relapse, thoughts not mentioned in our study. Instead, new knowledge from our findings on BD women's concern for illness relapse included the following: Depression was the most common concern across parity and type of BD. The fear of postpartum psychosis was almost exclusively reported by women with a diagnosis of BD I. The "unknown" – not having any experience in how the illness may be affected by childbirth – was evident among PP women as a major concern (Paper I).

A common finding across the three studies was that women expressed a need for more well-informed health services (Paper I) (Dolman et al., 2016; Stevens et al., 2017). The need for specialist perinatal mental health services, or at least specialist mental health services, was grounded in shared experiences that general psychiatrists and general practitioners lack training and knowledge in perinatal management of BD. Across the studies, women requested updated and individualised information on possible negative effects of medication on the foetus, questions of whether one is able to breastfeed a child when on medication and the risk of heredity of BD. Furthermore, participants identified a need for the possibility of conversations on how to combine BD and becoming a mother. Indeed, throughout the three studies, women worried about their illness impacting mothering and about mood episodes affecting their child negatively. Another common concern was the negative impact of mood episodes on the partner. In sum, women expressed a need for health professionals to extend their focus from managing the disorder to also include the particular phase of life, with its many complex decisions (Paper I) (Dolman et al., 2016; Stevens et al., 2017), thus confirming the need for more comprehensive and psychologically oriented perinatal care. Notably, Dolman et al. (2016) described women's experiences of stigmatising attitudes among health

professionals as a possible barrier to information access and treatment. Such experiences were not correspondingly expressed in our study (Paper I), nor in the study of Stevens et al. (2017).

With regard to preparations and support, women across the three studies defined support from their partner as vital, even decisive, when becoming a mother with BD. Family assistance was also important (Paper I) (Dolman et al., 2016; Stevens et al., 2017). Additionally, our study contributed in highlighting women's personal strategies, such as adjustment of daily life and being conscious about priorities (Paper I). Overall, the findings show that in the perinatal management of BD there are more protective and preventive measures on which to focus than medication alone. Women may use relational, practical and mental strategies as well.

6.1.2 Becoming a mother with bipolar disorder and generic theories of the transition to motherhood.

Based on the assumption that the reorganisation process described in generic theories of maternal transition is of universal validity (within the Western social-cultural context (Stern, 1995)), it is of significant value to understand this process when it involves not “only” motherhood but motherhood in the context of BD.

In her meta-synthesis, Nelson claims that growth and transformation do not automatically follow the transition to motherhood. These processes require that the woman be engaged and make a commitment to mothering, as a primary process, to open the way for a secondary process of transformation into a new identity of being a mother. Such commitment means accepting and exhibiting the responsibilities of motherhood and mothering, also behaviourally (Nelson, 2003). Stern regards identity reorganisation, in which the woman must transform and negotiate what is central in her identity, as a necessity to master the tasks within the other transition themes: life-growth, primary relatedness and supporting matrix (Stern, 1995).

Hence, there appear to be some differences in what Nelson and Stern emphasise as driving the transition and transformation process in becoming a mother. A common view, however, is that complexity and contradictions are inherent in the process for all women (Cohen & Slade, 2000; Nelson, 2003; Stern, 1995). It is reasonable to assume that the reorganisation process for women with BD is even more complex. I offer some reflections on this process below.

First, there is a particular complexity in the reorganisation task of balancing and integrating the two identities of being a “patient with BD” and a becoming mother. Here, I put forward a hypothesis that this reorganisation is processed differently among women with different levels of concern for postpartum illness relapse (Paper I). As women with a low level of concern

presented low risk recognition, they may be viewed as not sufficiently considering the “patient with BD” element of their identity. This oversight does not imply that these women were not engaged and committed to becoming mothers in general (Nelson, 2003), but their commitment to preparing for BD risk was lower than for women with moderate or high levels of concern. Unfortunately, their low risk recognition may jeopardise a positive maternal transition and the responsibilities of motherhood. For instance, consequences of a postpartum illness relapse may be detrimental for the experience of motherhood and the mother-infant relation. Furthermore, with low risk recognition, there may be too few preparations for the care of the infant in case of an illness relapse.

In contrast, for women with a high level of concern, the “patient with BD” identity seemed distinctly present and may have been experienced as “threatening” the becoming mother. Some of these women were highly engaged and committed to extensive and adaptive preparations. However, a subgroup of women with a high level of concern did not achieve this preparation. Within this framework, it may seem as though some women had the capability to balance the distinctly present identities of “patient with BD” and a becoming mother, thereby exhibiting the responsibilities of motherhood (Nelson, 2003). Other women with a high level of concern may be interpreted as having been overwhelmed by the “patient with BD” identity and failing to manage the balancing task.

Women with a moderate level of concern may be considered to more or less be occupying a balanced and integrated state between being a “patient with BD” and a becoming mother. The group of women with a moderate level of concern consisted mainly of MP women. Interestingly, some MP women spoke about the “lessons learned” when not sufficiently considering BD risks when becoming mothers the first time, which had resulted in negative experiences. I take these statements as support for the importance of balancing and integrating the two identities of being a “patient with BD” and a becoming mother in BD women’s transitional reorganisation.

Second, complexity may be potentiated in BD women’s processing of maternal transition themes. For instance, in Paper I, we learned about the women’s concerns regarding negative effects of medication on the foetus, questions of whether they could breastfeed their infant when on medication and the fear of heredity of BD. These matters deal with the health and growth of the child, thus potentially intensifying the life-growth theme (Stern, 1995) for perinatal women with BD.

In addition, the primary relatedness theme (Stern, 1995) became highly significant in the women's reflections on how mood episodes may affect their mothering and their relationship with the infant (Paper I).

The transition theme of "disruptions in daily life" (Nelson, 2003) seemed less complex for the women to process (Paper I). For instance, several women straightforwardly mentioned deliberations regarding daily life adjustments, including securing sleep.

The theme of balancing motherhood and work commitment (Nelson, 2003) did not emerge as a common theme among the women in our sample. This difference may be because the interview was conducted in pregnancy or early postpartum, and the question of work was felt to be far ahead. On the other hand, over half of the women (54 %) had already made deliberations and adjustments about work participation because of their BD. Instead, the women talked about "economising" their own energy as an important priority for the sake of mothering and staying well (Paper I).

Finally, postpartum, when the adaptation to motherhood becomes transactional and the aim is to "work it out" as a particular mother to a particular child (Cohen & Slade, 2000; Nelson, 2003; Stern, 1995), complexity may be embedded in mother-infant interactions. Papers II and III describe challenges for mothers with BD and their infants in sharing positive affect and "finding" each other in interactions in the first year. Over time, interaction problems and lack of connectedness may have a negative effect on the mother's sense of competence and maternal identity (Stern, 1995; Weatherston et al., 2010).

Our focus and analysis in Paper I was descriptive, where we took the women's accounts at face value. Interestingly, from an intra-psychological interpretive perspective new research has found more deviating maternal representations in the transition to motherhood among women with SMD (psychosis, BD, depression), compared to non-clinical women (Røhder, MacBeth, et al., 2019; Røhder, Nyström-Hansen, et al., 2019). Factors that influenced the maternal representations of women with SMD were symptom severity, lack of social support, adverse childhood experiences and parental mental illness during own childhood (Røhder, Nyström-Hansen, et al., 2019). In our study, all women with a low level of concern reported long-lasting relational conflicts with their own background family, and we hypothesised that defensive processes might have complicated their process of acknowledging their own postpartum risk (Paper I). Some women's narratives were characterised by unresolved relational traumas. Their narratives may indicate that the identity reorganisation process

through encountering the “ghosts of mothering received” (Nelson, 2003) had not been sufficiently reworked and resolved (Cohen & Slade, 2000). Thus, for some women, the transition to motherhood may be burdened by a double risk of having BD and conflicted maternal representations.

6.1.3 Postpartum illness relapse and symptom load

Direct comparison of postpartum relapse rates between studies is difficult. For instance, studies differ regarding the duration of postpartum follow-up (i.e., 1 - 12 months postpartum), inclusion of women with BD I and/or BD II diagnoses, and women with or without medication (Wesseloo et al., 2016). In our sample, 46.1 % of the women had a mood episode between birth and three months postpartum: 11.5 % mild, 15.4 % moderate and 19.2 % severe (Paper II). With reservations due to comparison difficulties, our rate of 46.1 % corresponds relatively well with the upper estimated limit (i.e., 45 %) of overall relapse rate in the meta-analysis of Wesseloo and co-workers (2016). Relapse rates ranged between 9 % - 75 % in their included studies (Wesseloo et al., 2016). Consistent with the meta-analysis (Wesseloo et al., 2016), most episodes in our sample were depressive (Paper II).

MP women in our study experienced more affective episodes (61.5 % vs 30.8 %) within the first three months postpartum than PP women, although more MP women used medication in pregnancy (77 % vs 54 %). As a trend, more additional risk factors for postpartum relapse were present among the MP women who experienced a mood episode than among the PP women with mood episodes. These factors included mood deviations in the current pregnancy, mood episodes in previous postpartum periods, high lifetime relapse rate and family history of BD (Akdeniz et al., 2003; Bergink et al., 2012; Doyle et al., 2012; Freeman et al., 2002; Jones et al., 2014).

During our 12-month follow-up, there were four severe illness relapses requiring hospitalisation. Two women (1 PP, 1 MP) were hospitalised with psychosis within two weeks postpartum. The MP woman had a second psychotic episode at 11 months postpartum, and yet another woman (PP) experienced a borderline-psychotic mixed episode at 12 months postpartum. In addition, one woman experienced a manic episode without hospitalisation within 0-3 months postpartum. Thus, when applying the definition used by Wesseloo and co-workers for a severe episode (i.e., psychosis, mania, mixed episode and/or psychiatric hospitalisation), 15.4 % of the women in our sample experienced a severe postpartum illness

relapse, which corresponds relatively well with their report of 17 % in the meta-analysis (Wesseloo, et al., 2016).

It was not possible for us to obtain reliable information on mood episodes between three and 12 months postpartum, but we reassessed the presence of mood symptoms with IDS and YMRS at 12 months (Paper III). Compared to the presence of symptoms at three months, the proportion of women with moderate to severe mood symptoms (i.e., depressive; hypomanic/manic; mixed) had increased from 34 % to 54 %. In sum, our assessments give a picture of the first postpartum year as burdened by mood deviations for a considerable group of mothers with BD, corroborating the fear of illness relapse among the women in our research (Paper I).

Given the increased presence of mood symptoms, the observation that follow-up from mental health services showed a declining trend from pregnancy to 12 months postpartum is worrisome. In pregnancy, 76.9 % of the women received mental health interventions. This proportion was reduced to 57.7 % at three months postpartum and to 38.5 % at 12 months – half the proportion in pregnancy. The proportion of women on medication altered correspondingly: 65.4 % in pregnancy, 73.1 % at three months postpartum, and back to a proportion of 65.4 % at 12 months (see section 4.2.2.1). The reduction in follow-up from mental health services is in contrast with BD women's request for continuing care in trustful relationships with specialists, where ongoing support is available for the illness and motherhood (Stevens et al., 2017). Noteworthy, follow-up studies of women with severe postpartum mental illness have shown poor development in mood symptoms over time for a substantial group of women, warranting comprehensive and long-term management plans (Reilly, Brake, Briggs, & Austin, 2019; Vliegen et al., 2013).

6.1.4 Interaction difficulties in dyadic coordination and synchrony

The main findings from Papers II and III were the BD dyads' continuous difficulties in the interactional domain of dyadic coordination. Among maternal, infant and dyadic behaviour, the latter domain most strongly differentiated the BD sample from the non-clinical sample in the first postpartum year.

Dyadic mutuality and reciprocity were evidently problematic among the BD dyads. In addition, the dyadic exchanges were affectively subdued, with little shared positive affect but also little anger or tension, illustrating a narrow range of affective expressiveness. Taken

together, our research findings revealed continuous challenges for mothers with BD and their infants in “finding” each other and sharing a positive “rhythmic dance” (Papers II and III).

In my discussion, I use the concept of dyadic coordination as interchangeable with dyadic synchrony since the dyadic variables in PCERA (Clark, 1985, 2006, 2009, 2010) (See Supplementary File 1, Paper III) overlap with the various terms applied in research on dyadic synchrony (see Table 7). Furthermore, the empirical and theoretical work on synchrony suggests important implications for child development relevant for our research (Feldman, 2007a, 2007b, 2015; Granat, Gadassi, Gilboa-Schechtman, & Feldman, 2017; Harrist & Waugh, 2002; Leclere et al., 2014).

Synchrony may be viewed as an active behavioural dialogue between mother and infant contingent on both partners’ capacity to take social initiatives and respond to each other in a dynamic adaptation over time (Feldman, 2007a; Harrist & Waugh, 2002; Leclere et al., 2014).

As reported in Papers II and III, the mothers with BD demonstrated ongoing challenges in affective and behavioural involvement. In comparison with the healthy mothers, the mothers with BD had a significantly lower level of infant-attuned verbalisations and social initiatives. They had more difficulties in reading infant cues and displaying attuned contingent responses. The mothers with BD mirrored, as well as structured and mediated, the infants’ expressions to a lesser extent than the healthy mothers. The BD infants, for their part, expressed little positive affect and had a lower level of social initiative and responses than the infants of healthy mothers.

In Paper III, we concluded that subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours in the BD dyads in the first year. These behaviours are regarded as weak contributions to synchrony in interactions (Harrist & Waugh, 2002; Leclere et al., 2014).

Table 7. Components in synchrony, as proposed by Leclère et al. (2014).

Components	Description
1. A dyad	An interactive unit.
2. Mutuality	The partners are mutually regulated.
3. Reciprocity	The partners show reciprocity, adaptation, flexibility and conformity to each other.
4. Rhythmicity	The partners maintain balance in the system.
5. Harmonious interaction	The partners frequently share or experience similar behavioural states and affect.
6. Maintained engagement	The partners experience prolonged social engagement characterised by mutual attention and turn-taking.

When applying the different components of synchrony (Table 7) in the interpretation of our findings in Papers II and III, we may summarise that both partners (i.e., mothers and infants) were overtly regulated but with little mutuality (point 2). The partners showed little reciprocity as expressed in turn-taking (points 3 and 6). The constricted range of affect and social behaviours indicate reduced flexibility and sharing of affect (points 3 and 5). Regarding point 4, the partners maintained a balance in the interaction system, but more in the sense of “too little going on” than a continuous dynamic adaptation. The identified underinvolvement on behalf of both partners was not in agreement with prolonged social engagement with mutual attention and turn-taking (point 6) (Leclere et al., 2014).

The establishment of dyadic coordination and synchrony seems to be of particular significance during a sensitive period between two and nine months, although its precursors may be observed within the first hours after birth (Feldman, 2015). We identified significant difficulties in dyadic coordination among BD dyads at three months postpartum (Paper II), indicating that on the threshold of developing dyadic coordination, the BD dyads had already stumbled. Their dyadic difficulties continued in the first year (Paper III), thus deviating from normative development of increased coordination in this period (Evans & Porter, 2009; Harrist & Waugh, 2002; Tronick & Cohn, 1989). The comparison dyads showed trends of increased coordination from 3 to 12 months and significantly higher levels of coordination than the BD dyads at both time points (Paper III).

Because synchrony is a feature of the dyadic system, it may be compromised by risk conditions originating in both mother and infant (Feldman, 2007a). In Paper II, we elaborate

somewhat on possible explanations relating to mother and infant, respectively, in trying to interpret the dyadic findings. Additionally, disruptions in dyadic coordination have been observed in dyads with maternal unipolar depression (Feldman, 2007a; Granat et al., 2017; Leclere et al., 2014; Tronick & Weinberg, 1997). Notably, in cases of unipolar depression, maternal “building blocks” of dyadic synchrony such as infant attuned vocalisations, gaze, affect, touch and proximity are decreased (Feldman, 2007a; Tronick & Weinberg, 1997). Moreover, infant avoidance and self-regulation during positive moments (Granat et al., 2017) and mutual withdrawal behaviour in mother and infant (Gandillot, Wendland, Wolff, & Moisselin, 2012) are increased. Whether and how our dyadic findings are linked to depressive symptomatology or other factors related to BD requires further investigation. In our research, we could not confirm an association with concurrent symptom load (Paper II).

Correlational and longitudinal studies suggest that dyadic coordination yields formative experiences within different biopsychosocial domains (Feldman, 2007a; Harrist & Waugh, 2002; Leclere et al., 2014). Developmental outcomes are reported in capacities for self-regulation, learning and cognitive development, play and symbolic use, empathy and attachment across childhood and adolescence (Evans & Porter, 2009; Feldman, 2007a; Harrist & Waugh, 2002; Leclere et al., 2014). Thus, our findings of continuous and evident difficulties in dyadic coordination indicate enhanced developmental risk for bipolar offspring (Paper III).

Finally, most mothers with BD in our research expressed concerns about their disorder affecting mothering, even if this concern was primarily related to active mood episodes (Paper I). The women feared that depression could trigger withdrawal behaviour, which corresponds with findings on maternal behaviour in Papers II and III. Notably, the mothers anticipated fussiness, crying and displaying tension as infant reactions to their mood episodes (Paper I). This indicates a risk that the observed infant behaviours of subdued affect and underinvolvement (Papers II and III) may be overlooked as possible reactions. That is concerning since these behaviours may indicate infant social withdrawal, which in turn may be a sign of infant distress that needs attention (Puura et al., 2010; Puura et al., 2013).

6.2 Methodological considerations

All research entails methodological challenges. When conducting clinical research with vulnerable groups, the challenges often become particularly apparent. Inevitably, certain pragmatic compromises will occur, resulting in a gap between the “ideal” research standards

and what is possible to carry out in a given study. As this gap yields consequences for the interpretation of the results, methodological concerns must be addressed.

Since the current study used a mixed methods approach, it has had the advantage of being able to capture different perspectives and phenomena with more breadth and depth than would have been possible to achieve with either a qualitative or quantitative method alone. However, qualitative and quantitative approaches produce different methodological considerations. Specifically, issues such as validity, reliability and generalisability are viewed and treated differently in qualitative and quantitative research traditions (Hesse-Biber & Johnson, 2015; Maxwell, 2012; Mays & Pope, 2000; McLeod, 2011; Shadish et al., 2002). Nevertheless, despite these differences, both approaches must deal with quality criteria and the fundamental questions: Has the study succeeded at investigating what the researcher set out to investigate? Is the research trustworthy and believable? Are the inferences supported by the research findings? To what extent are the findings generalisable?

Thus, in this section, I need explore quality criteria for both qualitative and quantitative research. I will first focus on issues regarding the BD sample that relate to the research as a whole. Thereafter, I address quality and methodological issues relating to the individual studies, qualitative (Paper I) and quantitative (Papers II and III).

6.2.1 Bipolar disorder sample

6.2.1.1. Recruitment and sample size

We had a total BD sample of 26 women with their infants. The conventions and logics for sample size and sampling are different in qualitative and quantitative research (Mason, 2002). The sample size of 26 women in our qualitative study (Paper I) is within the common range of 15 to 30 individuals in research that has a broad exploratory focus and aims to identify patterns across data (Braun & Clarke, 2013). For the quantitative parts of the study (Papers II and III), the sample size is relatively small and posed some statistical limitations (elaborated below in methodological considerations on Papers II and III).

Originally, we set out to recruit N=50 in the BD sample. However, our expectations of difficulties with identifying and recruiting pregnant women with BD were confirmed and correspond with the reports of other researchers (Dolman et al., 2016; Driscoll et al., 2017; Harder et al., 2015). Several matters may explain the recruitment difficulties. The women have a SMD, which in itself requires effort and time to manage. Additionally, our study

required participation during a potentially stressful and very sensitive phase of life (i.e., pregnancy, childbirth and the first year postpartum). Another matter is that women with SMD may be sceptical about the consequences of being monitored and concerned about being involved with child protection services. In general, it is expected that these matters result in potential participants being reluctant and even declining to join a research study. The inclusion criteria in our study, which required a cohabitating partner who also agreed to participate, limited the recruitment possibilities further. Given the funding for the study, we had limited resources and time frame for the recruitment (two years). Eventually, we reached N=26 within our time limit.

6.2.1.2 Diagnosis

The women's BD diagnosis (BD I or II) was clinically established. Preferably, we should have conducted a standardised validated diagnostic assessment before inclusion in the study to verify the diagnoses. However, this assessment was not performed, primarily to avoid placing undue strain on the women in a sensitive phase of life. Another reason was the limited resources in the study.

As described in the methods section, the women's BD diagnosis was verified by examining their specialist mental health patient records and/or by contacting their specialist mental health worker. All women had received their diagnosis in the specialist mental health service. Additionally, several questions in the study interview concerned BD characteristics. This ensured important information about the illness that could support or even question the diagnosis. In fact, one woman's responses in the interview made me uncertain about her BD diagnosis, as she seemed more in the direction of recurring depressions, and it was decided not to include her in the current study. The other women's responses supported their BD diagnosis.

6.2.1.3 Representativeness and selection bias

The literature reflects that women with SMD often are characterised by multiple problems, such as poor life conditions and restricted relational resources (Bybee, Mowbray, Oyserman, Lewandowski, & Research, 2003; Lewin & Templin, 2016; Oyserman, Mowbray, Meares, & Firminger, 2000). The women in our BD sample were satisfied with their life situation (i.e., housing and economy) and had a cohabitating partner, and several also had access to a supporting family network. The education level was on par with the general Norwegian population, and 46 % of the BD women worked full-time. Furthermore, the women had the

capacity to participate in a longitudinal research investigation in a demanding and sensitive phase of life. Additionally, the infants in our BD sample represented low biomedical risk with regard to negative birth outcomes described in the literature (e.g., SGA and low birth weight) (Rusner et al., 2016). Hence, our BD sample may represent a skewed “resourcefulness”. Still, I may argue that within the sample there was reasonable variation regarding demographic and clinical characteristics relevant for our investigation (elaborated further below in methodological considerations on Paper I).

Altogether, the indications of skewed resourcefulness imply that I cannot infer that our BD sample represents the BD population at large, thus limiting the generalisability of the findings. It is reasonable to assume that the levels of concern (Paper I) and interactional difficulties (Papers II and III) found in the current research may be even higher among mothers with BD who have additional risk factors such as single motherhood, substance abuse, socioeconomic difficulties, and infants with negative birth outcomes.

6.2.2 Paper I

In addition to the different ontological and epistemological paradigms that define quantitative and qualitative research, there exist a variety of qualitative approaches with their respective philosophical assumptions and quality standards (Levitt, Motulsky, Wertz, Morrow, & Ponterotto, 2017; Maxwell & Mittapalli, 2010; McLeod, 2011; Morrow, 2005).

I have read and found recommendations and guidelines for quality criteria in different literature (Elliott, Fischer, & Rennie, 1999; Hamberg, Johansson, Lindgren, & Westman, 1994; Hesse-Biber et al., 2015; Mays & Pope, 2000; Yardley, 2000, 2008). In my thesis, I draw mainly on the recommendations from Levitt with co-workers (Levitt et al., 2017). They have developed a framework with principles to promote methodological quality and integrity in qualitative research in psychology, based on a synthesis of the qualitative literature (Levitt et al., 2017). Levitt and co-workers (2017) propose the overarching concept of methodological integrity as the methodological foundation of trustworthiness of qualitative research. At the core of methodological integrity they further distinguish two central constituents: fidelity (to the subject matter) and utility (in achieving the research goals) (Levitt et al., 2017). Naturally, in my work, I have also leaned on quality guidelines presented by Braun and Clarke (2013) as they apply to thematic analysis. Quality principles from other sources will also be evident in the discussion below.

As a structure for my reflections on the methodological considerations in Paper I, I use the concepts and principles from Levitt et al. (2017, p. 11), which focus on methodological integrity in data collection and data analysis, respectively. The concepts, with respective principles, are numbered consecutively below (eight).

6.2.2.1 Data collection

1. Fidelity to Subject – “Are the data adequate?”

Levitt et al. (2017) suggest that “Fidelity is improved when data are collected from diverse sources that can shed light upon variations in the phenomenon as they are relevant to the study goals.” (p. 11).

As described above, our BD sample may express skewed “resourcefulness”. Nevertheless, the sample represents reasonable diversity regarding demographic and clinical characteristics relevant to our study goal. The number of primi- and multiparous women was equal, as was the number of women having education up to and above secondary school level. The same variety holds for employment status, where approximately half of the sample was working full-time and the other half part-time and/or was receiving benefits. Additionally, the age range was quite large. We had participants from large and smaller cities, as well as district areas.

The clinical characteristics also reflected variations. Both women with BD I and BD II were represented. The years having had a BD diagnosis ranged from newly diagnosed to 16 years. Illness history as represented by number of hospitalisations was also diverse. There were women with and without medication, and they received different mental health services. There were also variations regarding the women’s perceived mood stability.

Through these variations, the sample represented different characteristics and experiences when having BD, which extended the possibility for multiple viewpoints in relation to our research questions, i.e., “a richness of the subject matter” (Levitt et. al., 2017, p. 11).

However, women without partners did not participate. Thus, their experiences and viewpoints are likely to differ but were not represented in our data.

Levitt et. al.’s principle of “...data (...) collected from diverse sources...” (2017, p. 11) may also be understood as the use of different data collection methods. Our study is an interview inquiry. For the first research question, this approach poses only minor issues since we were

interested in how the women perceived the risk for a postpartum illness relapse and their concerns. Interviewing is well suited for gaining adequate data on these matters. For the second research question, one may point to limitations since an interview only covers what the women report regarding resources and preparations. We do not know whether they actually make use of the resources in preparing for the dual demands of illness and motherhood. Thus, a potentially fuller picture could have been obtained in triangulating with additional data sources, such as, for example, observations (Braun & Clarke, 2013; Gibbs, 2007). This triangulation was not performed. Notably, several MP women linked their narratives of current resources and preparations to “lessons learned” from previous pregnancies and postpartum periods. One may argue that this gave their accounts groundedness and credibility.

Although Levitt et al. (2017) do not directly connect fidelity and adequacy of data to the concepts of accuracy and validity, I want to add some reflections on these concepts as they relate to the current research.

In interview inquiry based on qualitative research, the conventional concept of reliability is debated and even rejected, as it is more associated with quantitative research (Brinkmann & Kvale, 2015; Mason, 2002). A central question underlying the debate is whether knowledge produced through interviews can be objective (Brinkmann & Kvale, 2015). Both Brinkmann and Kvale (2015) and Mason (2002) try to reconceptualise reliability to be relevant to interview research.

Applied to our study, one aspect concerns consistency as to whether the women would have given similar answers (i.e., shown similar results) at another time point, in another setting and to another interviewer. The interview was semi-structured with an interview guide to ensure that the same topics were covered across all interviews, thus strengthening the possibility for consistency and replication of the interview inquiry. On the other hand, an interview is a conversation, and knowledge is “produced” and socially constructed in each encounter (Brinkmann & Kvale, 2015). For example, the use of follow-up questions to probe elaborations may differ across interviews. In the current study, I adjusted follow-up questions to the individual woman’s affective state at the time of interviewing. Four women were affected by mild depressive symptoms, and one woman was mildly hypomanic. These matters have likely influenced the interview conversations and may also have biased the women’s descriptions and reflections. However, shifting moods represent the nature of living with BD.

Thus, regarding only viewpoints in euthymic phases as reliable and valid viewpoints worth reporting may be ontologically and epistemologically debatable.

Related to the topic of consistency is the question of reactivity. This issue includes whether the interview questions generated thoughts and reflections in the women that were not “there” without the interview. Some of the women made statements such as “Hmm, that is an interesting question. I have not thought about that before. But, I believe...”. If a knowledge claim is to “collect” data that the women “had in them” before they entered the interview situation independent from the questions, then this type of response may pose a validity problem. However, if a knowledge claim is to describe various experiences and viewpoints – whether old (what they “had in them”) or new (constructed in their reflections in the interview situation) – both old and new viewpoints can be valid (Brinkmann & Kvale, 2015). I join Brinkmann and Kvale (2015) in the latter knowledge claim. As research interviews rely on conversations, I believe that old and new knowledge is inevitably intertwined in the answers given.

Brinkmann and Kvale (2015) further discuss the common methodological critique that findings from interviews are not valid because the participants’ reports may be false. Indeed, an interviewee may not be telling the “truth” about factual states of affairs, but the statements may still express the “truth” of the person’s view of himself or herself and of the phenomena studied. In addition, there is no guarantee that a participant’s answers to a questionnaire would be more truthful. It may actually be more possible to check the trustworthiness in an interview by validity tests such as questioning further, asking for clarifications, following up on contradictions, looking for negative evidence and making “if-then” tests (Brinkmann & Kvale, 2015).

In the current study, there may particularly be a question of “false” reports in relation to two issues. The first concerns the seven women who were interviewed postpartum. Their recall might have been biased because of not remembering their concerns in pregnancy or having revised their viewpoints after birth. In my evaluation of this matter, the following was considered: Four of the seven interviews were among the longest interviews in the sample, two were of mean length, and one was 50 minutes. The length is in itself no evidence for true reports. However, my interview notes document that within this generous time frame, all seven interviews were characterised by open contact and in-depth conversations in which the

women elaborated and reflected extensively on the topics. Taken together, it is my evaluation that these seven women gave rich and nuanced descriptions of their pregnancies.

As touched upon above, the second question of possible false reports concerns the women's accounts on resources and preparations. In fact, in the interview, there is no question that explicitly addresses what resources and preparations the women could foresee as important regarding the dual demands of illness and motherhood. We did not want to pose a leading question that presupposes these deliberations. Although there is one question that generally asks whether there are any supporting resources in the woman's life, it was primarily up to the woman to link the available resources to the needs of being a mother with BD.

Furthermore, what preparations the women envisioned evolved in the narratives without a specific question. This yields the reports more credibility than if I had explicitly asked about preparations.

Finally, the concept of descriptive validity (Collins, 2015) concerns whether I "got the facts right" – the factual accuracy of an account as reported by me. In audiotaping the interviews, I strengthened the possibility of ensuring factual accuracy about what the women said.

Furthermore, at 12 months postpartum, a validation was conducted at a second interview in the overarching Bi-sam study. The women were presented with verbal summaries of their first interviews. All women confirmed that their accounts and viewpoints were portrayed accurately.

2. Fidelity to Subject – Perspective management in data collection

Levitt et al. (2017) propose that "Fidelity is improved when investigators recognise and are transparent about the influence of their perspectives upon data collection and appropriately limit that influence to obtain clearer representations of their phenomenon – regardless of the researchers' direct experience with or standpoint in relation to that phenomenon." (p. 12).

Here, the subject of reflexivity is significant, which is a central concept concerning credibility of the data in qualitative research (Collins, 2015; Finlay & Gough, 2008; Gibbs, 2007; Malterud, 2001; Yardley, 2000, 2008). Reflexivity includes the process of being critically reflective and aware of oneself as a "human instrument" in the research (Collins, 2015). In qualitative research, the subjectivity of the researcher is recognised as a resource and integral to the project, but at the same time, it is important to critically approach how one might introduce potential bias that compromises the trustworthiness (Finlay & Gough, 2008). This

approach requires a reflective practice in which the researcher actively and critically identifies and attends to his/her preconceptions brought into the study. These preconceptions may come from social background, personal and professional beliefs and experiences, and theoretical foundations and assumptions (Collins, 2015; Finlay & Gough, 2008; Malterud, 2001, 2017). Elliot et al. (1999) label this process “Owning one’s perspective” (p. 221) and ask researchers and authors to specify their theoretical orientations as well as personal anticipations and assumptions. Such disclosure will help readers interpret and understand the data and consider possible alternatives.

In the process of being reflective and “owning my perspective”, I have particularly, but not exclusively, considered the following when conducting the study:

I do not have an insider’s view in regard to being a mother with BD or having a mental disorder. Nonetheless, I am a woman and a mother. I have met many perinatal women with mental health problems, including BD, as a clinical psychologist in an infant mental health team in secondary mental health service. In this work, I have encountered different experiences, viewpoints and positions in women’s transitions to motherhood when having mental health problems. Such diversity has engaged me, inspired me to search for more knowledge and, eventually, motivated me to conduct the current study. I have recognised the roots of this engagement in both my personal and professional orientations.

Since I was quite young, I have taken an active stance toward life changes and transitions. What may the change bring with it? What do I leave behind? What do I want to take with me further? How will I be changed?

Undeniably, becoming a parent is one of life’s most profound transitions. In my first pregnancy, I engaged in many reflections about my own childhood, my parents as parents, and what I wanted to “bring on” and “try to stop” in the intergenerational transmission. I actively made a “mental list” and have continued to think about its content through my years as a woman and mother (whose children are now young adults (!)). Professionally and theoretically, I found a deep resonance with my reflections when I read Daniel Stern’s “The Motherhood Constellation” a few years after my first pregnancy (Stern, 1995). Further foundations for my thoughts on the transition to motherhood were developed in reading Ian Brockington’s “Motherhood and Mental Health” (Brockington, 1996) and Margareta Brodén’s “Graviditetens möjligheter” (Brodén, 2004). My view on perinatal psychology is also professionally rooted in early developmental psychology, which highlights the infant’s

emotional and relational needs. Additionally, attachment theory, including theories about mentalising and “parental reflective functioning”, are significant professional anchor points for me and are thus influential on my perspectives on motherhood and life transitions (Cassidy & Shaver, 2008; Fonagy, 2001; Jurist, Slade, & Bergner, 2008; Slade, 2005; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005).

Importantly, I have had to acknowledge several times that the way I relate to life transitions may differ from other people’s approaches. These experiences have been helpful in my perspective management while performing interviews in the study. I posed questions about experiences and thoughts on pregnancy, reflections on the impact of BD on motherhood, and the like. In our sample, there were women who elaborated and reflected extensively on these topics, while others did so moderately. There were also women who described few thoughts, and some even expressed doubts regarding the questions: “I don’t know. Such odd questions. Do people really think about these kinds of things?”

First, it was an ethical aspect of the research not to impose a feeling of shortcoming in women who described few thoughts. Second, both ethically and methodologically, it was important that all women felt free to answer the different questions from their own viewpoints, not the ones they thought I wanted to hear. I was deliberate in stating that I welcomed variety, that I had an exploratory focus, that there is very little knowledge on perinatal experiences in the context of BD, and that, therefore, all viewpoints were valuable. Brinkmann and Kvale (2015) emphasise that the interviewer should be deliberate in leading the research interview toward certain themes, however not leading to specific opinions about the themes. This differentiation I kept as a constant reminder.

In ending the interview, I asked the women whether they had any comments about the interview and whether they felt that something had been omitted in my questioning on which they wanted to speak.

Reflexivity also helped me be attentive to preconceptions from my prior experiences in secondary mental health service, where I have worked with a selected group of perinatal women with BD. It was important for me to exhibit openness and curiosity to new phenomena and experiences about early motherhood in the context of BD other than those I had encountered in clinic (Brinkmann & Kvale, 2015).

3. Utility in Achieving Goals – “Are data contextualised and limits clear?”

Levitt et al. (2017) argue that when findings are considered within their proper context - such as location, culture, time period - their utility is improved. Tables 1 and 2 in Paper I and the additional descriptions of the exclusion criteria and recruitment areas in Paper I, I comply with these proposals.

The principle of contextualisation (Levitt et al., 2017) concerns possibilities and boundaries for generalisation. Generalisation as a horizontal extension of the findings is debated in qualitative research because of the context-bound nature of knowledge and focus on subjectivities (Braun & Clarke, 2013; Brinkmann & Kvale, 2015; Mason, 2002).

Transferability has been suggested as a more applicable and useful concept in qualitative research than generalisation (Braun & Clarke, 2013; Brinkmann & Kvale, 2015).

Transferability refers to the extent to which aspects of the qualitative findings can be transferred to other relevant situations and contexts.

My goal in this study has been to present a reasonable and relevant picture of how perinatal women with BD may relate to their risk of illness relapse, their concerns, resources and preparations. My aim has been to capture - through data collection and analysis - some common and important themes that may be transferable to and useful for other women in the same life situation. This is comparable to naturalistic generalisation, which rests on personal experience. Here, the reader of the findings can generalise from his or her own personal or vicarious experiences, and the knowledge leads to expectations and propositions rather than predictions (Brinkmann & Kvale, 2015; Onwuegbuzie & Hitchcock, 2015). This propositional generalisation is also found in the concept of analytical generalisation, i.e., a reasoned judgment about the extent to which the findings can be used as a guide to what might occur in another situation. The similarities and differences of the situations are analysed (Braun & Clarke, 2013; Brinkmann & Kvale, 2015; Onwuegbuzie & Hitchcock, 2015). By specifying the supportive evidence, giving rich contextual descriptions and making arguments explicit in the paper, the researcher allows the reader to judge the soundness of the transferability and generalisation claim (Brinkmann & Kvale, 2015).

I find the above forms of generalisation and transferability relevant for the question “What lessons can we learn from the findings (Mason, 2002), relevant for other pregnant and perinatal women with BD?” As mentioned before, an important limitation to bear in mind is that this study did not include single mothers. However, when reasoning by the principles of

transferability, naturalistic and analytical generalisation, it may be possible to uncover aspects of the findings that can also be relevant for these mothers.

4. Utility in Achieving Goals – Using Data as Catalyst for Insight

The last data collection principle from Levitt et al. (2017) concerns the importance of collecting data that are unconstrained and provide rich grounds for insightful analyses. In concrete terms, ensuring such collection can mean choosing certain personnel to conduct the interviews and deciding how to introduce the interviewer and how questions ought to be framed, all with the goal of providing “rich data”.

The fact that I am a clinical psychologist may have had advantages and disadvantages regarding this specific principle, i.e., been a double-edged sword.

In introducing myself to the women, I described my position as a clinical psychologist, my experience with the study topic and the background for the study. Some women explicitly expressed that it was important for them to be interviewed by a person who “knew what they were talking about”. Several women stated that they had searched for knowledge and information about being pregnant, becoming a mother and having an infant and family with BD but had not found it. They were happy to be able to contribute with their thoughts and experiences to a clinical psychologist conducting research. This position may have given me legitimacy and an easier access to the women’s experiences. Furthermore, I believe that my field knowledge enabled me to be more targeted in certain clinically relevant follow-up questions. Brinkmann and Kvale (2015) underline the importance of the interviewer’s familiarity with the theme investigated to the ability to pose relevant questions. However, the idea that I was someone who “knew what they were talking about” may have had unintended consequences. Both the women and I may have taken some implicit knowledge and understandings for granted. This situation could have been different with a naïve interviewer, possibly resulting in even more details and alternative perspectives.

A clear advantage of me being a clinical psychologist is that I am used to containing and handling communication with strong emotions, and I do not become anxious about such situations. I am also receptive to situational and individual cues, for example, signals of dysregulation, and know how to intervene regulating. This position may have contributed to a “safe setting” in which the women could be open about stressful and emotion-evoking themes. No interviews were interrupted, and almost all women expressed that the interview

was a good experience and conversation, even if several of them were emotionally moved in the interviews.

Still, in hindsight, I see a disadvantage in being a clinical psychologist conducting interviews. I evaluate that in some interviews, I safeguarded the clinical principle of establishing a working alliance too much, which led me to be too cautious. In some cases, it was right to not probe for more elaboration in order not to dysregulate a woman. However, in listening to the audiotapes and reading transcripts, I believe that in some interviews I could have gone further in the questioning. I left the subject too soon.

Finally, the key questions about experiences and thoughts in pregnancy, and thoughts about motherhood, were framed and posed open-ended. The order in which the questions in the interview guide were presented was also adapted to the natural development of each interview. By letting the women choose where they wanted to be interviewed, we facilitated that they would feel comfortable and at ease. I evaluate that through these different measures we enhanced the possibility for unconstrained and rich data in the interviews.

A qualitative research concept that is related to “rich data” is data saturation. Saturation usually refers to an observation that additional data does not generate new or richer information –it only gives more of the same (Braun & Clarke, 2013). Typically, saturation has consequences on sample size, where no further participants are included in a study when data saturation has been reached. However, we did not evaluate data saturation. We needed as many participants as possible for our quantitative research questions (Papers II and III) and allowed this circumstance be decisive for sample size. We had no reason to exclude any participants from the qualitative study (Paper I).

6.2.2.2 Data analysis

Essentially, the means to transform qualitative data into scientific knowledge is the analytic work.

5. Fidelity to Subject – Perspective management in data analysis

This principle compares to the aforementioned reflexivity in data collection. Thus, the outline of “owning my perspective” will not be rewritten here. I want to note challenges embedded in data analysis and the measures I took to promote perspective management.

Taking an inquiring and interpretative position on data, i.e., asking “what the data mean” in relation to the research questions is a multilayered and active mental process. On the one hand, it requires that you “immerse” yourself in the data to become familiar with it and, on the other hand, that you manage to distance yourself for an analytic and critical perspective (Braun & Clarke, 2013). Inevitably, your “own perspective” is a companion in these activities.

Even though the data analysis had an inductive approach in which the themes were data-driven (Braun & Clarke, 2013), it is not possible to be fully free from preconceptions and perspectives influenced by theory and experience (Finlay & Gough, 2008; Willig, 2012). In particular, perinatal psychology (Brodén, 2004; Cohen & Slade, 2000; Stern, 1995; Tyano, Keren, Herrman, & Cox, 2010) has constituted a theoretical lens and formed a frame of reference in the analytic process.

In my process of enhancing fidelity and sensible analysis, I discussed the analytic work and interpretations with my supervisors. My main supervisor read all the transcripts and therefore had an independent relationship to the data. He has a different clinical experience, specialisation and theoretical orientation than I do. Our discussions were a way of using triangulation in the analysis, not in the sense of establishing a unified “truth” but as a way of being critical, obtaining a more comprehensive picture and strengthening the analytic claims (Braun & Clarke, 2013). Elliot et al. (1999) incorporate this activity in their credibility check and verification step to process discrepancies, overstatements or errors.

My second supervisor had not read the transcripts, which allowed her to have a naïve position in addressing possible omissions and contradictions in the analytic process.

I have also discussed interpretations and received critical input from colleagues and peer groups within and outside the perinatal work field.

Furthermore, I spent substantial time reading, noting and reflecting on the data. Since I conducted a thematic analysis, my analytic steps were based on and repeatedly checked-back to the principles of Braun and Clark (2006; 2013), critically supplemented by the perspectives of Mason (2002).

6. Fidelity to Subject – Groundedness

The principle of groundedness emphasises that the meanings identified in the analysis must be rooted within the data in an understandable way (Levitt et al., 2017). This requirement is comparable to interpretive validity, where the analytic narrative must portray and draw meaning from the participants' perspectives (Collins, 2015).

How can I defend the analysis as valid and acceptable? In the methods section in the thesis (section 4.5.1) and in Paper I, the analytic steps are described to demonstrate how the results were derived. Furthermore, we make extensive use of quotations in Paper I. This approach meets the request of using quoted material as supportive evidence of the findings and the analytic points (Braun & Clarke, 2013; Elliott et al., 1999; Levitt et al., 2017).

In qualitative research, the use of frequency counts of data is controversial and even discouraged (Braun & Clarke, 2013; Maxwell, 2010). Within the qualitative paradigm, it is argued that frequency does not determine validity and relevance of the findings (Braun & Clarke, 2013; Maxwell, 2010). Quantification implies a variable-oriented view (i.e., “whether”, “to what extent”), whereas a central epistemological aim in qualitative research is to study cases and processes (i.e., “how” and “why”) (Hesse-Biber et al., 2015; Johnson & Onwuegbuzie, 2004; Maxwell, 2010). Nonetheless, in Paper I, we use quantification of the qualitative data to report accurate occurrences of viewpoints. This approach makes the basis for our interpretative claims more transparent and contributes to groundedness (Mason, 2002; Maxwell, 2010). Notably, the reported views are spontaneously expressed in the interviews. We do not know the “true” number of women who actually held certain views since some may have had similar views without expressing them. Thus, the proportions reported may be conservative.

7. Utility in Achieving Goals – “Are the findings meaningful contributions toward the project goal?”

According to Levitt et al. (2017), this principle links to the former principle of data as catalyst for insight (i.e., data collection). Meanings generated in the research can serve many functions and be useful in different ways (Levitt et al., 2017). Yardley includes the impact and importance of the research, whether practical and applied, theoretical or socio-cultural, as a quality criterion (2000, 2008). Furthermore, Brinkmann and Kvale pose a legitimacy question for interview research in terms of its pragmatic goal in providing useful knowledge (2015).

In line with our research aim, the main purpose of the data analysis was to illustrate a broad reflection of predominant themes rather than to conduct an in-depth analysis of particular issues. Thematic analysis fits this descriptive and exploratory focus well, and a broad approach is suitable for research on understudied topics (Braun & Clarke, 2013). I argue that our broad analytic scope was a good choice in producing knowledge with value not only theoretically but practically and applied. How our findings contribute clinically is described in Paper I and in section 6.3.1 (Clinical implications) in the thesis.

8. Utility in Achieving Goals – Coherence between meanings

The last principle highlights that meanings developed in the analysis should make sense in relation to one another (Levitt et al., 2017). This requirement is in line with Braun and Clarke, who ask that the analysis tell a convincing and well-organised story about the data and topic (2013). According to Elliot et al., meaning should be represented in a way that achieves coherence and integration while preserving nuances in the data (1999). I find the concepts of coherence and integration implicit in Braun and Clarke's (2013) definitions of themes and subthemes. A theme is a central organising concept with patterned meaning across a dataset that captures something important about the data in relation to the research question. A subtheme captures and develops one notable specific aspect of the theme. Good themes are distinctive and make sense on their own but also fit with one another in the overall analysis and meaning (Braun & Clarke, 2013).

In my view, this principle captures the duality in seeking for patterns while, at the same time, acknowledging variations and trying to create meaning(s) that include this complexity.

The framework within which we searched for knowledge and meaning in Paper I constituted perinatal women with BD and their increased risk for postpartum illness relapse. In sorting data in distinct themes and subthemes that were named and organised hierarchically, we searched to create an overall meaning of the data. In a further search for coherence between meanings, we conducted cross-case analysis with the purpose of identifying similarities and differences between PP and MP women. Thus, we used parity as a principle in which different meanings could potentially make sense in relation to one another. Regarding one viewpoint, i.e., fear of psychosis, the type of BD was a more appropriate principle for sense-making than parity. Finally, as the analysis revealed different levels of concern for postpartum illness relapse among the women, we organised the women into three subgroups to enhance understanding and meaning of this subject.

In qualitative research, it is recognised that there is more than one “right” way of making meaning of the data (Braun & Clarke, 2013). Therefore, it is possible that other qualitative researchers would have sorted, named and organised the data differently than we did. Nevertheless, for knowledge production to be empirical, the analysis must be plausible, coherent and grounded in data (Braun & Clarke, 2013). In this review and discussion on quality criteria as proposed by Levitt et al. (2017), I have tried to be transparent and make a case for our findings in Paper I as empirical.

6.2.3 Papers II and III

Below, I describe methodological challenges and considerations in Papers II and III as they relate to principles for sound research practice and quality criteria within the quantitative paradigm (Field, 2013; Onwuegbuzie & Hitchcock, 2015; Shadish et al., 2002).

6.2.3.1 Sample size

As previously mentioned, a relatively small sample size such as ours is associated with statistical limitations. First, effects are harder to detect on a statistically significant level in smaller samples, thus increasing the probability for a Type II error (failure to detect a real effect) (Field, 2013; VanVoorhis & Morgan, 2007). We did, in fact, find evidence for group differences in interaction quality in both studies. Having accomplished this with such a limited sample size underscores the clinical significance of our findings.

In Paper II, we did not find that maternal concurrent symptom load was associated with interaction quality, either when analysing individual subscales or the PCERA scale as a whole. In addition, we did not find an association between infant medication exposure and interaction quality. In both cases, it is possible that an association could have been detected in a larger sample. Thus, the non-significant findings must be considered with caution since a Type II error cannot be ruled out in our hypothesis testing.

Second, small sample sizes increase the width of confidence intervals, i.e., imprecision in the estimates (Field, 2013). Consequently, the confidence intervals for the mean differences between the groups on the different subscales are large in both Paper II and III. This characteristic warrants some reflections.

In Paper II, should the “true values” of the significant group differences all tilt towards the smallest confidence bounds (see Table 3 in Paper II), it is not immediately given that the group differences are clinically relevant on the subscales “Maternal positive affective involvement, sensitivity and responsiveness”, “Maternal negative affect and behaviour”,

“Infant positive affect and behaviour” and “Dyadic tension”. We cannot rule out this possibility.

Regarding the subscale on “Dyadic mutuality and reciprocity”, even the smallest confidence bound of -0.64 corresponds to a substantial group difference with high clinical relevance.

In Paper III, should the “true value” of the significant group difference tilt towards the smallest confidence bound (see Table 2 in Paper III) on the subscale “Maternal negative affect and behaviour”, we cannot rule out that the group difference is of no clinical relevance since both group means were within an area of strength on this subscale according to PCERA. There is also a possibility that the same logic holds for the subscale “Infant quality of play, interest and attentional skills”.

However, on the subscales “Maternal positive affective involvement and verbalisation”, “Maternal intrusiveness, insensitivity and inconsistency” and “Infant positive affect, communicative and social skills”, the significant group differences would still be clinically relevant should the “true values” of the group differences tilt towards the smallest confidence bounds. On the subscales “Dyadic mutuality and reciprocity” and “Dyadic disorganisation and tension”, the group differences would still be of high clinical relevance on the smallest confidence bounds.

Notably, in both Paper II and III, there is no overlap of the 95 % confidence intervals for the respective mean values for BD sample and non-clinical sample on all the above mentioned subscales. This result may imply that the mean values represent two different populations (Field, 2013).

Furthermore, the effect sizes of the group differences in Paper II on the subscales “Maternal positive affective involvement and verbalisation”, “Infant positive affect, communicative and social skills” and “Dyadic tension” were all medium to large (Cohen’s d 0.73 – 0.74). On the subscale “Maternal negative affect and behaviour”, the effect size was large (Cohen’s d 0.81), and on “Dyadic mutuality and reciprocity” it was very large (Cohen’s d 1.32). In Paper III, the effect sizes of the group differences on the subscales “Maternal negative affect and behaviour”, “Infant positive affect, communicative and social skills” and “Infant quality of play, interest and attentional skills” were large to very large (Cohen’s d 0.97 – 1.19). On the subscales “Maternal positive affective involvement and verbalisation”, “Maternal intrusiveness, insensitivity and inconsistency”, “Dyadic mutuality and reciprocity” and

“Dyadic disorganisation and tension” the effect sizes were very large to huge (Cohen’s d 1.36 – 1.78) (Ellis, 2010; Sawilowsky, 2009).

6.2.3.2 Comparison group

Because of limited resources, we did not recruit a control or comparison group specifically for the current study; instead, we used existing data from 2005-2009. Whether this approach biased the comparisons is a reasonable question. Is it plausible that healthy mothers and infants on average interacted differently and/or “better” in 2005-2009 compared to 2014-2017? In other words, has the older interaction data resulted in Type I error (erroneously concluding an effect, when there in fact is none) (Field, 2013; Shadish et al., 2002; VanVoorhis & Morgan, 2007) and yielded a group difference that we would not have found with concurrent comparison data?

As stated before, interactions are transactional and dynamic processes between infants and their parents (Beebe et al., 2010; Tronick, 2007). At its core, parent behaviour is conceptualised as a product of complex interactions of biological, experiential and socio-cultural factors (Crockenberg & Leerkes, 2000; Feldman, 2007b; George & Solomon, 2008; Papoušek & Papoušek, 2002). With reference to the same literature, the likelihood that there would have been enough systematic changes within all or any of these factors to result in significantly different interaction contributions among non-clinical mothers in less than a decade is very small, nor is it likely that the behavioural and communicative foundations for infant interaction contributions have changed within this time span (Nelson & Bosquet, 2000; Zeanah, Boris, & Larrieu, 1997).

Moreover, normative and comparison data in clinical and psychometric assessments are often not contemporaneous.

Comparable with the BD sample not being representative of all dyads in which the mother has BD, the dyads of the non-clinical sample are not representative of the general population in Norway. The non-clinical sample consisted of mothers without known substance abuse or mental health problems, an above-average level of education and work participation, and healthy infants without birth complications. For the study aim, it was important that the mothers in the comparison group did not have substance abuse or mental health problems and that the infants did not have birth complications. From a research perspective, we would have preferred that the age, level of education and work participation be lower among the comparison mothers. However, in a sensitive transition phase such as pregnancy, it is not

surprising that it is the most resourceful mothers who agreed to join a longitudinal research project and saw the value in contributing as “comparisons”. Thus, we may conclude that both samples are skewed towards the resourceful end of the populations they represent. For generalisation, this entails limitations. For comparison – given the existing premises in the non-clinical sample – it was valuable that the BD sample also be a resourceful group.

Two dyads from the original non-clinical sample of 30 dyads did not participate in the mother-infant interaction assessments at 12 months. Regarding methodological and statistical considerations, it is noteworthy that the mean values for these two dyads on the different subscales at three months either matched or were above the group means. Thus, it is not likely to assume that the non-participation of these two dyads necessarily resulted in higher group means at 12 months for the comparison group (Paper III).

6.2.3.3 Information collection about affective symptoms and episodes 0-3 months postpartum

The collection of information about postpartum affective symptoms and episodes 0-3 months postpartum was performed by two means. There was direct contact with the mothers and/or their respective specialist mental health professionals at least once 1-2 months postpartum, in which affective symptoms and episodes were addressed. Furthermore, this information was examined retrospectively in an interview with all women at three months, in conjunction with the interaction session and assessment with the IDS and YMRS. Optimally, the women would have registered symptoms in a mood diary, which would have provided more reliable and valid information. This approach was originally planned in the current research. However, the women expressed reluctance when the use of a mood diary was thematised. The typical reasons were either practical – that it would be difficult to comply with in the hustles of daily life with an infant – or emotional – that the women felt the registration would lead to too much focus on mood, which they anticipated as frightening and stressful as new mothers.

6.2.3.4 Assessment of mother-infant interactions and objectivity in the assessments

The details and quality of mother-infant interactions are most objectively measured by observations with video-recording. There are several assessment methods for measuring mother-infant interactions with varying psychometric qualities (Lotzin et al., 2015). No assessment method has status as a gold standard, and various factors must be considered when selecting an appropriate method for a given study (Lotzin et al., 2015).

In Papers II and III, an important aim was a comprehensive assessment that included both maternal and infant behaviour and their dyadic coordination. In addition to this premise, it

was important that the applied assessment method covered the age span of three to 12 months and was considered relevant within clinical work and research. Furthermore, it was important to choose a method with well-established procedures for training and certification of coders. Based on these criteria, there were three possible assessment options: Coding Interactive Behaviour (CIB) (Feldman, 1998), the Child-Adult Relationship Experimental Index (CARE-Index) (Crittenden, 2006) and the PCERA (Clark, 1985, 2006, 2009, 2010). The PCERA has recently been reported as the instrument most used in research studies (193 publications documented in 2015 vs. 137 for the CARE-Index and 65 for the CIB) (Lotzin et al., 2015). The PCERA and CARE-Index have demonstrated the best validity evidence (Lotzin et al., 2015). Another important matter was the availability of experienced and certified coders, favouring either the PCERA or CARE-Index. A decisive reason for choosing the PCERA was that it contains more variables than the CARE-Index (65 vs. 15), thus allowing a more micro-analytic and explorative assessment. This affordance we regarded as important since mother-infant interactions in the context of BD are understudied. Finally, we could use existing completed ratings for the comparison group when choosing the PCERA.

Regarding rating objectivity of the BD sample's interactions, the coders were naïve to all information about the dyads except for the mothers' BD status. This situation may have influenced their ratings. Counteracting possible biases, the variables in PCERA are strictly operationalised in the manual, with extensive descriptions to enhance the precision of ratings (e.g., frequency, duration and intensity). Both coders were highly experienced, trained and certified as reliable coders. Moreover, they attained good inter-rater reliability on exact agreement on the ratings at both three and 12 months. The main coder for Papers II and III also coded the comparison data. In addition to mothers without substance abuse or mental disorders, that research study also included one group of mothers with substance abuse problems and one group with mental health problems. All information, including group status, was unknown to the coders. In this study, the coders also attained good inter-rater reliability for the ratings at both three and 12 months, calculated on categorical agreement (1-2, 3, 4-5) (Siqueland et al., 2014).

Finally, at the end of the video-recording sessions, the mothers in both samples subjectively evaluated the representativeness of the interactions. Nearly all mothers in both samples regarded the recorded interactions as representative. One mother in the BD sample felt awkward because of the video recording at three months. At 12 months, two mothers in the BD sample evaluated their infants to be somewhat affected by a viral infection and being a

little less active in their play than usual. We assess that such instances may have had some, but limited, impact on the main findings.

Because the locations for mother-infant interactions were not identical for the BD and comparison group, a question about validity may be raised. Based on ethical regard, the BD sample had the opportunity to choose the location for the mother-infant interactions, i.e., at their home or at the clinic (Papers II and III). The comparison group did not have this opportunity, and their interaction assessments took place in a professional setting. If this situation had been a requirement for the BD sample, then several participants would either not have joined the study or would have later withdrawn (as described in section 4.6.3), which would have led to an even smaller sample with more statistical limitations.

As a research principle, it is highly important and advisable to secure assessment situations that are as identical as possible for the study groups when comparing them on different variables. However, I argue that the flexibility and free choice of location for the BD sample created more optimal conditions for their interactions, potentially reducing the biases of stress and unfamiliarity. Since these procedural adjustments may be viewed as favouring the BD sample, I argue that the inferences of more challenges in mother-infant interactions in the BD sample, compared to the non-clinical sample, are valid.

Additionally, the literature suggests that assessments of interactions in the participants' homes strengthen the ecological validity (i.e., generalisability) of the data (Gardner, 2000).

6.2.3.5 Confounding variables

Particularly in studies that compare non-randomised or non-matched samples, there may be many different variables potentially influencing the results (Shadish et al., 2002). Thus, it is important to be mindful of possible confounding variables and to try to control for these in the analyses.

We included eight possible confounders in our analyses in both Paper II and III (maternal age, maternal education, maternal employment status, parity, infant gestational age, infant gender, infant birth weight and infant exact age at the interaction session). The inclusion of infant exact age at the interaction session is not common to include as a possible confounder, but we viewed it as important to examine because of possible differences in infant maturity related to age. Maternal age was found to have a confounding effect on some of the subscales in Paper

II and maternal age and employment status on some of the subscales in Paper III, and these effects were adjusted for. Group differences remained significant after adjustments.

We also considered smoking/nicotine use as a possible confounder. However, this was uncommon (range $n=1$ – $n=4$, depending on time point for registration) in both samples. Substance abuse is a known confounder, but this was an exclusion criterion. Both samples had cohabitating partners; thus, there were no single mothers. We are not aware of other possible confounders in our data set that could be justified based on previous work and the research literature.

Whereas the resourcefulness of our BD sample may limit the generalisability of the findings, at the same time, it also limits the possible confounding effects of generally disadvantageous life conditions.

6.3 Implications

6.3.1 Clinical implications

The main clinical implication of the current research is empirical support for the importance of a more comprehensive and psychologically oriented perinatal care for women with BD and their families. This adds to common clinical management, which has a narrower focus on illness course and medication (Sharma & Sharma, 2017; Yatham et al., 2018).

Paper I provided knowledge about concerns that BD women may have for the postpartum period and what the women recognised as important preparations and resources in trying to prevent mood instability to cope as mothers and secure the infant's care needs. Papers II and III reported on continuous difficulties in all three interaction domains among BD dyads throughout the first year. Our suggestions for addressing these matters clinically are outlined in the clinical implications in Papers I – III and are not replicated here.

However, several matters require further elaboration from a clinical perspective.

There is a growing notion that mental health in the perinatal period represents an important public health issue with unmet care needs (Howard, Piot, & Stein, 2014; Tyano et al., 2010). Some countries, for instance, the United Kingdom and Australia, have developed specialist perinatal mental health services (Austin & Highet, 2017; Howard, Megnin-Viggars, Symington, & Pilling, 2014). Such services do not exist in Norway. Therefore, the BD women's requests for follow-up from specialist mental health services in Paper I may be

comparable to women's requests for specialist perinatal mental health services in countries where these services exist (Dolman et al., 2016; Megnin-Viggars et al., 2015; Stevens et al., 2017). Obviously, procedures for collaborative care among specialists in perinatal mental health (adult and infant), general psychiatrists, obstetric care and primary health care services are more optimal than ordinary specialist mental health services (Austin & Highet, 2017; Howard, Megnin-Viggars, et al., 2014). Nevertheless, studies report on training needs due to insufficient knowledge, regardless of care level (Dolman et al., 2016; Doucet et al., 2012; Megnin-Viggars et al., 2015). Our findings in Papers I – III may contribute applicable and relevant knowledge to the improvement of services and in the development of new care models (Lewin & Templin, 2016).

Nearly a third of the women in our sample had developed a birth/care plan in cooperation with their health professionals (Paper I). Perinatal care plans are highly important for BD women (Jones et al., 2014; Meltzer-Brody & Jones, 2015). Therefore, it ought to be a goal to compile care plans for all perinatal BD women. In particular, our findings in Paper I provide suggestions for issues to consider and include in individualised birth/care plans, in addition to medical management (Jones et al., 2014).

Furthermore, women expressed a need for health professionals to extend their focus from managing their mental disorder to also include concerns associated with motherhood (Paper I) (Dolman et al., 2016; Doucet et al., 2012; Megnin-Viggars et al., 2015; Stevens et al., 2017). However, these matters may be delicate and not straightforward to address. Women have described ambivalence about being regarded as “high-risk”, as this label may diminish focus on the “normalities” in their pregnancy and motherhood, even though the “high-risk” label also actuates special care (Paper I) (Dolman et al., 2016; Stevens et al., 2017). Moreover, women with SMD frequently report worries of being judged as “bad mothers” and a fear of losing custody of their children if they disclose too much about difficulties in their caregiver role (Diaz-Caneja & Johnson, 2004; Dolman et al., 2016; Megnin-Viggars et al., 2015). This fear may even cause women not to ask for help when their BD is deteriorating (Dolman et al., 2016). Consequently, women want health professionals to acknowledge and support them as mothers in a non-judgmental manner (Megnin-Viggars et al., 2015; Stevens et al., 2017). Nevertheless, there may be occasions where the needs of the mother and the infant conflict. It is inevitable that the presence of a SMD may cause concerns about a woman's capability to care for her infant. In such cases, health professionals need to involve child protection services. Their involvement may further activate the abovementioned fears. Thus, navigating

the themes of SMD and motherhood requires sensitivity in health professionals and an awareness of the needs of mother AND infant.

In section 6.1.2, I discussed how unresolved relational traumas among some BD women may complicate their maternal identity reorganisation. Additionally, it has been established that past unresolved traumas may have a negative impact on a woman's mothering and hamper her ability to be sensitive in interactions with her infant (Cohen & Slade, 2000; Huth-Bocks, Krause, Ahlfs-Dunn, Gallagher, & Scott, 2013). Therefore, it is of clinical importance to assess a possible comorbidity of past unresolved traumas and BD. In such cases, additional therapeutic interventions may be required for the woman to process and rework difficult feelings and relational traumas (Cohen & Slade, 2000; George & Solomon, 2008; Van IJzendoorn, 1995).

As stated in the introduction, a psychologically oriented perinatal care may also be justified on the basis of the infant's needs, not least with reference to their high-risk status for developing mental disorders. The justification has received recent support in research reporting that child exposure to moderate or severe parental BD from birth to two years is significantly associated with the risk of subsequent development of psychopathology, including mood disorder (Goodday et al., 2018). The authors emphasise the need for interventions that help both the parent with BD and their children, especially early in development (Goodday et al., 2018). I argue that our findings on mother-infant interaction patterns in the first year (Papers II and III) contribute knowledge on important elements to target in such interventions to promote resilient infant development.

Finally, within comprehensive and psychologically oriented perinatal care, attention to the father ought to be a matter of course. As described in Paper I, BD women addressed concerns about the double strain impacting fathers in being affected by their mood episodes while simultaneously having to provide support and care to both mother and infant. Based on our findings in Papers II and III, whether father-infant interactions may moderate risk in mother-infant interactions is also a clinical question. To be moderating and protective, father-infant interactions must be of better quality, and the father must spend substantial time with the infant (Hossain et al., 1994; Mezulis, Hyde, & Clark, 2004). To manage these tasks, the father may need information about different aspects of the mother's BD and to participate in counselling and prevention planning. Furthermore, in the case of an illness episode for the

mother, the father may need practical and emotional support (Doucet et al., 2012). Fathers, however, may be reluctant to identify their own support needs and hesitant to ask for help (Doucet et al., 2012). Clinicians must thus be aware of possible barriers in accessing and including fathers.

6.3.2 Implications for future research

The background and motivation for the current research was the particular scarcity of studies on psychological matters in the perinatal management of BD. We have contributed to this subject, but more studies are clearly needed. Below, I suggest some areas for future research. Some of our findings in Paper I were supported in the studies of Dolman et al. (2016) and Stevens et al. (2017). Replication studies are nevertheless needed, especially with less-resourceful samples and single women with BD. The perceptions of these women on the perinatal period and their needs are likely to differ from those expressed by the women in our sample. It would also be valuable with outcome studies to compare counselling as usual with the counselling approach suggested in Paper I.

Our findings on mother-infant interactions need replication in studies that address the limitations noted in Papers II and III. In particular, larger samples are required to offset statistical limitations and increase the generalisability of findings. Increased heterogeneity in the BD sample and comparison sample is also vital. Studies on the developmental trajectories of mother-infant interactions beyond the first year postpartum are important, as existing literature indicates increasing difficulties with age, including more conflicted interactions (DeMulder & Radke-Yarrow, 1991; Gaensbauer et al., 1984; Kochanska et al., 1987).

Several interaction characteristics of the BD dyads in Papers II and III resemble interaction patterns of dyads with unipolar depressed mothers (Field, 1984; Field, Diego, Hernandez-Reif, Schanberg, & Kuhn, 2003; Hart, Jones, Field, & Lundy, 1999; Malphurs et al., 1996). We need better knowledge of the similarities and differences in the interaction patterns of these different dyads. For instance, such knowledge would be helpful in evaluating whether interaction treatments developed for dyads with unipolar maternal depression (MacBeth et al., 2015; Nylen, Moran, Franklin, & O'hara, 2006; Puckering, McIntosh, Hickey, & Longford, 2010) are transferrable to dyads with maternal BD.

The findings of increased mood deviations from three to 12 months among the BD women motivate further studies. A prospective design with measures of duration and severity of

deviations is significant. Longitudinal data on these variables is important for a better understanding of how maternal disorder severity may impact mother-infant interactions. We did not find an association with concurrent symptom load (Paper II) but cannot rule out that our assumption of such an association was too simplistic. It would also be interesting to study whether deficits in emotion recognition and mentalising (Bjertrup, Friis, & Miskowiak, 2019; Samame, 2013; Samame, Martino, & Strejilevich, 2012) among mothers with BD may impact mother-infant interactions.

More prospective cohort studies on bipolar offspring from infancy are required. Important areas are psychophysiological vulnerability, cognitive development, affect regulation and attachment behaviour, just to mention a few. Harder and co-workers (2015) are conducting a longitudinal cohort study following infants of mothers with BD, schizophrenia, and/or depression and infants of healthy mothers. Measures in different developmental domains are employed. The study will thus contribute to the knowledge base on early developmental trajectories of bipolar offspring.

There are more data in the larger Bi-sam study than utilised in the current research. Such data includes data on the fathers, such as interview data on their views and experiences on becoming/being a father in the context of their partner's BD. There are also data on father-infant interactions at three and 12 months after childbirth. Analysis of these data and report of the findings will make relevant contributions to the comprehensive perspective on perinatal management of maternal BD. Obviously, more research within these areas is needed.

7. Conclusions

The aim of this PhD thesis was to generate knowledge that may inform more comprehensive and psychologically oriented perinatal care for women with BD and their families. The aim of this thesis was based on an unmet need for collaborative care alongside the common perinatal BD management, which has a narrower focus on the illness course and medication.

Corresponding with this aim, the main objective of this thesis was to investigate the transition to motherhood, from a subjective and dyadic perspective, for women with BD. To the best of our knowledge, the current study is the first to address such psychological matters in the context of BD. This thesis has drawn particular attention to the postpartum part of the perinatal period.

An important finding on the subjective perspective of the transition to motherhood was the identification of BD women's different levels of personal concern for postpartum illness relapse, i.e., low, moderate and high, and the associated levels of perinatal deliberations and preparations. Since the latter may have consequences for BD women's postpartum adjustment, it is important to assess women's personal risk recognition, perinatal concerns and available resources and preparations. Women with a low level of concern for illness relapse and a subgroup of women with high levels of concern revealed the fewest perinatal preparations and resources, thus representing particularly vulnerable subgroups that are critical to identify and to offer comprehensive follow-up.

Regarding the content of perinatal concerns, resources and preparations, PP and MP women were very similar. Their concerns for illness relapse included concerns for depression and psychosis. PP women worried about "the unknown" in relation to postpartum reactions. Overall, the most significant concerns were the impact of mood episodes on mothering and on the partner. Concerns regarding the infant were maternal medication, mood episodes affecting the child, and heredity. Resources and preparations included support from the partner, the family, and health services; adjustment of daily life; and mental strategies. We suggest that these topics be addressed in perinatal counselling of BD women in ways that do not increase their concerns.

Within the dyadic perspective of the transition to motherhood, a main finding was continuous difficulties with dyadic coordination and reciprocity in mother-infant interactions in the first year postpartum. The BD mothers and their infants had challenges in "finding" each other and sharing a positive "rhythmic dance". Because dyadic coordination has an important impact on

the infant's socio-emotional development and its establishment seems to be of particular significance in the first year, our findings suggest that mother-infant interaction patterns may enhance developmental risk for bipolar offspring. In addition, subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours.

On the positive side, there was little expression of negative affect or tension in maternal, infant and dyadic behaviour, and some positive changes in infant behaviour were observed from 3 to 12 months. At three months postpartum, we could not find significant associations between maternal symptom load and interaction quality. However, as the presence of mood symptoms increased from 3 to 12 months among the BD mothers in our study, we propose postpartum clinical interventions that address both the BD mothers' needs in relation to mood deviations and the mother-infant interactions. We suggest interaction interventions that help sensitise mothers to their infant's cues and provide attuned contingent responses to promote dyadic coordination and reciprocity.

The overall conclusion, and the main clinical implication of this thesis, is empirical support for the importance of more comprehensive and psychologically oriented perinatal care for women with BD and their families. Managing BD in the perinatal period is complex and involves particular demands and challenges for the woman in her transition to motherhood and in the establishment of positive mother-infant interactions. A psychologically oriented perinatal care ought to give BD women opportunities to share their thoughts, concerns and deliberations and to encourage and support them in making adaptive preparations for childbirth and the postpartum period. Early detection of postpartum mood deviations is pivotal, and mother-infant interactions need to be targeted to promote resilient infant development.

8. References

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Appendix 1.

Interview with mother, regarding BD, mental and physical health, pregnancy, maternal role and life situation.

Date: _____ ID: _____

Intro: Thank you, for being willing to participate and share your experiences and thoughts, as a mother (to be), in this interview. First, I wish to pose some questions regarding your BD and your mental and physical health, and use of alcohol and stimulants. Then, I have some questions regarding pregnancy. Finally, I wish to hear about your thoughts on becoming a mother and your life situation. The interview will take approximately 1 – 1.5 hour.

BD, mental and physical health, use of alcohol and drugs:

- What kind of BD do you have? *(Type I or II?)*
- When were you diagnosed?
- How long before you were diagnosed do you think you struggled with the symptoms leading up to a BD diagnosis?
- Can you describe your typical/usual mood shifts? *(Further elaboration: Current state. If perceived stability, for how long?)*
- Can you describe what kind of treatment you receive now? *(Further elaboration: How often? How long have you received treatment? How do you regard your treatment?)*
- Have you ever been admitted to an inpatient ward? (If «yes»): Was it because of your BD, or some other reason?
- Do you take medication now for BD? (Pregnancy? Postpartum?) (If “yes”): What kind of medication? *(Further elaboration: Experiences)*
- Do you have family relatives with BD?
- Do you have other mental health problems, in addition to BD?
- Do you have any physical health problems, medical illness? (If “yes”): What kind?
- How do you evaluate your physical health?”

1=Poor, 2=Not especially good, 3=Moderately good, 4=Good, 5=Very good.

- How often do you drink alcohol per week?

0 _____ 1-2 times _____ 3 or more _____

- How many alcohol units per time?

1-2 _____ 3 or more _____

- How often do you use other stimulants (drugs) per week?

0 _____ 1-2 times _____ 3 or more _____

- What kind?

Pregnancy

- Was the pregnancy planned?
- How was your reaction when you found out being pregnant?
- How have you experienced the pregnancy? (*Further elaboration: Joys? Concerns?*)
- What have you been thinking about your child in pregnancy?
- What thoughts do you have on becoming a mother?
- What are your thoughts of your partner becoming a father/parent?

Mothering

- What is important for you in being a mother? /What are your wishes as a mother?
- Do you think that having BD affects you in becoming a mother/as a mother? (If “yes”): How? Elaborations.
- In what way do you think your BD may impact your child?
- What gives you most joy in being a mother?
- What gives you worries; is difficult as a mother?
- Do you have any worries for your child?

- Is there anything from your childhood, in the way you received care; were brought up, that you wish to bring on as a mother to your child?
- Is there anything from your childhood, in the way you received care; were brought up that you wish to do differently, as a mother to your child?
- Is there anything you think will be difficult to do differently, even if you wish?
- What do you hope your child will learn from having you as a mother?

Life situation

- How satisfied are you with your present life conditions – regarding housing, economy and such?”

1= Dissatisfied, 2= Not especially satisfied, 3= Moderately satisfied, 4= Satisfied, 5= Very satisfied. Further elaboration: Can you describe why it is so?

- Are there any stressing/concerning conditions in your life now? (If «yes»): What?
- Are there any resources/support in your life? (If “yes”): What kind of?

Ending

Thank you, for sharing this about yourself, your thoughts and experiences. How was it for you to have these questions? Is there anything you wish to add; comment on; or ask about?

Paper I

Anke, T.M.S., Slinning, K., & Skjelstad, D.V. (2019). “*What if I get ill?*” Perinatal concerns and preparations in primi- and multiparous women with bipolar disorder. *International Journal of Bipolar Disorders*, 7:7.

RESEARCH

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“What if I get ill?” Perinatal concerns and preparations in primi- and multiparous women with bipolar disorder

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Abstract

Background: Women with bipolar disorder have a high risk of illness relapse postpartum, including psychosis. The aim of the study was to explore how perinatal women with bipolar disorder relate to the risk. What are their concerns? How do they prepare for the dual demands of mood episodes and motherhood?

Methods: A qualitative study was conducted. To ensure rich insight into the research questions, 13 primiparous and 13 multiparous women with bipolar disorder (I or II), were individually interviewed in pregnancy or early postpartum. Thematic analysis was applied.

Results: Across parity, concerns for illness relapse included concerns for depression and psychosis. Primiparous women worried about “the unknown” in relation to postpartum reactions. Overall, the most significant concerns were the impact of mood episodes on mothering and on the partner. Concerns regarding the infant were maternal medication, mood episodes affecting the child, and heredity. Resources and preparations included: support from the partner, the family, and health services; adjustment of daily life; and mental strategies. Women were aware of the postpartum risk, but their levels of personal concern varied between low, moderate and high. Women with low level of concern for illness relapse had made the least deliberations and preparations. A subgroup of women with high level of concern also had limited resources and preparations.

Conclusions: The findings highlight the importance of including a psychological and psychosocial focus in perinatal prevention planning and counselling. Even if women with BD are informed about the increased risk of illness relapse postpartum, they relate to it differently. Their level of personal concern impacts their perinatal deliberations and preparations, which in turn may impact postpartum adjustment. When counselling these women, it is important to assess their personal risk recognition, perinatal concerns and available resources and preparations, and support them accordingly. Extra attention should be given to women with a low level of concern, and women with a high level of concern who have limited resources and preparations. These women represent particularly vulnerable subgroups that are critical to identify and offer comprehensive follow-up.

Keywords: Bipolar disorder, Perinatal, Postpartum, Primiparous, Multiparous, Mood episodes, Concerns, Preparations, Prevention, Counselling

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Background

For women with bipolar disorder (BD), childbirth and the postpartum period are associated with significantly heightened risk of illness relapse (Pope et al. 2014). A recent meta-analysis found an overall relapse risk of 37% within the first year postpartum and most relapses occurred within 6 months. Relapse was less common among women on prophylactic medication during pregnancy (23% vs. 66%). For 17% the relapse was severe, requiring hospitalisation (Wesseloo et al. 2016). Despite the high prevalence of postpartum episodes, there is a scarcity of studies regarding perinatal management of BD (Jones et al. 2014; Pope et al. 2014; Yatham et al. 2018).

Furthermore, existing literature is mainly related to illness course and medication (Sharma and Sharma 2017; Yatham et al. 2018). These are indeed crucial issues, but managing BD in the perinatal period is complex and involves challenges that exceed pure medicational matters (Jones et al. 2014; Pope et al. 2014). Moreover, postpartum mood episodes occur in a psychologically sensitive phase of life, with significant implications for the mother, the infant and the father (Sutter-Dallay et al. 2016; Tyano et al. 2010). Hence, a growing body of literature recommends a more comprehensive follow-up which includes psychological and psychosocial matters (Howard et al. 2014; Meltzer-Brody and Jones 2015; Pope et al. 2014; Sharma and Sharma 2017). However, there is a significant knowledge gap regarding the perceived needs of women with BD in relation to pregnancy, childbirth and motherhood (Rusner et al. 2016).

To our knowledge, there are only two previous studies focusing on perinatal matters for women with BD from an experiential viewpoint (Dolman et al. 2016; Stevens et al. 2017). Both studies addressed family planning and pregnancy, and the women's decision-making on whether to become pregnant or not. The decision-making process was complex, and many women did not feel appropriately supported by health professionals (Dolman et al. 2016; Stevens et al. 2017).

To learn more about the concerns and preparations of perinatal women with BD, the present study aimed at exploring how women with BD relate to the increased risk of illness relapse postpartum: How do they perceive the risk? What are their concerns regarding the possible impact of BD for mothering and their families? What resources do they make use of in preparing for the dual demands of illness and motherhood? To ensure rich insight into these research questions, a group of primiparous (PP) and multiparous (MP) women with BD diagnosis was interviewed. The overarching aim was to gain knowledge that may inform prevention planning and counselling for perinatal women with BD.

Methods

Design

The study is part of a Norwegian prospective investigation on families in which the mother has BD. Data were collected at four time points from pregnancy to 12 months postpartum. For the present study, a qualitative approach was chosen to explore subjective experiences in an open and inclusive manner. We used interviews to gain detailed and rich information.

Recruitment procedures and participants

The study included 26 pregnant or postpartum women with a BD I or II diagnosis. Because of the aims of the larger investigation they had to have a cohabitating partner who was willing to participate. Exclusion criteria were parental substance abuse; multi childbirth; premature birth < 35 weeks; or having an infant with a known serious medical condition or syndrome. These parental and child conditions could bias the interaction observations that are included in the larger investigation.

Recruitment took place between September 2014 and July 2016. Most participants ($n = 15$, 58%) were recruited from the geographic area of Vestre Viken Hospital Trust in Norway, with a population of 490,000. The remaining participants were recruited from nearby counties in the South-Eastern part of Norway. We provided oral and written information about the study at mental health outpatient clinics and wards, infant mental health teams at child mental health services, community well-baby clinics, pregnancy care and maternity wards. The health professionals then distributed information leaflets and asked eligible women whether a clinical psychologist and researcher (T.A., first author) could contact them by phone to provide more details about the study.

A few participants were recruited from the web-site of the national BD association and at group psychoeducation courses for patients with BD (Skjelstad et al. 2015).

Women and partners who were willing to participate gave oral and written consent at an information meeting with T.A. The consent allowed T.A. to have the women's clinical BD diagnosis verified by examining their specialist mental health patient records and/or by contacting their specialist mental health worker. All participants had received their diagnosis in the specialist mental health service. Further details concerning the history, presentation, and treatment of the BD were covered in the study interview. It was deemed unnecessary to reassess any BD diagnosis with a semi-structured diagnostic instrument.

Thirty-five women were interested in more information about the study. In three cases, the woman's partner declined to participate. Three women turned out not to have a formal BD diagnosis. One woman did not respond to T.A.'s calls for setting up a meeting and two women

changed their mind. Thus, the final sample comprised 26 women diagnosed with BD (13 PP and 13 MP). We have no record of the number of eligible women who declined to participate when informed by collaborating health professionals.

Data collection

Nineteen women (73%; 8 PP and 11 MP) were interviewed in pregnancy (mean 32 weeks, range 21–39), and seven (27%; 5 PP and 2 MP) in the early postpartum period (mean 11 weeks, range 4–16). The interviews were conducted by T.A., either at the participant's home (77%) or at T.A.'s office, as chosen by each woman.

In the interview, the women were asked to describe their experiences of the pregnancy, their thoughts on becoming a mother with BD, and how they envisioned managing the dual demands of illness and motherhood. MP women were allowed to refer to previous pregnancies and postpartum periods when they felt it relevant.

An interview guide was used to ensure that the topics were covered across all interviews. The order in which questions were presented was adapted to the natural development of each interview. First, the questions were posed in an open-ended manner to invite in-depth descriptions. Probe questions were then used to encourage elaborations. The interview guide also contained some questions with fixed responses, including a question about satisfaction with life conditions. These topics were also elaborated on.

The interviews lasted approximately 1 h (mean 70 min, range 35–109). Audio was recorded and transcribed.

Data analysis

An inductive thematic analysis was applied, because of its suitability for investigating understudied topics (Braun and Clarke 2006; Braun and Clarke 2013). Each interview was listened to and read repeatedly by the first author. With the research questions in mind, initial codes were generated case by case (Braun and Clarke 2013, p. 206). The codes reflected salient features in text segments. The next step was to look for patterns and similarities among the different codes in order to organise them into candidate themes. Codes and candidate themes were then modified in a flexible “dialogue” with the data (Braun and Clarke 2013, p. 224).

The third author read all the transcripts and supervised the analysis. Interpretations and candidate themes were discussed throughout the analytic process and revised until agreement was reached. Distinct themes were named and organised hierarchically in collaboration. The second author, who has extensive experience in perinatal mental health, addressed possible omissions and contradictions in the analytic process. Interpretations were

also discussed in peer groups. Finally, the material was analysed across the cases with the purpose of identifying similarities and differences between PP and MP women.

An interviewee validation was done at a second interview at 12 months postpartum. The participants were presented with verbal summaries of their first interviews. All participants confirmed that their viewpoints were portrayed accurately.

The qualitative software NVivo 10 was used as a coding and organising tool.

Results

Demographic and clinical characteristics

Table 1 shows the demographic characteristics of the sample. All women lived with the infants' biological father. In the MP group, 85% had their second pregnancy.

Table 2 displays clinical characteristics of the sample. The majority (73%) had mental health struggles, including affective problems, since before age 16. We do not report comorbidity diagnoses because of incomplete data.

Thematic results

The thematic analysis generated two superordinate themes, named as “Concerns” and “Resources and preparations”. Within “Concerns” we identified four themes: “Illness relapse”, “Early mothering and mood episodes”, “Perinatal impact on child” and “Illness impact on partner”, with corresponding subthemes. Within the superordinate theme “Resources and preparations”, we identified the two themes “Supportive network” and “Personal strategies”, with related subthemes.

In the analysis we recognised that women expressed different levels of concern for a postpartum illness relapse. The levels of concern are detailed in the beginning of the theme “Illness relapse”. Correspondingly, we recognised different distributions of resources and preparations among the women. These are described in the beginning of the superordinate theme “Resources and preparations”.

Concerns

Table 3 shows the four themes and subthemes of concerns with illustrative quotes, and the number of primiparous (n=13) and multiparous (n=13) women addressing the themes.

Illness relapse

First, we describe “how” the women related to the risk for illness relapse, with different levels of concern. Then, we describe the content of the concerns.

Table 1 Demographic characteristics of the sample

Variables	Total N = 26		Primiparous N = 13		Multiparous N = 13	
Age at inclusion	M 30.5; range 22–37		M 28; range 22–36		M 32.9; range 25–37	
Satisfaction with life conditions ^a	M 4.2; range 3–5		M 4.2; range 3–5		M 4.2; range 3–5	
	n	%	n	%	n	%
Planned pregnancy	16	62	5	38	11	85
Completed education						
Primary school	8	31	5	38	3	23
Secondary school	5	19	2	15	3	23
Bachelor's degree	11	42	6	46	5	38
Master's degree	2	8	0		2	15
Employment status when not pregnant						
Working full-time	12	46	6	46	6	46
Working part-time ± receiving benefits	4	15	2	15	2	15
Receiving benefits only	8	31	3	23	5	38
Unemployed	1	4	1	8	0	
School	1	4	1	8	0	

^a Question in interview: "How satisfied are you with your current life conditions—regarding housing, economy and such?" Answers on a 5 point Likert scale: 1 = dissatisfied, 2 = not especially satisfied, 3 = moderately satisfied, 4 = satisfied, 5 = very satisfied

Table 2 Clinical characteristics of the sample and the health status of partners

Variables	Total N = 26		Primiparous N = 13		Multiparous N = 13	
Years with BD diagnosis ^a	M 6.5; range 0–16		M 5.2; range 0–16		M 7.8; range 2–13	
	n	%	n	%	n	%
Primary diagnosis						
BD I	7	27	4	31	3	23
BD II	19	73	9	69	10	77
Number of hospitalisations for BD episodes						
0	10	38	6	46	4	31
1–3	10	38	3	23	7	54
≥ 4	6	23	4	31	2	15
Perceived mood stability						
> 1 year prior to pregnancy	11	42	4	31	7	54
Medicated for BD during pregnancy	17	65	7	54	10	77
Specialist mental health service in pregnancy						
Adult mental health	14	54	5	38	9	69
Infant mental health ^b	4	15	3	23	1	8
Both adult and infant mental health	2	8	2	15	0	
None	6	23	3	23	3	23
Health status partner (N = 26) ^c						
Mental problems	5	19	4	31	1	8
Medical problems	1	4			1	8

^a Self-reported in interview: "When did you get your diagnosis?"

^b Mental health service for prevention of mother-infant relationship difficulties

^c Self-reported by partners as part of the larger investigation

Table 3 Themes and subthemes of perinatal concerns

Illness relapse	Early mothering and mood episodes	Perinatal impact on child	Illness impact on partner
<i>The unknown</i> "I am concerned about how my body will react after giving birth, how things will work hormonally and all that. We don't know, even if all is well now." (P17, PP) 7 PP	"It's about the attention. When you are depressed, you don't have the energy. When you are hypomanic, you don't have the time. So it impacts you as a mother in both states." (P12, MP) 9 PP; 8 MP	<i>Medication</i> "I have been afraid that there will be something wrong with the baby, because of the medication, especially since I take so many different kinds of medications." (P10, MP) 4 PP; 4 MP	"He is very good at not letting the depression affect him so much. He manages to see the positive in things and tries to have me do the same. But the postpartum psychosis I had, that was heavy for him." (P2, MP) 7 PP; 10 MP
<i>Depression</i> "If I have a bad day, I get a little panicked, because I'm so afraid that the bad day will stay there for a long time. What if this is the start of a depression?" (P23, PP) 6 PP; 6 MP		<i>Heredity</i> "I hope it's the father's genes that are passed on. I think a lot about it, and hope that he won't become ill and unstable, like me." (P11, MP) 4 PP; 4 MP	
<i>Psychosis</i> "I had psychosis after my last birth. So, of course there is this fear that it will come back again (...) It's frightening to think that I have it in me." (P2, MP) 4 PP; 2 MP		<i>Mood episodes affecting foetus or infant</i> "I have been afraid that I won't be patient enough, and if I have a "down trip", will he notice?" (P21, PP) 8 PP; 1 MP	

Levels of concern for illness relapse

The women were aware of the postpartum risk of illness relapse, but it varied whether they related to this risk personally and with concern. Overall, 73% of the women expressed explicit concern for illness relapse, whereas the remaining women had vague or rejecting declarations.

To further explore the levels of concern and the characteristics of women, we organised the women into three subgroups according to their perceived concern for postpartum illness relapse: low level of concern (LC: n=7; 3 PP, 4 MP; 1 BD I, 6 BD II), moderate level of concern (MC: n=9; 2 PP, 7 MP; 3 BD I, 6 BD II) and high level of concern (HC: n=10; 8 PP, 2 MP; 3 BD I, 7 BD II).

The LC group described few thoughts about the risk—"I don't foresee any mood shifts. It's not something I think about." (P22, PP)—or referred to previous postpartum experiences, "All went well last time, so I think it will go well this time too, most likely." (P11, MP).

The women in the MC group explicitly acknowledged being at risk, but had it mostly in the back of their minds—"I know that it's a very vulnerable and difficult phase, the first 2 months...but I am not that worried, because I have decided to take Lithium after birth." (P3, MP).

HC women were more emotionally activated in the interviews, expressed recurrent and elaborate

descriptions of becoming ill, with an accompanying use of strong emotional words, such as "fear", "frightening", and even "horror". Some women revealed having had marked concerns long before pregnancy—"This horror of becoming ill (...) has actually ridden me for many years in deciding whether to have a child or not." (P17, PP).

Most (71%) women with LC perceived themselves as currently "stable" (euthymic). The women were often younger, had a lower level of education and work participation, had fewer planned pregnancies, and reported longlasting relational conflicts with own background family.

The majority (78%) of women with MC had completed secondary school or a bachelor's degree, worked full time, were euthymic for at least 1 year prior to pregnancy, and had planned pregnancies. Many (78%) had close relatives with BD diagnosis.

Eighty percent of the HC women reported mood instability prior to and during pregnancy. Over half of the women (60%) had previously experienced severe illness episodes, and had the highest life time prevalence of hospitalisations. They varied regarding education, work participation and how long they had had their BD diagnosis.

The proportion of women being on medication was similar across groups. The number of women within each

group being interviewed in pregnancy vs. postpartum were: LC 6 vs.1, MC 5 vs. 4, HC 7 vs. 2.

The unknown

Over half of the PP women (54%) were worried about the unknown—not having any experience in how their illness may be affected by childbirth and the hormonal changes. *“There is this fear, where there should have been joy. You know, having a risk pregnancy.”* (P19, PP). None of the MP women reported such worries.

Depression

The most frequent concern related to illness relapse was depression (46%), evenly expressed by PP and MP women. The women reported being vigilant of depressive symptoms in pregnancy. On the one hand, this could be confusing and stressing. On the other hand, it could be valuable for prompt interventions—*“I recognised that it was going downwards. The hopelessness came, the negative thoughts came, and I doubted whether I could manage. I imagined a postpartum depression, so I just had to stop it all (i.e. work, engagements).”* (P18, PP).

Psychosis

A concern for postpartum psychosis was evident in five women with BD I (71%), and in one woman with BD II (5%), thereby being more related to type of BD than parity. Psychotic episodes with experiences of not being in control of oneself, having a fear of doing harmful things, and being judged by others as “mad”, were worrisome to think of in pregnancy—*“I become very strange when I am ill. People around me say that it’s not “me”. I become like another person, say strange things, and do strange things.”* (P15, PP).

A PP woman (P17) was concerned about the nature of the treatment she would be subjected to, should she experience a postpartum psychosis. Will it differ from previous interventions? Where would she be hospitalised? Would it be by force? Even though she was familiar with hospitalisation from several previous psychoses, the thought of it felt different and strange in pregnancy.

Early mothering and mood episodes

A baseline perspective among the women was that given euthymia, BD has no impact on their mothering. Another common view was that the impact depends on the intensity of mood deviations. Mild intensity was viewed as rather unproblematic, as “healthy mothers experience it too”. Nevertheless, 65% of the women expressed concern for mood episodes affecting them as mothers.

Being naïve to mothering, PP women were mainly concerned from a hypothetical stance—*“What, then, if I get a huge “down trip” and I am supposed to take care of her?*

What kind of mother will I be then if I don’t function?” (P26, PP). Some also feared that a postpartum relapse could affect maternal affection and bonding—*“That is something I’m very afraid of, that I might not want my child. That would be terrible.”* (P18, PP).

In remembering prior pregnancies, MP women validated doubts concerning own mothering in depressive episodes—*“When I was depressed at the end of pregnancy last time, I didn’t believe I could manage to be a mother. I just couldn’t understand how I could be able to be a mother.”* (P2).

In their current pregnancy, MP women’s concerns were based on lived experiences of mood episodes interfering with mothering. Not being available, was a particularly salient concern, as in depression triggering withdrawal behaviour—*“I just need to be alone, and that weighs heavily on my conscience, because I have chosen to have a husband and a child. And still, I just lie here and don’t want to be with them.”* (P4, MP). Parallel to the PP women’s hypothetical concerns, a few MP women worried that the choice of an additional child might be pushing their limits too far.

Despite the concerns about mood episodes affecting their mothering, only a very small minority of the total sample (8%, 2 PP) explicitly expressed fear of child protection services—*“What if I get really psychotic for a long time? What if I get really ill and if our marriage breaks down? Then they will choose my husband as the caregiver. Why would they choose me?”* (P17, PP).

Perinatal impact on child

Eighty-five percent of the women expressed at least one of the concerns related to perinatal impact on child.

Medication

Sixty-five percent of the women were on medication (see Table 2). Approximately a third of the total sample, with even numbers of PP and MP, expressed concerns for how medication may affect the health of the foetus and the ability to breastfeed the infant. Women were more concerned about Lithium and antipsychotics, than Lamotrigine and SSRI medication. Additionally, some expressed concern for high doses and medication combinations.

Heredity

An equal distribution of PP and MP women (31%), brought up concerns about heredity. Some thought that a stable and safe childhood could counteract the genetic risk—*“Well, the father is also bipolar, so of course I’m worried. But I also think that the circumstances the children grow up with matter...I mean, if a bipolar disorder will develop or not.”* (P7, MP).

Mood episodes affecting foetus or infant

Particularly PP women (62% PP vs. 8% MP) were concerned whether an infant will notice mood shifts and be affected by them. This was often intertwined with the concerns for mood episodes affecting mothering, as in the case of impaired bonding and reduced emotional availability. Some women stressed the importance of being extra attentive with infants—*“It’s extra important to be aware of it with an infant, because they can’t speak up. They can’t come to you and say, “Mummy, why are you so strange?”* (P20, PP) Fussiness, crying and being tense were mentioned as possible infant reactions. Deviating from the PP women’s narratives, MP women primarily elaborated on consequences of mood episodes for toddlers or older children.

A minority (15%) worried that the foetus may be affected by their stress during mood episodes. This led them to find strategies to calm down in pregnancy.

Illness impact on partner

All partners knew about their female partner’s BD diagnosis, but lived experiences with mood episodes varied. In the MP group, all partners had had such experiences, and 54% had experienced severe episodes needing hospitalisation. In the PP group, 77% of the partners had had experiences with the woman’s mood episodes, and 38% with severe episodes.

Both PP and MP women (54% PP vs. 77% MP) addressed concerns about the double strain impacting their partner: being affected by their mood episodes, while at the same time having to provide support (elaborated below in resources and preparations). Furthermore, several women described their partner as a counterweight to their mood instability in being calm and patient—*“He is very stable mentally. I think that’s important in a family in which the other isn’t. So I think that as a family we are doing well, but it’s obvious that most of the hard work falls on him.”* (P12, MP).

Some women reflected on the possibility that the partner keeps BD worries to himself—*“He seems very calm about all these things (i.e. medication, illness relapse), but it’s not unlikely that he keeps some things to himself, because he wants to support and normalise. But surely, he has his thoughts about things that worry him.”* (P19, PP).

A minority of PP women worried whether their partner would cope with a postpartum illness relapse—*“What worries me the most is how he will react and handle it, and how in turn I will handle him.”* (P16, PP).

Resources and preparations

Table 4 shows themes and subthemes of resources and preparations, with illustrative quotes, and number of primiparous (n=13) and multiparous (n=13) women addressing deliberations about the themes.

Distribution of resources and preparations among subgroups

The MP women tended to have more resources and preparations than the PP women, but there were variations. Overall, LC women (n=7) had made the least deliberations and preparations. However, none were without resources or preparations. Among the MC women (n=9), five of the MP women (n=7) and one of the PP (n=2) had sufficient access to resources and coping strategies. Among the women with high level of concern (n=10) for illness relapse, six women, including both MP women, were extensively prepared. The remaining women (n=4) had more limited preparations and resources.

Supportive network

Partner

The partner was described as an immense support by more than half (58%) of the women. Based on experiences, MP women described different kinds of support. A recurrent theme was the partner’s readiness to take night shifts with the infant, his active participation in child care and domestic chores—*“You know last pregnancy, I went all crazy, I got depressed and I panicked. I think he was shocked about how bad it really can get. But he handles it so well. He supports me 100%. He arranges everything, there’s really no end to what he does, because I need to rest a lot, even when I am not pregnant. He does a lot of the housekeeping, and doesn’t really complain, even if I say that it’s bad that it has to be like that. He says, “But, that’s how we function. Then our daily life works.””* (P5, MP).

Moreover, the MP women underscored the importance of the couple having a shared responsibility in taking the illness into account—*“We talk about it a lot, we do, and he says, “When you feel, if you feel, that it’s sneaking up on you, you feel that something is happening, then you have to tell.” And I do. So I think we manage quite well.”* (P10, MP).

PP women referred to the partner’s assistance in pregnancy and him being a safe and stable person, when expressing confidence in his postpartum support—*“I have felt it now in the pregnancy, how he arranges and fixes things—really “nesting”—he cares. He is present, and it seems like he has reflected a lot.”* (P18, PP).

Still, 23% of the PP women and 8% of the MP women explicitly expressed doubts about support from the partner. These women were either concerned about their partner becoming too affected by an illness relapse or

Table 4 Themes and subthemes of perinatal resources and preparations

Supportive network	Personal strategies
<p>Partner</p> <p><i>"He is a big, big support for me."</i></p> <p>(P2, MP)</p> <p>7 PP; 8 MP</p>	<p>Adjustment of daily life</p> <p><i>"We are going to bottle feed the baby, partly because of my medication, but mostly because we feel it's very reassuring that he (partner) can assist more and I can sleep."</i></p> <p>(P5, MP)</p> <p>9 PP; 10 MP</p>
<p>Family</p> <p><i>"My mother will take a week vacation after birth, so she can assist us. With regard to what happened to me last time (i.e. postpartum psychosis) she has decided to do that, and we appreciate it."</i></p> <p>(P2, MP)</p> <p>10 PP; 7 MP</p>	<p>Mental strategies</p> <p><i>"We think it will work out this time, because now we know better what is ahead of us. We know a lot more about my illness and how it develops. I recognise the signs much earlier and take them more seriously than I did last time. Then I just thought, "Oh, this will work out well." And the stuff about risk for psychosis afterwards... "No, that's not about me."</i></p> <p>(P2, MP)</p> <p>10 PP; 13 MP</p>
<p>Health services</p> <p><i>"I think it is very important to talk about medications with the one who has the knowledge, not indirectly through my GP. If I have critical questions, then the GP has to contact the psychiatrist and it gets so much more complicated."</i></p> <p>(P2, MP)</p> <p>9 PP; 8 MP</p>	

that his own health problems might occupy his capacity—*"He is very ill, so it's also very important for him to rest and sleep. As it is now, his health is a priority over mine. I have to function, but I think I go in "minus", because there is so little support from him and I get tired."* (P13, MP).

Family

Several women (65%) displayed good hopes for family support when needed. Among MP women, 23% described that close access to family support had been a prerequisite in their planning to have their first child, whereas this held for 15% of the PP women—*"My parents are close all the way. They live nearby, and it's both for the sake of me and our child, and not the least for the sake of my husband. Because when I get ill, he goes to them and they make plans together, and I don't have to think about it. I don't know if I would have been as relaxed about having children if we hadn't had them. I think I would have been more reluctant. It definitely makes it easier. We talked with them before we decided to have our first child."* (P4, MP).

A lack of family support was frequently conveyed with sadness (46% MP vs. 23% PP). Relational conflicts and/or the family living far away were common reasons—*"I have always had trust in my family, but I have lost it. And now, (i.e. postpartum) it's an extra burden that I don't have that safe setting anymore."* (P24, PP) For some, a lack of family support was compensated by assisting friends—*"You do have people that are your, not your blood family, but they are your friend family. You know, you grow your friends. We are fortunate to have a lot of good friends."* (P3, MP).

Health services

Sixty-five percent communicated the importance of follow-up from specialist mental health services. Women expressed satisfaction when issues specifically related to the perinatal period and becoming a mother were addressed—*"I talked with a psychiatrist at the specialist mental health clinic. He is specialised in BD, and we talked about my pregnancy and the illness. One thing was the medication; can I use the medication I am on? Another thing was that everybody can actually have a postpartum depression. Things can happen in everybody's lives, and some are physically ill. So there can be many reasons to you bringing on specific genes and not functioning all the time. You know, it doesn't have to be that I become "the worst mum in the world" because of my bipolar luggage. I have reflected and worked a lot with myself. It may also be an asset—that you are self-conscious. So it was good talking with him."* (P18, PP).

It was vital for the women to receive qualified guidance regarding perinatal medication, including effects on the foetus and advice on their decisions about breastfeeding. In these matters, several regarded the counselling in primary health care as unsatisfactory and wanted guidance from a psychiatrist in specialist mental health services.

Even numbers of PP and MP, (31%), had developed a specific birth plan in cooperation with health professionals. This included the possibility for a single room at the postpartum ward (to make the presence of the partner possible and to secure sleep), medications, and an option to prolong the stay in the postpartum ward. A couple of women had also given written consent to allow their partner to decide on forced hospitalisation in case of a serious illness relapse.

Personal strategies

Adjustment of daily life

Deliberations regarding daily life adjustments was mentioned by 73% of the sample. The need to secure sleep postpartum, was declared by 38% of the MP women, and 46% of the PP women. For 23% of the MP women the issue of securing sleep was decisive in deciding not to breastfeed. Besides sleep, several also mentioned the importance of rest and avoiding stress. The daily routines that come with having infants and small children were appreciated by several women—*“What’s been good with having a child is that there are routines. The routines, calming down and having less social life, those things have probably helped me to stabilise.”* (P4, MP).

Mental strategies

We identified mental strategies among 88% of the women. A common strategy was consciousness about priorities. Mothering and “economising” with own energy, were described as two interconnected main priorities—*“There are things that have to be done, but it’s important that I don’t use all my energy dealing with them. The most important, is to use my time with my child, and with us as a family. I need to have the energy for that.”* (P6, MP).

Especially MP women described the importance of acknowledging the disorder, and the need for adjustments. They had accepted the need for medications, and not being able to breastfeed the baby. Some MP women referred to adopting another way of thinking compared to their first pregnancy. They underlined the importance of acknowledging that it is a vulnerable phase of life and that they have to take the illness seriously. Furthermore, they talked about the importance of recognising early signs of a possible postpartum relapse, and of not hesitating to ask for help from family and health services.

Discussion

The present study addresses the knowledge gap on how perinatal women with BD relate to the increased risk for illness relapse postpartum. We wanted to learn about the women’s concerns and preparations for the dual demands of illness and motherhood. Further, we explored variations in experiences and viewpoints between subgroups, including PP and MP women. Our overarching aim was to gain knowledge that may inform prevention planning and counselling for perinatal women with BD.

Levels of concern for illness relapse, and associations with resources and preparations

A main finding was that even if women with BD know about the postpartum risk, their level of personal concern

differ. Three levels of concerns were identified, which were divided into three sub-groups, low (LC), moderate (MC) and high (HC). Group belonging was associated with different levels of perinatal deliberations and preparations.

The least deliberations and preparations were done by women in the LC group, which seems little adaptive in relation to BD postpartum risk (Jones and Craddock 2005). Thus, this group of BD women is important to identify. Denial of thoughts about risk, minimisation and indifference are reasonable indicators of a low level of concern.

Some characteristics of our LC group may be helpful in identifying and understanding a low concern stance. All the women in the LC group, had a current perception of wellness with regard to BD. Indeed, a recurrent disorder such as BD can confound risk awareness. Pregnant women who are euthymic may believe this to last, although euthymia during pregnancy is not protective of postpartum illness relapse (Doyle et al. 2012). Still, the mere presence of euthymia in pregnancy seems to be a too simplistic explanation for low concern, since other euthymic women in our sample were more concerned of postpartum illness relapse.

Noteworthy, the proportion of unplanned pregnancies was markedly high in the LC group. The overall decision making process of whether to continue the pregnancy may have overshadowed a specific focus on postpartum risk. This is worth keeping in mind, since unplanned pregnancies are found to be more common among women with BD than among healthy women, especially for primiparous women (Marengo et al. 2015).

Additionally, more complicated psychological conflicts may interfere with the process of acknowledging personal postpartum risks. The observation of longlasting relational conflicts for all women in the LC group is notable. Some women’s narratives were characterised by unresolved relational traumas. This may imply that more profound defensive processes are at play in certain cases of low concern perception.

Finally, the majority of the youngest women in our sample were in the LC group. They were almost exclusively PP. A large body of literature documents more challenges in adapting to the responsibilities of motherhood among young mothers, than in older mothers (Wakschlag and Hans 2000). For some young women, acknowledging the additional postpartum challenges may be too demanding to incorporate in their maternal transition process, thus leading to minimisation. Within a framework of additional risk factors, such as lower level of education and work participation, these young PP women represent a particularly vulnerable subgroup among women with low level of concern.

A sufficient amount of resources and preparations was found among women with moderate concern for illness relapse. Throughout the interviews, the women balanced a personal recognition of the risk with descriptions of resources and preparations. Women belonging to the MC group were characterised by having higher education and work participation, more planned pregnancies, and a longer period with mood stability. Altogether, the MC group was characterised by little additional risk, beyond the BD postpartum risk per se.

The HC group was more diverse with regard to level of resources and preparations, as well as sociodemographic factors, than the LC and MC groups. However, the women in the HC group shared clinical characteristics such as mood instability before and during pregnancy, and having had prior severe illness episodes and multiple hospitalisations. Their narratives were characterised by emotional activation and recurrent and elaborate descriptions of illness episodes. Together, this makes their high level of concern understandable.

Within the HC group, approximately half of the women had made the most comprehensive preparations of the whole sample, and mobilised extensive supportive resources. Hence, they had managed to transform their high level of concern into adequate behaviours. Their examples of goal-directed preparations challenge a stigmatising view of women with BD as poorly coping (Dolman et al. 2016; Wittkowski et al. 2014).

The remaining women in the HC group, all PP, had limited resources and preparations. We argue that these women also represent a particularly vulnerable subgroup that is critical to identify and offer comprehensive follow-up. Also, a persistent high level of concern can generate excessive negative stress for both mother and foetus (Glover 2011).

Content of perinatal concerns, resources and preparations

Overall, PP and MP women had the same types of perinatal concerns, and envisioned similar resources and preparations. They differed on two subthemes: “The unknown”, a concern solely expressed by PP women, and “Mood episodes affecting foetus or infant”, where the MP women mostly focused toddlers or older children.

For both groups, the most significant concerns were the impact of mood episodes on mothering and on the partner.

Concerns for mothering are recurrent in studies on women with severe mental illness, including reports of a pervasive fear of being a bad parent and self-stigma (Diaz-Caneja and Johnson 2004; Dolman et al. 2013; Dolman et al. 2016). The women in our sample communicated a more conditioned view—mothering is affected only in case of active mood episodes. This highlights

that women with severe mental illness may have varying views on own mothering, where nuances are important to recognise. The conditioned view in our sample may in part be associated with many women having managed relatively well in different areas of life (see Table 1). Indeed, life context for women with severe mental illness (education, employment, partner, housing etc.) has been found to be associated with their mothering (Bybee et al. 2003; Oyserman et al. 2000). Furthermore, reduced self-stigma among individuals with BD has been associated with education above primary school and employment (Brohan et al. 2011).

The women’s concerns for their partners’ demanding position, match partners’ descriptions of living with a spouse with BD (Granek et al. 2016; Tranvåg and Kristoffersen 2008). In addition, the “ordinary” burden is likely to increase in the postpartum period, as the woman will have extensive needs for support to prevent illness relapse. Another critical matter is to secure the care needs of the infant in case of mood episodes. A trust in the father taking over the caregiving during illness relapse, may partly explain that only two women in our sample mentioned fear of child protection services. Some women provided particularly good descriptions of well functioning relationships, where the couple work as a team with regard to the BD. This is positive, since a good partner relationship has been found protective against emotional stress in the perinatal period (Røsand et al. 2011; Røsand et al. 2012).

On the other hand, our findings underline that partner issues may increase postpartum vulnerability. The partner may not have the capacity to give the woman support, either because he becomes too affected by her mood episodes, or has own mental/medical health problems. His problems may even be the main priority for the couple.

Moreover, if a partner is naïve to mood episodes, it is more difficult for him to take the illness into account, recognise early signs of mood deviations and to cope with a possible severe postpartum illness episode, such as a psychosis. These outlined partner matters are critical to address in perinatal counselling. If challenges are evident, the couple needs assistance in finding adaptive strategies.

Concerns evenly relevant for PP and MP women, were postpartum depression, negative medication effects on the child, and heredity of BD. The concerns for depression correspond with this being the most commonly reported postpartum episode polarity for women with BD (Driscoll et al. 2017; Freeman et al. 2002; Viguera et al. 2011). Concerns for medication and heredity has similarly been reported by BD women in the preconception phase (Dolman et al. 2016; Stevens et al. 2017), confirming them as central perinatal themes. In the present study, these were highlighted in the women’s request for

updated and qualified guidance from specialist mental health services.

The fear of postpartum psychosis was related to diagnosis with BD I, not parity. Psychological after-effects of postpartum psychosis are found to last for years (Robertson and Lyons 2003). Our findings indicate that psychotic episodes outside the postpartum period are also affecting the women's perinatal concerns.

The emphasis on family support correspond with BD women's statements of what is important in their decision making about pregnancy (Dolman et al. 2016; Stevens et al. 2017). Family conflicts and geographical distances may complicate support. It is also a challenge that traditional family network support has been reduced in Western culture, leaving the woman and the partner more alone in providing each other support (Eberhard-Gran et al. 2010). It is valuable to consider and concretise the realistic extent of family support for each couple.

Psychological theories of the perinatal period highlight mental processes, where self-representations need to be reorganised to encompass new roles (Cohen and Slade 2000; Stern 1995). We argue that an enduring mental illness as BD demands a crucial reorganisation task in balancing and integrating the two identities of being a "patient with BD" and a becoming mother. Low risk recognition, or a self-stigmatising position (Dolman et al. 2013), may both be viewed as tilting out of this balance. In our view, the daily life adjustments and mental strategies described in our sample correspond to this reorganisation process. However, it is notable that some MP women mainly recognised this process in their current pregnancy. It evolved after "lessons learned" by not taking the "patient with BD" sufficiently into account when becoming mothers the first time. This seems important to keep in mind in counselling with PP women.

Clinical implications

Based on our findings, we suggest a stepwise approach in prevention planning and perinatal counselling. The first step includes an evaluation of whether the woman is aware of the BD postpartum risk for illness relapse, and how she relates to the risk. A relevant question is whether her subjective risk perception corresponds with an objective risk status. In case of a low (i.e. minimisation of the risk) or high level of concern, possible reasons need to be identified in a dialogue.

Low concern may be associated with euthymia in pregnancy, insufficient knowledge of particular risk factors, unplanned pregnancy, or more complicated psychological conflicts in acknowledging own risk. In order to relate to the risk more personally and in-depth, women with low concern may need to have more proactive counselling, where their individual risk factors are discussed.

However, this need may be ignored by health professionals because of the undemanding presence of these women, compared to women with high concern and anxiety. To prevent this from happening, health professionals need to be extra attentive and explorative when encountering LC women.

A high level of concern may be associated with longlasting or current mood instability, prior severe illness relapses and hospitalisations. Women with high level of concern may need a particularly close and attuned counselling. Their specific concerns need to be identified. Goal-directed interventions to alleviate their stress are central. Extra attention should be given to women with a high level of concern with little resources and preparations. In general, PP women are more vulnerable than MP women.

Further, we propose that the perinatal concerns identified in the present study are relevant issues to address in counselling, regardless of women's levels of concern. However, it is imperative to address them in ways that do not increase the women's concerns. The aim is to give the women opportunities to share their thoughts and deliberations, and encourage and support them in making adaptive preparations. This includes supporting the women in mobilising supportive relationships, adjusting daily life, and heightening their awareness of useful mental strategies.

If the woman has a cohabitating partner, it is clearly beneficial if (s)he is included in the prevention planning. Women who choose to be medication-free in pregnancy and postpartum may need extra counselling on how to prepare for, prevent, and manage illness relapse.

Strengths and limitations

The study has its strength in contributing rich and multiple descriptions of perinatal concerns and preparations in women with BD. The qualitative exploratory nature of the study gave women opportunity to describe their experiences and views in detail.

However, there are limitations to point out. We do not know the characteristics of the women who declined to participate when informed by collaborating health workers. Our sample may represent a skewed "resourcefulness" in having the capacity to participate in a longitudinal research project in a demanding and sensitive phase of life. Therefore, the participants may have had fewer concerns and more preparations to report than those not participating. An important factor that limits the generalisability of the findings is that perinatal women without partners are not represented. Their concerns and preparations are likely to differ.

Seven women were interviewed postpartum. Their recall might have been biased because of not

remembering their concerns in pregnancy or having revised their viewpoints after birth. Still, it is our evaluation that these women gave rich and nuanced descriptions of their pregnancy.

Not all women were euthymic when interviewed. Four were affected by mild depressive symptoms, and one woman was mildly hypomanic. This may have biased their descriptions and reflections. On the other hand, shifting moods represent the nature of living with BD.

An important remark concerns the result section. We use quantification of the qualitative data to report accurate occurrences of viewpoints. This makes the basis for our interpretative claims more transparent. However, the reported views are spontaneously expressed in the interviews. We do not know the “true” number of women who actually held certain views, since some may have had similar views without expressing them. Thus, the proportions reported may be conservative.

Conclusion

The findings from the present study highlight the importance of including a psychological and psychosocial focus in perinatal prevention planning and counselling. Even if women with BD are informed about the increased risk of illness relapse postpartum, they relate to it differently. Their level of personal concern impacts their perinatal deliberations and preparations, which in turn may impact postpartum adjustment. When counselling these women, it is important to assess their personal risk recognition, perinatal concerns and available resources and preparations, and support them accordingly. Extra attention should be given to women with a low level of concern, and women with a high level of concern who have limited resources and preparations. These women represent particularly vulnerable subgroups that are critical to identify and offer comprehensive follow-up. Primiparity increases the vulnerability even more.

This article contributes to an emerging clinical knowledge base for perinatal women with BD, in which disorder-centered and patient-centered perspectives are integrated and complement each other.

Abbreviations

BD: bipolar disorder; PP: primiparous; MP: multiparous; LC: low level of concern; MC: moderate level of concern; HC: high level of concern.

Authors' contributions

TMSA designed the study in collaboration with DVS. TMSA performed recruitment and data collection and was the main coder in the analysis. DVS contributed and supervised throughout data analysis. KS provided critical and clinical input in the analytic process. TMSA is the primary author in the writing of the manuscript. DVS and KS have critically revised and substantially contributed throughout the compilation of the manuscript. All authors read and approved the final manuscript.

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Acknowledgements

No acknowledgements.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

The data will not be shared or made publicly available, since participants may be identifiable. Informed consent for this was not sought from the participants prior to data collection.

Consent for publication

Participants gave consent for publication.

Ethics approval and consent to participate

The study was approved by the Regional Committee for Medical Research Ethics (2014/388), and carried out in accordance with the Helsinki Declaration. A central ethical consideration was that the women represented a vulnerable group in a sensitive phase of life. Given these premises, intervening with a research purpose requires distinct ethical awareness and caution. In conducting the interviews, it was important to reduce the risk of destabilising the women's mental health. Thus, in three cases, T.A. did not pursue themes as much as would have been optimal for the research purpose. At the discretion of the participants, T.A. shared clinically relevant information with the participants' mental health workers. All participants gave oral and written informed consent to participate.

Funding

This work was supported by Vestre Viken Hospital Trust.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Received: 17 June 2018 Accepted: 19 January 2019

Published online: 03 March 2019

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Paper II

Anke, T.M.S., Slinning, K., Moe, V., Brunborg, C., Siqveland, T. S, & Skjelstad, D.V. (2019). Mothers with and without bipolar disorder and their infants: group differences in mother-infant interaction patterns at three months postpartum. *BMC Psychiatry, 19:292*.

RESEARCH ARTICLE

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Mothers with and without bipolar disorder and their infants: group differences in mother-infant interaction patterns at three months postpartum

Teija M. S. Anke^{1*} , Kari Slinning², Vibeke Moe³, Cathrine Brunborg⁴, Torill S. Siqueland⁵ and Dag Vegard Skjelstad^{1,3}

Abstract

Background: Women with bipolar disorder (BD) have a high risk of illness relapse postpartum. The risk coincides with the period when mother-infant interactions are evolving. We compared mother-infant interactions in dyads where the mothers have BD with dyads where the mothers have no mental disorder. The association between concurrent affective symptoms of BD mothers and interaction quality was investigated.

Methods: Twenty-six women with BD and 30 comparison women with infants were included. The Parent-Child Early Relational Assessment (PCERA) was used to assess maternal behaviour, infant behaviour and dyadic coordination in interactions at 3 months postpartum. The Inventory of Depressive Symptomatology and Young Mania Rating Scale were used to assess affective symptoms of BD mothers at the time of interaction.

Results: There were significant group differences with medium to large effect sizes (0.73–1.32) on five of six subscales within the three interactional domains. Most interactional concerns were identified in dyadic coordination. No significant associations were found between maternal symptom load and interaction quality within the BD sample. Forty-six percent of the BD mothers experienced a mood episode within 0–3 months postpartum.

Conclusions: The present study identified challenges for mothers with BD and their infants in “finding” each other in interaction at 3 months postpartum. If sustained, this interaction pattern may have a long-term impact on children’s development. We suggest interventions specifically focusing on sensitising and supporting mothers to read infants’ cues on a micro-level. This may help them to respond contingently and improve dyadic coordination and synchronicity.

Keywords: Bipolar disorder, Postpartum, Mother-infant interaction, Affective symptoms, Dyadic coordination

Background

The quality of mother-infant interaction is suggested as an important environmental mediator between perinatal mental disorder in mothers and infant development [1]. Emerging evidence implies that there may be disorder-specific deviations in interaction patterns [1–7]. To date, there has been little research on mother-infant interactions in the context of maternal bipolar disorder (BD).

For women with BD, childbirth and the postpartum period yield an increased risk of illness relapse compared with non-postpartum periods [8–11]. Estimations suggest an approximate one in five risk for a severe illness relapse [9–11] and one in two deliveries resulting in any affective episode [10, 11]. Thus, a high-risk period of illness relapse coincides with the period when mother-infant interaction patterns are evolving.

Within a dyadic system approach, interaction is defined as a bi-directional and dynamic process consisting of three domains: 1) parental contribution, 2) infant contribution, and 3) dyadic coordination [12, 13]. Attentiveness,

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sensitivity to infant cues and contingent responsiveness, are underscored as crucial parental components [13–15]. Potentially, BD symptoms with marked alterations in affect, energy, activity and cognition may impact these maternal behaviours. As a group, infants of mothers with BD have been linked to an increased risk for negative birth outcomes, such as neonatal readmissions and morbidity, small for gestational age (SGA <2nd-3rd percentile), low birth weight (< 2500 g) and prematurity [16]. Furthermore, preliminary findings suggest that the infants have disruptions in their physiological stress responsivity and regulation, which may imply an increased susceptibility to stressors [17]. Thus, there are risk factors that may affect interactional contributions on behalf of both the mother and infant, as well as potentially indicating the infants' increased need for sensitive care. The third domain, dyadic coordination, concerns whether the interactional behaviours of mother and infant are mutual and synchronised. Based on empirical findings, dyadic coordination is considered particularly indicative for child development [12, 13, 18, 19].

To the best of our knowledge, there are only three studies where the different domains of mother-infant interactions have been investigated within the first year postpartum, when the mother has BD. Maternal interaction behaviour was studied among mothers with BD who were admitted to a Mother and Baby Unit (MBU) within 1–36 weeks postpartum [20]. MBUs are specialised perinatal psychiatric units, where women with mental illness episodes are receiving mental health care and support in their relationship with their infant. Mothers with BD and schizophrenia deviated more from the normal range in their interaction behaviour, than mothers with unipolar depression [20]. Ten mothers with BD and nine with unipolar depression were reassessed at 12 months postpartum [21]. All had recovered from their prior postpartum episodes, but the mothers in the study group were evaluated as less sensitive and appropriate in their behaviour, with more negative affect than healthy controls. However, BD mothers showed significantly more affectionate talk to their infants than mothers with unipolar depression. Furthermore, the infants in the study group displayed a non-significant trend to be less expressive than controls [21]. When comparing maternal sensitivity and mother-infant reciprocity at 12 months postpartum among three groups of mothers (bipolar depression, unipolar depression and non-depression), mothers with bipolar depression obtained poorer scores than the other two groups. However, the differences were not significant [22].

With a scarce evidence base indicating difficulties, further research is needed, not least because interaction quality as a suggested mediator between maternal mental disorder and infant development is potentially modifiable [1, 16, 23].

In particular, we suggest that studies should include all three interactional domains to provide a comprehensive picture of mother-infant interactions. Furthermore, studies in early postpartum are needed. The majority of birth-related affective episodes develop before 6 months postpartum [8, 10], with the most severe (i.e., postpartum psychosis) often within 4 weeks after childbirth [10]. Moreover, two major biobehavioural shifts in infant development occur before 12 months, with the first appearing at 2–3 months. At this age, the infant's capability of participating in synchronous interactions is greatly enhanced, with emerging memory and anticipation of recurring interaction patterns [19, 24]. Early detection of possible deviations is also important to lessen the negative impact on development [24] and possibly the risk of subsequent mental disorders, including BD.

Finally, we know little about how variations in maternal symptom load may affect interaction, apart from one study where illness relapse requiring hospitalisation was associated with clear deviations in maternal behaviour [20].

In the present study, we compared mother-infant interactions in dyads where the mothers had BD with dyads where the mothers had no mental disorder. All three interactional domains (maternal behaviour, infant behaviour and dyadic coordination) were assessed at 3 months postpartum. As suggested by the aforementioned studies on maternal BD [20–22] and other maternal mental disorders [1–7], we anticipated more concerns in the mother-infant interactions of the BD sample than in the comparison group. We expected differences in all three interactional domains. Furthermore, we hypothesised that concurrent symptom load in the BD sample was negatively associated with interaction quality.

Methods

Design

The study is part of a Norwegian prospective investigation. Infant families where the mother has BD are studied from pregnancy to 12 months postpartum, with data collection at four time points.

Recruitment procedures and subjects

BD sample

Inclusion criteria for the study were women with a BD I or II diagnosis, with a cohabitating partner, and who were either pregnant or had recently given birth (within 3 months). Because of the main aims of the larger investigation, their partner had to be willing to participate. The exclusion criteria were parental substance abuse, multi-childbirth, premature birth < 35 weeks, or an infant with a known serious medical condition or syndrome. All eligible participants who consented to participate were included.

We provided oral and written information about the study to health professionals at mental health outpatient clinics and wards, infant mental health teams at child mental health services, community well-baby clinics, pregnancy care and maternity wards. We also informed about the study through the website of the national BD association and at group psychoeducation courses for patients with BD [25].

Recruitment took place between September 2014 and July 2016. Most participants (58%) were recruited from the geographic area of Vestre Viken Hospital Trust. The remaining participants were recruited from nearby counties in the south-eastern part of Norway.

All participants gave oral and written consent on behalf of themselves and their infant at an information meeting with TA (first author). The consent allowed TA to have the women's clinical BD diagnosis verified from their specialist mental health records and/or by contacting their specialist mental health professional. In addition, TA assessed the BD diagnosis using a semi-structured interview and discussed the diagnosis with the last author when needed.

Thirty-five women were interested in participating. In three cases, the woman's partner declined to participate. Three women were assessed not to have BD. One woman did not respond to TA's calls for setting up a meeting, and two women changed their mind. Thus, the final sample comprised 26 women diagnosed with BD. We have no record of the number of eligible women who declined to participate when informed by collaborating health professionals.

Non-clinical sample

Data for comparison of mother-infant interactions were included from another Norwegian study. The comparison group consisted of 30 mother-infant dyads, recruited from local well-baby clinics in Oslo, Norway, between December 2004 – January 2009 [26]. Inclusion criteria for the comparison group were being pregnant and having no substance abuse or mental health problems. The mothers' mental health status was investigated in pregnancy with European Addiction Severity Index [27], Millon's Clinical Multiaxial Inventory-III [28] and Hopkins Symptom Check List, SCL-25 [29]. At 3 months postpartum, the Edinburgh Postnatal Depression Scale (EPDS) [30] was administered to assess the presence of depressive symptoms. The maximum score on the EPDS is 30, and a score ≥ 10 indicates a risk for postpartum depression. The EPDS mean score in the comparison group was 3.16 (SD 3.20, range 0–12), corresponding to a low depression risk. All women in the comparison group also had a cohabitating partner. All participants gave oral and written consent on

behalf of themselves and their infant at the time of enrolment.

Assessments

Mother-infant interaction at three months postpartum

The same interaction situation and method of assessment were used for both samples. Mothers and infants were video-recorded in a 5-min free-play interaction situation. The recordings of the BD sample were performed at the participants' home ($n = 25$) or at an outpatient clinic ($n = 1$). The latter was the case for all recordings of the comparison group. The mothers were asked to interact with their infant as they were used to and as they pleased, with optional use of toys. At the end of the video-recording session, the mothers in both samples subjectively evaluated the representativeness of the play interaction. All mothers, except one in the BD sample who felt awkward because of the video-recording, regarded the play interaction as representative.

The mother-infant interactions were analysed using the Parent-Child Early Relational Assessment (PCERA) [31]. It is a standardised assessment method that has demonstrated good content and factor validity, as well as discriminant validity between clinical and non-clinical groups [32, 33]. The PCERA aims to examine strengths and concerns in parental and infant components and in their dyadic pattern. It contains 65 behavioural, affective and communicative variables. These are operationalised in a manual and rated numerically based on observed frequency, duration and intensity. Rating is performed on a five-point Likert scale. The five points are categorised into three areas of concern/strength according to PCERA: (1, 2) area of concern, (3) area of some concern and (4, 5) area of strength [31].

In the present study, all interactions in the BD sample were rated by an independent certified main coder. A second independent certified coder double-rated a random selection of 31% of the interactions for calculation of inter-rater reliability. A good inter-rater reliability was found using absolute agreement on ratings (intra-class correlation 0.75). The coders were aware of the women's BD diagnosis but were blinded to all other information.

In the study from which the comparison group data were derived, two independent experienced coders rated the interactions. The main coder in the present study was one of the coders. Both coders double-rated 20% of randomly selected interactions, and inter-rater reliability was calculated using categorical agreement (1-2, 3, 4-5). Intra-class correlation varied between 0.80 and 0.97 for the different subscales used in the study [26]. All information, including group status (no mental health problems vs. substance abuse or mental health problems), was unknown to the coders.

Maternal symptom load at three months postpartum in the BD sample

Assessments of symptom load were conducted at the same time-point as the interaction session. Depressive symptoms were assessed with the Inventory of Depressive Symptomatology (IDS) [34] and hypomanic/manic symptoms with the Young Mania Rating Scale (YMRS) [35].

We collected information about postpartum affective symptoms and episodes at least once at 1–2 months postpartum, either by direct contact with the mothers and/or their respective specialist mental health professionals. Furthermore, this was examined retrospectively in an interview with all women at 3 months, in conjunction with the interaction session and assessment with IDS and YMRS. Two mothers joined the study at 3 months postpartum and had not been in contact with any mental health care system postpartum.

Statistical analyses

Demographic and clinical data are presented as either proportions or means with their standard deviations (SD) and range. When conducting analyses on interaction data, PCERA variables were organised into six subscales according to the manual, with two maternal, two infant and two dyadic subscales [31]. Subscales are used since not all variables in the PCERA are applicable for all child ages. In the present study, subscales appropriate for infant age 3–4 months were chosen. However, two variables from the original infant subscales were excluded. “Quality of exploratory play” was excluded on recommendation from the coders, since this is a difficult variable to rate on infant age 3 months. “Consolability/soothability” is not possible to rate if no need for soothing occurs during the interaction. The final subscales contained 25 maternal, 17 infant and 8 dyadic variables (see Table 1).

Group differences, using PCERA mean scores on the subscales, were analysed using independent samples t-tests. The chi-square test for contingency tables or Fisher’s exact test was used to detect associations between categorical variables and BD vs. the non-clinical sample. Correlation analyses were performed separately for BD and non-clinical samples using Pearson’s correlation coefficient (r).

To identify possible confounders, we studied all variables that could influence the outcome known from the literature. Possible confounding factors investigated were maternal age, education, work participation, parity, infant gestational age, infant gender, birth weight and infant exact age at the interaction session. Only variables with significant relationships with both the exposure (BD vs. non-clinical) and the outcome variables (PCERA maternal, infant and dyadic subscales) were considered as possible confounders and included in the multiple linear regression analysis.

Within the BD sample, we conducted an independent samples t-test to investigate whether infant exposure to

maternal BD medication in pregnancy and postpartum was associated with PCERA mean scores.

Pearson correlation analyses and linear regression analyses were used to examine the association between maternal symptom load as a continuous variable and the outcome variables. Additionally, we dichotomised symptom scores to obtain categorical variables. An IDS score of 20 and a YMRS score of 14 were used as cut-offs between “low” and “high” symptom loads. According to the IDS scale, a score of 21 is the cut-off between mild and moderate symptom load [34]. Based on our data, we defined 20 as a cut-off between “low” and “high” symptom load, in order to obtain a fairly equal distribution of the BD participants in two groups. This is purposeful for statistical analysis with a small sample. The same logic was applied when deciding a score of 14 as cut-off on YMRS. According to the YMRS, the mean score of patients who clinically are assessed as hypomanic/lightly manic is 13 [35]. Differences in PCERA mean scores between “low” and “high” symptom load were analysed with independent samples t-tests.

Data regarding the presence of symptoms and affective episodes 0–3 months postpartum are used only for descriptive purposes. The total data were complex and would result in too many variables for statistical analysis of correlation in a small sample.

Overall, a significance level of 0.05 was applied. Effect sizes were calculated by Cohen’s d . Small effect sizes were defined as 0.20, medium as 0.50 and large as 0.80 and higher [36]. The internal consistency of the subscales was examined using Cronbach’s α . An α value > 0.70 is considered satisfactory, and α values ≥ 0.90 are considered excellent.

The proportions of the BD sample and the non-clinical sample were organised into three areas of concern/strength (scores 1–2, 3, 4–5) to show the distribution of interaction quality.

Data were analysed using the IBM SPSS statistics for Windows version 23 (Armonk, NY, USA: IBM Corp).

Results

Sample characteristics

The maternal and infant characteristics of the two samples are presented in Table 2.

The non-clinical sample had significantly higher maternal age, education, and work participation than the BD sample. Gestational age and birth weight were within the normal range for both infant samples, and there were no significant group differences. A majority of the infants in the BD sample (65%) were exposed to BD medication in pregnancy. As some mothers chose not to breastfeed when on medication, the proportion of infants exposed both in pregnancy and postpartum was lower (38%).

Table 1 PCERA maternal, infant and dyadic subscales utilised, with Cronbach's alpha for both samples

Subscale	Variables included in subscales	Cronbach's alpha BD sample vs. Non-clinical sample	
S1-Maternal positive affective involvement, sensitivity and responsiveness	2) ^a Expressive, non-flat tone of voice 3) Warm, kind tone of voice 4) Expressed positive affect 7) Lack of depression, withdrawn mood 9) Enthusiastic mood 12) Enjoyment, pleasure 13) Positive physical contact 15) Visual contact 16) Amount of verbalisation 17) Quality of verbalisation 18) Social initiative 19) Contingent responsiveness 22) Sensitivity, reads cues and responds 23) Connectedness 24) Mirroring 26) Creativity	0.92	0.96
S2-Maternal negative affect and behaviour	1) Angry, hostile tone of voice 3) Warm, kind tone of voice 5) Expressed negative affect 6) Angry, hostile mood 11) Displeasure 14) Negative physical contact 16) Amount of verbalisation 19) Contingent responsiveness 21) Lack of structuring and mediating 22) Lack of sensitivity and responsiveness 25) Rigidity 27) Intrusiveness 28) Inconsistency/unpredictability	0.88	0.93
S3-Infant positive affect, communicative and social skills	30) Expressed positive affect 32) Happy, pleasant 33) Apathetic, withdrawn 38) Alertness 39) Social initiative 40) Social responsiveness 47) Robustness 55) Visual contact 56) Communicative competence 57) Readability	0.96	0.94
S4-Infant dysregulation and irritability	31) Expressed negative affect 34) Anxiety 35) Irritable, angry 37) Emotional lability 41) Avoiding/averting 46) Attentional abilities 50) Self-regulation, organisation	0.80	0.87
S5-Dyadic mutuality and reciprocity	59) No flat, empty, constricted 61) Enthusiasm, joie de vivre 63) Reciprocity	0.96	0.88
S6-Dyadic tension	58) Anger, hostility 60) Tension, anxiety 62) No joint attention, activity 64) Disorganisation 65) State dissimilarity	0.86	0.90

^aVariable number in manual [31]**Mother-infant interaction**

Table 3 demonstrates that there were significant group differences with medium to large effect sizes (Cohen's *d* 0.73–1.32) on all subscales, except on subscale 4, "Infant dysregulation and irritability".

Figure 1 shows the distribution of the BD and the non-clinical sample on the three categories of concern/strength for each subscale.

The proportion of BD and comparison dyads displaying interaction behaviour within the area of strength

Table 2 Characteristics of mothers and infants in the BD and non-clinical sample

Variable	BD sample <i>N</i> = 26		Non-clinical sample <i>N</i> = 30		<i>p</i> -value
Maternal age at inclusion (years) mean ± sd; range	30.5 ± 4.6; 22–37		33.3 ± 5.0; 27–44		0.04
	n	%	n	%	
Primary diagnosis					Not applicable
BD I	7	27	0		
BD II	19	73	0		
Parity					0.32
Primiparous	13	50	20	67	
Multiparous	13	50	10	33	
Completed education					< 0.001
Primary school	8	31	1	3	
Secondary school	5	19	5	17	
Bachelor's degree	11	42	8	27	
Master's degree	2	8	16	53	
Work participation when not pregnant					0.002
Working full-time	12	46	23	77	
Working part-time +/- receiving benefits	4	15	2	7	
Receiving benefits only	8	31	0		
Unemployed	1	4	1	3	
School	1	4	4	13	
Infant gender					0.91
Girl	10	38	12	40	
Boy	16	62	18	60	
Infant exposure to BD medication					Not applicable
In pregnancy	17	65	0		
In pregnancy + 2–3 months postpartum	10	38	0		
Infant birth weight (gram)	3632 ± 507;		3720 ± 434;		0.49
mean ± sd; range	2905–5085		2911–4715		
Infant gestational age (months)	39.5 ± 1.2;		40 ± 1.2;		0.13
mean ± sd; range	37.2–41.6		37–42		

Table 3 Interaction score comparisons (mean) between BD sample and non-clinical sample on PCERA subscales

Subscale	BD sample Mean (sd) 95% CI	Non-clinical sample Mean (sd) 95% CI	Mean difference 95% CI	Sign./ Adjusted sign.	Cohen's <i>d</i>
S1-Maternal positive affective involvement, sensitivity and responsiveness	3.7 (0.43) 3.5–3.8	4.1 (0.63) 3.8–4.3	−0.40 (−0.70 to −0.10)	0.01*/0.04*	0.73
S2-Maternal negative affect and behaviour	4.0 (0.39) 3.8–4.1	4.4 (0.54) 4.2–4.6	−0.38 (−0.63 to −0.12)	0.004*/0.03*	0.81
S3-Infant positive affect, communicative and social skills	3.2 (0.71) 2.9–3.5	3.7 (0.70) 3.5–4.0	−0.51 (−0.89 to −0.13)	0.01*	0.73
S4-Infant dysregulation and irritability	4.0 (0.46) 3.9–4.2	4.0 (0.63) 3.8–4.3	−0.003 (−0.29 to 0.29)	0.98	0.01
S5-Dyadic mutuality and reciprocity	2.6 (0.83) 2.3–3.0	3.7 (0.82) 3.4–4.0	−1.08 (−1.53 to −0.64)	< 0.001*	1.32
S6-Dyadic tension	3.6 (0.52) 3.4–3.8	4.1 (0.71) 3.8–4.4	−0.46 (−0.80 to −0.13)	0.01*/0.04*	0.74

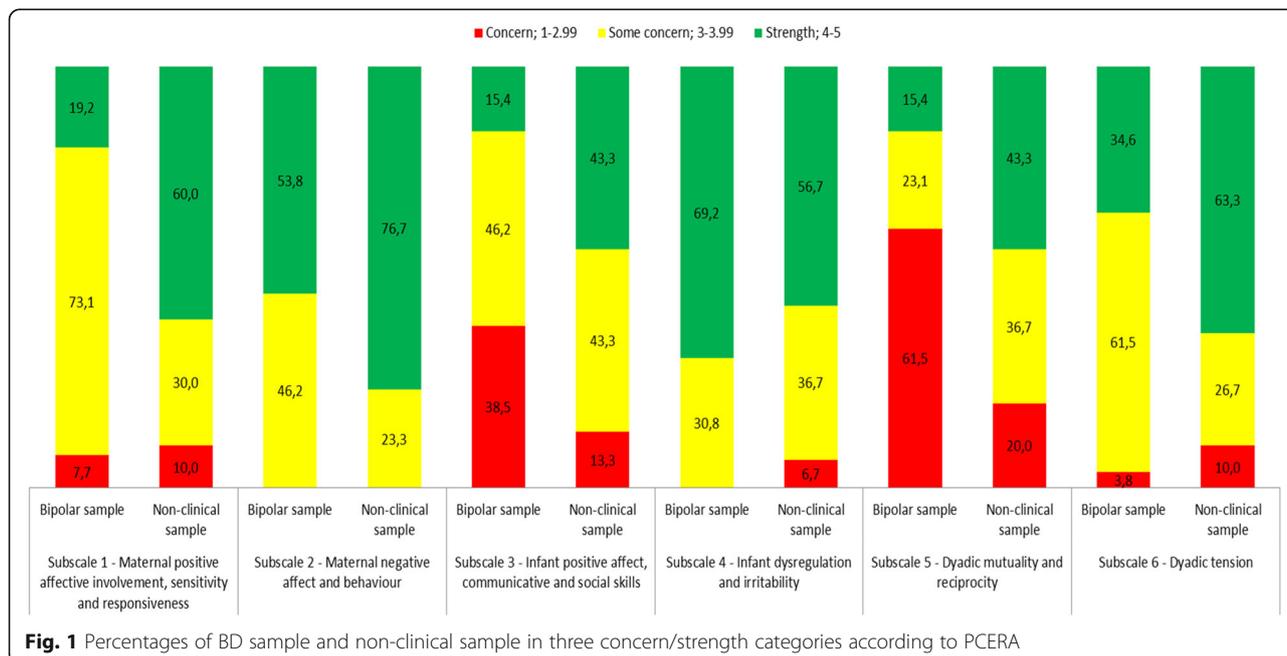


Fig. 1 Percentages of BD sample and non-clinical sample in three concern/strength categories according to PCERA

varied between 15.4–69.2% and 43.3–76.7%, respectively, depending on the subscale.

Maternal subscales

The BD sample scored significantly lower on subscale 1, “Maternal positive affective involvement, sensitivity and responsiveness”, than the non-clinical sample (mean difference (Δ_{mean}): -0.40, 95% confidence interval (CI): -0.70 to -0.10). In multiple linear regression analysis, this association remained significant after controlling for the confounding effect of maternal age (adjusted Δ_{mean} : -0.32, 95% CI: -0.62 to -0.02). No other confounding variables were found.

On subscale 1, a large majority of mothers in the BD sample (80.8% vs. 40%) were in the some concern - concern range (Fig. 1). Inspection of the 16 individual variables included in subscale 1 revealed that the differences between the groups were mainly identified on the variables “social initiative”, “quality of verbalisation”, “sensitivity, reads cues and responds”, “contingent responsivity” and “mirroring”, that is, on the variables that entail involvement. The BD sample did not differ from the comparison group on the variables “expressed positive affect”, “visual contact” and “amount of verbalisation”.

On subscale 2, “Maternal negative affect and behaviour”, the BD sample scored significantly lower than the comparison group (Δ_{mean} : -0.38, 95% CI: -0.63 to -0.12). This association remained significant after adjusting for maternal age. Approximately half of the BD sample (46.2% vs. 23.3%) was in the some concern range on subscale 2, whereas none of the participants were in the concern

range (Fig. 1). Considering the 13 individual variables included in subscale 2, the group differences were primarily on the same and similar variables as on subscale 1, “contingent responsivity”, “lack of structuring and mediating” and “lack of sensitivity and responsiveness”. In both groups, there were few signs of overt negative affect, anger and hostility.

Infant subscales

The BD sample had a significantly lower score on subscale 3, “Infant positive affect, communicative and social skills”, than the non-clinical sample (Δ_{mean} : -0.51, 95% CI: -0.89 to -0.13). No confounding factors were found for this association. Figure 1 displays that 84.7% (vs. 56.6%) of the infants in the BD sample were in the some concern - concern range. The largest group difference was found in concern scores (BD 38.5% vs. 13.3%). Inspection of the 10 individual variables on subscale 3 identified less optimal scores for the infants in the BD sample on “expressed positive affect”, “happy, pleasant”, “apathetic, withdrawn”, “communicative competence” and “social responsiveness”.

No mean difference on subscale 4, “Infant dysregulation and irritability”, was found between the BD and non-clinical samples (Δ_{mean} : -0.003, 95% CI: -0.29 to 0.29) after adjusting for the confounding effect of maternal age. A higher percentage (43.4%) of the infants in the non-clinical sample had scores in the some concern - concern range on subscale 4 compared with the BD sample (30.8%) (Fig. 1); however, the difference was not significant.

Dyadic subscales

The largest mean difference between the groups was found on subscale 5, “Dyadic mutuality and reciprocity”, showing that the BD sample on average scored more than 1 point lower than the non-clinical sample (Δ_{mean} : -1.08 , 95% CI: -1.53 to -0.64). No confounding factors were found. A total of 61.5% of the dyads in the BD sample were in the concern range (vs. 20%), and 23.1% were in the some concern range (vs. 36.7%) (Fig. 1). There were large group differences on all three variables on the subscale, with the BD dyads having less optimal scores on “flat, empty, constricted”, “enthusiasm, joie de vivre” and “reciprocity”.

The overall mean score was significantly lower in the BD sample than in the non-clinical sample on subscale 6, “Dyadic tension”, (Δ_{mean} : -0.46 , 95% CI: -0.80 to -0.13). This association remained significant after adjusting for the confounding effect of maternal age and work participation. A total of 65.3% (vs. 36.7%) of the BD sample were in the some concern - concern range (Fig. 1). Inspection of the 5 individual variables on the subscale revealed group differences on the variables “no joint attention, activity”, “disorganisation” and “state dissimilarity”. None of the

groups were characterised by dyadic “anger, hostility” or “tension, anxiety”.

Finally, no significant associations were found between infant medication exposure and mean scores on any of the subscales in the BD sample (Additional file 1). Though, the association was of medium effect size (Cohen’s d 0.53) on subscale 2.

Association between maternal symptom load and mother-infant interaction, and prevalence of postpartum episodes

Table 4 presents the symptom load in the BD sample at 3 months postpartum and affective episodes during the 0–3 months postpartum period.

At 3 months postpartum, 38.4% of the BD mothers had moderate to severe symptoms (34.6% depressive, 3.8% hypomanic), 30.7% had mild symptoms (23.1% depressive, 3.8% hypomanic and 3.8% mixed) and 30.8% of the BD mothers were euthymic. No significant associations were found between symptom load and interaction quality, either when treating symptom load as a continuous or categorical variable (Additional file 2 and Additional file 3). However, the association was of medium

Table 4 Symptom load of BD mothers at 3 months postpartum and proportion with at least one affective episode during the 0–3 months postpartum period

	Total N = 26				Primiparous N = 13				Multiparous N = 13			
	n	%	M	range	n	%	M	range	n	%	M	range
Symptom load 3 months postpartum												
Euthymia												
IDS score 0–13	8	30.8	5.3	0–12	6	46.1	6.7	2–12	2	15.4	1.0	0–2
+ YMRS score 0–7			1.3	0–2			1.7	0–2			0	
Depressive symptomatology (IDS score)												
Mild (14–21)	6	23.1	18.3	16–21	3	23.1	18.7	18–19	3	23.1	18.0	16–21
Moderate (22–30)	5	19.2	26.2	23–29	1	7.7	29.0		4	30.8	25.5	23–29
Severe (31–38)	4	15.4	36.0	32–38	2	15.4	37.0	36–38	2	15.4	35.0	32–38
Manic symptomatology (YMRS score)												
Hypomania (8–20)	2	7.7	14.0	10–18	0				2	15.4	14.0	10–18
Mixed state												
Mild (IDS 14–21 + YMRS 8–20)	1 ^a	3.8			1	7.7						
Affective episodes 0–3 months postpartum	12	46.1			4	30.8			8	61.5		
Depressive episode												
Mild	3	11.5			1	7.7			2	15.4		
Moderate	2	7.7			0				2	15.4		
Severe	4	15.4			3	23.1			1	7.7		
Manic episode	2	7.7			0				2	15.4		
Two subsequent episodes (hypomania; depression)	1	3.8			0				1	7.7		

IDS = Inventory of Depressive Symptomatology, YMRS = Young Mania Rating Scale

^aIDS score = 14, and YMRS score = 11.5

effect size (Cohen's d 0.70) on subscale 1, when treating symptom load as a categorical variable.

During the first three postpartum months, 12 (46.1%) BD mothers were assessed to have had affective episodes, six (23.1%) experienced subthreshold symptoms, and eight (30.8%) were euthymic.

More multiparous than primiparous BD mothers had at least mild affective symptoms at 3 months postpartum (84.7% vs. 53.9%), and at least one postpartum illness episode (61.5% vs. 30.8%).

Discussion

The present study addresses the knowledge gap on early mother-infant interaction in the context of maternal BD. Although there were individual variations, our results indicate significantly more concerns in mother-infant interactions at 3 months postpartum when the mother has BD compared to when the mother has no mental disorder. More concerns were observed in all three domains that were studied: maternal behaviour, infant behaviour and dyadic coordination. The results were not associated with concurrent maternal affective symptom load.

Sample characteristics

Although the women in the non-clinical sample had a higher level of education and work participation, the BD sample was in no way characterised by social adversity. Two-thirds had managed to complete secondary school and 50% had an even higher level of education, which is on par with the Norwegian population. Approximately 60% were either in full- or part-time work. The significant group differences reflect the skewed resourcefulness of the comparison group, even in comparison with the general population of Norway.

The infants in our BD sample did not have poorer newborn status than the comparison infants. With the exclusion criteria, we eliminated the most severe neonatal outcomes (i.e., prematurity and serious medical conditions). Neither were the infants in our BD sample affected by the negative birth outcomes described in the literature (i.e., SGA and low birth weight) [16]. Thus, the infants in our BD sample represented low biomedical risk with regard to these factors.

Mother-infant interaction

As anticipated, there were more concerns in the mother-infant interactions of the BD sample. Within the results, there are interesting nuances. On the one hand, the mothers in the BD sample resembled the non-clinical mothers in display of positive affect, visual contact and amount of verbalisation. However, in the BD sample, these maternal behaviours were less sensitively attuned and contingent on the infants' signals. The decreased maternal sensitivity corresponds with observations and tendencies

in prior studies [20–22]. Furthermore, our results align with previous findings of BD mothers vocalising more with their infants [21] and toddlers [37] than mothers with unipolar depression. Interestingly, when talking with their toddlers, a speech pattern with little turn-taking was representative of the mothers with BD, implying reduced sensitivity to child cues [37].

The mothers in our BD sample were not characterised by expressed negative affect, contrasting the findings of Hipwell et al. [21]. A possible explanation for the discrepant findings may be that their case group consisted of both mothers with BD and with unipolar depression. Although not conclusive, their analyses suggest that the unipolar depression group contributed the most to expressed negative affect [21]. Thus, when combining the results from the two maternal subscales, the mothers with BD were generally positive and friendly, but more BD mothers than comparison mothers displayed difficulties in different aspects of sensitivity, involvement and contingent responsiveness. Communication that is positive, but noncontingent, may have unintended consequences. Infants from 2 months of age are sensitive to the social contingency of maternal behaviour and respond to noncontingent communication with a decrease in their own positive affect [38, 39].

In fact, the infants in our BD sample were significantly less expressive of positive affect and happiness, as well as overall less expressive in communication and responsiveness, than the comparison infants. In combination with little expression of negative affect and irritability (subscale 4), a majority of the infants in the BD sample were quiet and subdued. This corroborates a trend reported by Hipwell et al. that infants in the study group were less expressive at 12 months postpartum than controls [21]. Notably, our observations of little expressed negative affect and dysregulation do not necessarily contradict the findings of Johnson et al. of disruptions in physiological stress responsiveness and regulation [17]. The infants of BD mothers in their study did not differ from controls in overt display of negative affect or behaviour. Their maladaptive regulation patterns only showed on physiological measures (respiratory sinus arrhythmia, RSA) [17]. However, physiological stress responsiveness and regulation have not been measured in the present study.

With reduced maternal sensitivity and contingent responsiveness (i.e., behaviours that promote reciprocity) and reduced communicative and responsive behaviours in the infants, the low level of dyadic coordination in our BD sample is a conceivable finding. Several mothers and infants had discrepant affective states, modest joint attention and minimal reciprocal communication, thus resulting in constricted dyadic exchanges. In other words, several mothers and infants did not seem to “find” and synchronise with each other. Whereas group

differences in the present study are significant, the observed difficulties in mother-infant reciprocity in dyads of mothers with bipolar depression did not reach the level of significance in a previous study [22]. The authors discuss whether their measurements were not sensitive enough to capture subtle differences in small samples [22]. The PCERA has been found to have good sensitivity and discriminant validity [31, 32], even with small sample sizes [40].

There are alternative interpretations of the dyadic findings. One line of thought has been touched upon above that maternal interaction patterns of reduced sensitivity and noncontingency may prompt specific responses in the infants, i.e., the infant withdraws from interaction and displays little affect and communication [38, 39]. A second line of thought concerns what effect the infant's behaviour may have on the mother. A small body of research highlights how infants' characteristics in communicative behaviour may reinforce or diminish caregiver contingent responsiveness [41]. Are BD-offspring constitutionally less expressive and communicative as young infants, making them "difficult" dyadic partners? This is an unanswered and complex question concerning infants of mothers with inheritable mental disorders [6, 7, 23]. The most obvious factors to consider, such as birth outcomes and infant medication exposure, could not shed light on the infants' behaviour in the present study. However, regardless of who contributes the most to the lack of reciprocity, dyadic difficulties are at risk of being maintained and strengthened by self-reinforcing mechanisms.

Associations between maternal symptom load and mother-infant interaction

The fact that 38.4% in the BD sample had moderate to severe affective symptoms at 3 months postpartum and 46.1% had prior or ongoing postpartum episodes illustrates that many women with BD experience an immense personal burden when the mother-infant relationship is established. Most deviations were of depressive character. This is consistent with depression being the most commonly reported postpartum episode for women with BD [42, 43].

Intuitively, the presence of affective symptoms should reduce the quality of mothers' interaction contributions. However, and contrary to our hypothesis, concurrent symptom load was not associated with interaction quality, neither when analysing individual subscales nor the PCERA scale as a whole. Thus, we did not observe a "dose-response" effect between current symptom load and interaction quality. We may remark that a type II error cannot be ruled out in our hypothesis testing. There was a medium to large effect size on subscale 1, when treating symptom load as a categorical variable (Additional file 2). Still, given the non-significant association, we treat our assumption as being too simplistic

and straightforward. It is likely that interactional dynamics are influenced by several factors. First, studies of maternal depression have highlighted individual differences in overt maternal behaviour despite the same symptom level [44]. Second, there may be individual differences in how the infants experience and thus respond to the mothers' symptoms [44]. Third, transient illness episodes have been found to be less influential on interaction quality than prolonged ones [44, 45]. In the women with BD, we observed large variations concerning the time of onset, duration, severity and consequences of mood episodes. The complexity and lack of statistical power did not allow us to explore this further.

Furthermore, there may be other factors at play related to having BD that may affect interaction quality regardless of symptom level. In several studies, persons with BD have been found to have deficits in emotion recognition and mentalising across different phases of illness [46, 47]. Sensitivity and contingent responsiveness in mother-infant interactions imply emotion recognition and mentalising capabilities especially with very young infants, who have small communicative repertoires and subtle emotional and social cues. Emotion recognition and mentalising were not investigated in the present study but may be important aspects to explore in future studies.

Altogether, the findings point to a need for clinical interventions that sensitise mothers to their infant's cues on a micro-level, for example by using specialised approaches such as the Newborn Behavioral Observations System [48] and the PCERA. With its thorough interaction assessment, the PCERA is also valuable for clinical application [31, 49]. Through viewing recorded samples of interaction, mothers can get detailed feedback of their infant's cues with guidance on contingent maternal behaviour. Such approaches may strengthen interactional reciprocity and synchronicity.

Strengths and limitations

Whereas prior studies have primarily assessed maternal interaction behaviour, the main strength of the present study is the inclusion of both maternal and infant behaviour and their dyadic coordination. This allowed for a more comprehensive interaction analysis. Almost all interactions in the BD sample were carried out in their homes. This strengthens the ecological validity of the data [50]. Furthermore, the mothers (except one) confirmed the representativeness of the interaction sessions.

The coders were not naïve to the mothers' BD status. This may have influenced their ratings. Counteracting such influences, the variables in PCERA are strictly operationalised in the manual, with extensive and precise descriptions regarding rating. Additionally, the main coder

in the present study also coded the comparison data. In that study, group allocation was unknown to the coders.

The relative resourcefulness of the included dyads is likely to limit the generalisability of our findings to subgroups with similar characteristics. However, it is noteworthy that we nevertheless found interactional concerns and significant group differences. A higher level of interactional concerns may be observed in dyads of BD mothers with risk factors such as single motherhood, substance abuse, socioeconomic difficulties, and infants with negative birth outcomes. In the same ways that the BD sample is not representative of all dyads in which the mother has BD, the dyads of the comparison group are not representative of the general population. The comparison sample consists of mothers without known substance abuse or mental health problems, an above average level of education, and healthy infants without birth complications. Thus, it is likely that both samples are skewed towards the resourceful end of the populations they represent.

Given the relatively small sample size, the findings need to be interpreted with some caution. A small sample size increases the width of confidence intervals and limits generalisation.

Replication studies and studies of less resourceful dyads are needed. We also suggest studies of father-infant interaction when the mother has BD to investigate whether the low level of expressiveness we found in the infants may be relationship-specific.

Conclusion

The present study identified concerns in maternal and infant interaction behaviour at 3 months postpartum in a relatively resourceful sample of mothers with BD and their infants compared to dyads with mothers without mental health problems. Most interactional concerns were identified in dyadic coordination. The findings were not influenced by the BD mothers' concurrent affective symptoms.

To achieve dyadic coordination and synchrony, the interaction partners need to be familiar with each other's behavioural repertoire and interaction rhythms [51]. Thus, we suggest interventions specifically focusing on sensitising and supporting mothers to read infants' cues on a micro-level. This may help them to respond contingently and improve interactional reciprocity and synchronicity.

Supplementary information

Supplementary information accompanies this paper at <https://doi.org/10.1186/s12888-019-2275-4>.

Additional file 1. Interaction score comparisons (mean) between groups (infants exposed vs. not exposed to BD medication) in BD sample ($n = 26$) on PCERA subscales.

Additional file 2. Interaction score comparisons (mean) between groups (maternal high vs. low symptom load) in BD sample ($n = 26$) on PCERA subscales.

Additional file 3. Correlations between PCERA subscales and symptom load in BD sample ($n = 26$).

Abbreviations

BD: Bipolar disorder; EPDS: Edinburgh Postnatal Depression Scale; IDS: Inventory of Depressive Symptomatology; PCERA: Parent-Child Early Relational Assessment; YMRS: Young Mania Rating Scale

Acknowledgements

We are grateful to the mothers and infants who generously contributed to enhanced knowledge about early interaction. We also thank MSc Clinical psychologists M. Meier and C. Furmark for their extensive work as PCERA coders.

Authors' contributions

TA designed the study in collaboration with DVS. TA performed recruitment and data collection. TA, CB and DVS made the statistical analyses in collaboration. TA is the primary author in the writing of the manuscript. DVS and KS have critically revised and substantially contributed throughout the compilation of the manuscript. VM and TS designed the study from which the comparison data are derived, and performed recruitment and data collection in that study. VM and TS contributed with revision and valuable inputs to the manuscript. All authors read and approved the final manuscript.

Funding

The study was supported by Vestre Viken Hospital Trust. The funding body had no role in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Availability of data and materials

The datasets generated and analysed during the present study (film recordings) will not be shared or made publicly available, since participants may be identifiable. Request of permission to access data may be sent to the corresponding author.

Ethics approval and consent to participate

The present study, and the study from where the comparison data were derived, were both conducted in accordance with the Declaration of Helsinki. All parents gave informed oral and written consent, on behalf of themselves and their infant.

The study from which the comparison group data were derived was approved by the Norwegian Center for Research Data (11724) and the Norwegian Regional Committee for Medical Ethics (2016/1300), which also approved the present study (2014/388).

Consent for publication

Participants gave written consent for publication.

Competing interests

The authors declare that they have no competing interests.

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Received: 28 January 2019 Accepted: 5 September 2019

Published online: 18 September 2019

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Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Mothers with and without BD interactions 3 months. BMC Psychiatry

Additional file 1. Interaction score comparisons (mean) between groups (infants exposed vs. not exposed to BD medication) in BD sample (n=26) on PCERA subscales.

Subscale	Infants exposed to BD medication (n=17) Mean (sd)	Infants not exposed to BD medication (n=9) Mean (sd)	Mean difference 95 % CI	Sign.*	Cohen's d
S1- Maternal positive affective involvement, sensitivity and responsiveness	3.6 (0.45)	3.8 (0.41)	0.15 (-0.22 to 0.53)	0.40	0.46
S2- Maternal negative affect and behaviour	3.9 (0.40)	4.1 (0.35)	0.21 (-0.11 to 0.53)	0.19	0.53
S3- Infant positive affect, communicative and social skills	3.2 (0.68)	3.2 (0.81)	-0.01 (-0.62 to 0.61)	0.98	0.01
S4- Infant dysregulation and irritability	4.0 (0.47)	4.2 (0.44)	0.18 (-0.22 to 0.57)	0.36	0.44
S5- Dyadic mutuality and reciprocity	2.6 (0.74)	2.6 (1.03)	-0.09 (-0.81 to 0.63)	0.80	0.10
S6- Dyadic tension	3.6 (0.59)	3.7 (0.41)	0.04 (-0.41 to 0.50)	0.85	0.20

*Independent sample t-test

Additional file 2. Interaction score comparisons (mean) between groups (maternal high vs. low symptom load) in BD sample (n=26) on PCERA subscales.

Subscale	High symptom load (n=11) Mean (sd)	Low symptom load (n=15) Mean (sd)	Mean difference 95 % CI	Sign.*	Cohen's d
S1- Maternal positive affective involvement, sensitivity and responsiveness	3.5 (0.44)	3.8 (0.42)	0.22 (-0.13 to 0.57)	0.21	0.70
S2- Maternal negative affect and behaviour	3.9 (0.39)	4.0 (0.39)	0.11 (-0.21 to 0.43)	0.47	0.26
S3- Infant positive affect, communicative and social skills	3.1 (0.73)	3.3 (0.71)	0.18 (-0.40 to 0.77)	0.52	0.28
S4- Infant dysregulation and irritability	3.9 (0.48)	4.1 (0.43)	0.23 (-0.14 to 0.60)	0.21	0.44
S5- Dyadic mutuality and reciprocity	2.6 (0.78)	2.6 (0.90)	0.07 (-0.63 to 0.76)	0.84	0.08
S6- Dyadic tension	3.6 (0.62)	3.7 (0.46)	0.07 (-0.37 to 0.50)	0.76	0.18

*Independent sample t-test

Additional file 3. Correlations between PCERA subscales and symptom load in BD sample (n=26).

Subscale	Depression		Hypomania/mania	
	r*	Sign.	r*	Sign.
S1- Maternal positive affective involvement, sensitivity and responsiveness	0.10	0.62	0.01	0.97
S2- Maternal negative affect and behaviour	0.02	0.92	0.05	0.80
S3- Infant positive affect, communicative and social skills	0.09	0.68	0.17	0.42
S4- Infant dysregulation and irritability	0.24	0.25	0.15	0.45
S5- Dyadic mutuality and reciprocity	0.10	0.63	0.02	0.91
S6- Dyadic tension	0.06	0.76	0.02	0.93

*Pearson's correlation coefficient. P-values from linear regression analysis.

Paper III

Anke, T.M.S., Slinning, K., Moe, V., Brunborg, C., Siqueland, T. S, & Skjelstad, D.V. (2020). Bipolar offspring and mothers: Interactional challenges at infant age 3 and 12 months - a developmental pathway to enhanced risk? *International Journal of Bipolar Disorders*. Manuscript submitted, under review.

**Bipolar offspring and mothers: Interactional challenges at infant age 3 and 12 months -
a developmental pathway to enhanced risk?**

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Abstract

Background: Bipolar offspring are considered a high-risk group for developing mental disorders. Developmental outcomes result from additive and interactive effects of biological vulnerability and environmental influences. Mother-infant interactions represent important early environmental influences that may modify infants' risk of mental disorders. However, little is known about the early mother-infant interaction trajectories in the context of bipolar disorder (BD).

Methods: The current prospective study investigated the patterns and development of mother-infant interactions from infant age 3 to 12 months in 26 dyads where the mothers had BD compared to 28 dyads where the mothers had no mental disorder. We assessed maternal, infant and dyadic behaviour with the Parent-Child Early Relational Assessment.

Results: BD dyads demonstrated significantly more challenges in all three interaction domains at infant age 12 months compared to the healthy dyads. This was in line with the findings at infant age 3 months. Subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours in the BD dyads. Continuous difficulties with dyadic coordination and reciprocity were the most concerning interaction behaviours throughout the first year.

On the positive side, there was little expression of negative affect or tension in maternal, infant and dyadic behaviour, and some positive changes in infant behaviour from 3 to 12 months.

Conclusions: The current results suggest that mother-infant interaction patterns in the first year of life may enhance developmental risk for bipolar offspring. Clinical interventions should address both the BD mothers' needs in relation to postpartum mood deviations, and mother-infant interactions. We suggest interaction interventions that help sensitise mothers to their infant's cues and provide attuned contingent responses, to promote dyadic coordination and reciprocity.

Keywords: bipolar disorder, offspring, mother - infant interaction, prospective study, developmental trajectories, dyadic coordination, at-risk states

Background

It is well established that bipolar offspring are a high-risk group for developing mental disorders. Estimates indicate that the risk of developing bipolar disorder (BD) is between 6 to 9 % (Rasic et al., 2013; Smoller & Finn, 2003), with a broader risk of 60 % for any mental disorder when one of the parents has BD (Rasic et al., 2013). Current research and theoretical models emphasise that developmental outcomes result from additive and interactive effects of a biological vulnerability and environmental influences (Chang et al., 2003; McGowan & Kato, 2008; Willcutt & McQueen, 2010). Heritability is estimated to explain 60 to 85 % of the variance in risk (Smoller & Finn, 2003). Nevertheless, the majority of bipolar offspring do not develop BD, and many do not develop any mental disorder (Rasic et al., 2013). In line with a developmental psychopathology framework, different influences need to be considered at different stages to understand the development of mental health risk and resilience (Cicchetti, 2010; Willcutt & McQueen, 2010).

In early life, caregiver-infant interactions contribute as environmental influences with profound impact on the infant's neurobehavioural and social-emotional development (Champagne & Curley, 2005; Greenberg et al., 2014; Nelson & Bosquet, 2000; Tronick, 2007). Coinciding, the first postpartum year is a period with increased risk of illness relapse for women with BD (Di Florio et al., 2013; Wesseloo et al., 2016). It is estimated that postpartum women with BD have a one in two risk for any affective episode, and a one in five risk for a severe illness relapse (Di Florio et al., 2013; Jones et al., 2014). Thus, it is likely that offspring are exposed to mothers with mood symptoms during the first 12 months. However, few studies have investigated mother-infant interactions in the context of maternal BD.

Within the first year, impairments in maternal behaviour, such as reduced sensitivity, have been demonstrated among mothers with BD (Hipwell et al., 2000; Hipwell & Kumar, 1996). Studies have also reported non-significant trends of decreased infant expressivity (Hipwell et al., 2000) and dyadic reciprocity (Logsdon et al., 2015).

In a recent publication we reported significant group differences in interaction patterns between mothers with and without BD and their three-month old infants. The mothers with BD were generally positive and friendly in the interactions, but displayed more difficulties in sensitivity, involvement and contingent responsiveness than the comparison mothers, and more infants showed subdued positive affect and communication. However, the most

concerning interaction behaviours were observed in mother-infant dyadic coordination (Anke et al., 2019a).

A few other studies have also reported on early interaction challenges. During admission to a specialised perinatal psychiatric care (i.e. Mother-Baby Unit), a maternal diagnosis of BD or psychosis was associated with poorer mother-infant interactions, than a maternal diagnosis of depression or anxiety disorder (Wright et al., 2018). Later in infancy and toddlerhood, avoidant infant behaviour (Gaensbauer et al., 1984), difficulties in cooperation and resolution of conflict (child ages 15 – 51 months) (Kochanska et al., 1987), and increased levels of insecure/disorganised attachment patterns (child ages 15 – 52 months) (DeMulder & Radke-Yarrow, 1991) have been found in dyads where the mother had BD.

Interactions are complex and comprise dynamic and interplaying processes between 1) parental behaviour, 2) infant behaviour, and 3) dyadic coordination (Beebe et al., 2010; Tronick, 2007), implying that a comprehensive investigation ought to include all three domains. To our knowledge, we are the first to have done this in the context of BD (Anke et al., 2019a). Furthermore, to assess the gravity of interactional challenges, and the possible impact this may have on the developmental risk of bipolar offspring, it is important to get a better sense of how mother-infant interactions develop over time.

To advance knowledge on these insufficiently investigated aspects, the aim of the current study was to compare the developmental trajectories of dyads where the mothers had BD to dyads where the mother had no mental disorder. First, we assessed mother-infant interaction patterns at infant age 12 months. Second, and building on our previous findings at infant age 3 months (Anke et al., 2019a), we explored patterns of change in the interactions within and between the groups from infant ages 3 to 12 months. These time points were chosen based on our decision to utilise validated, age-dependent assessment-scales when coding the mother-infant interactions (see Methods section). All assessments included the three interaction domains: maternal behaviour, infant behaviour and dyadic coordination. We anticipated more interaction difficulties in the BD group at 12 months, and the BD group to have developed more poorly than the comparison group between 3 and 12 months.

Methods

Design

This study is part of a Norwegian prospective investigation of infant families where the mother has BD (Anke et al., 2019a; Anke et al., 2019b).

Recruitment procedures and participants

BD sample

The BD sample consisted of 26 mother-infant dyads. Inclusion criteria were women with a BD I or II diagnosis that were pregnant or had recently given birth (within three months). Because of the aims of the larger investigation, they had to have a cohabitating partner that was willing to participate. The exclusion criteria were parental substance abuse, multi-childbirth, premature birth <35 weeks, or an infant with a known serious medical condition or syndrome.

Women were recruited from mental health outpatient clinics, infant mental health teams at child mental health services, community well-baby clinics, pregnancy care, maternity wards, through the website of the national BD association, and at group psychoeducation courses for patients with BD (Skjelstad, et al., 2015). Recruitment took place between September 2014 and July 2016 in the southeast part of Norway.

The women's clinical BD diagnosis was verified from their specialist mental health records and/or by contacting their specialist mental health professional and by utilising a semi-structured interview. For more details about recruitment procedures, see Anke et al., 2019b.

Non-clinical sample

Comparison group data of 28 mother-infant dyads were gathered from another Norwegian study. These dyads were recruited from local well-baby clinics in Oslo, Norway, between December 2004 – January 2009 (Siqueland et al., 2014). Inclusion criteria were being pregnant and having no substance abuse or mental disorder. The women's mental health status was investigated during pregnancy with the European Addiction Severity Index (McLellan et al., 1992), Millon's Clinical Multi-axial Inventory-III (Millon et al., 1997) and Hopkins Symptom Check List, SCL-25 (Derogatis et al., 1974). All women in the comparison group also had a cohabitating partner.

Procedure

Data on mother-infant interactions were collected at infant ages 3 and 12 months. All interactions were video recorded. The assessed session for both samples at both time-points was 5-minute free-play interaction. The mothers were asked to interact with their infant as they typically did and as they pleased. At 3 months, there was an optional use of toys. At 12 months, the mothers were asked to actively use a selection of provided toys in the interaction.

The recordings of the BD sample were performed at the participants' home (3 months: n=25, 12 months: n=24) or in a professional setting (3 months: n=1, 12 months: n=2). The latter was the case for all recordings of the comparison group at 3 and 12 months.

At the end of the video-recording session, the mothers in both samples subjectively evaluated the representativeness of the interaction. One mother in the BD sample felt awkward because of the video recording at 3 months. At 12 months, two mothers in the BD sample evaluated their infants to be somewhat affected by a viral infection and being a little less active in their play than usual. The remaining mothers in both samples regarded the recorded interactions as representative.

Assessments

The mother-infant interactions in both samples were assessed by use of the Parent-Child Early Relational Assessment (PCERA) (Clark, 1985, 2006, 2009, 2010). It is a standardised assessment method that has demonstrated good content, construct and factor validity, discriminant validity between clinical and non-clinical groups, as well as sensitivity to change (Clark, 1985, 2006, 2009, 2010, 1999; Lotzin et al., 2015). The PCERA is developed to examine strengths and concerns in parental (henceforth maternal) and infant behaviour separately and in their dyadic interactions. It contains 65 behavioural, affective and communicative variables. These are operationalised in a manual and rated numerically based on observed frequency, duration and intensity. The rating is a five-point Likert scale. The five points are categorised into three areas of concern/strength according to PCERA: 1-2 = area of concern, 3 = area of some concern and 4-5 = area of strength (Clark, 1985, 2006, 2009, 2010).

In the current study, all interactions in the BD sample were rated by an independent, certified main coder. A second independent certified coder double-rated a random selection of 31 % of the interactions for calculation of inter-rater reliability. A good inter-rater reliability was found using absolute agreement on ratings. Intra-class correlation was 0.75 for 3-month ratings and 0.85 for 12-month ratings. The coders were aware of the women's BD diagnosis but were blinded to all other information.

The main coder of the BD sample also rated the interactions for the comparison group together with a second independent experienced coder. Twenty percent of randomly selected interactions were double-rated and inter-rater reliability was calculated using categorical agreement (1-2, 3, 4-5). Intra-class correlation varied between 0.80 and 0.97 at 3 months and

between 0.73 and 0.94 at 12 months for the different subscales used in the study (Siqueland et al., 2014). The coders were blinded to all information about the participants.

Additionally, data on the presence of affective symptoms among mothers in the BD sample were collected at 3 and 12 months. Depressive symptoms were assessed with the Inventory of Depressive Symptomatology (IDS) (Rush et al., 1996), and hypomanic/manic symptoms were assessed with the Young Mania Rating Scale (YMRS) (Young et al., 1978). In the current study, these data are used for descriptive purposes.

PCERA subscales used for analyses

When conducting analyses on interaction data, PCERA variables were organised into subscales. Subscales are used since not all variables in the PCERA are applicable for all child ages. For the investigation of possible group differences at 12 months, we utilised a validated scale for free-play at this age (Clark, 1985, 2006, 2009, 2010). The scale consists of three maternal subscales: “Maternal positive affective involvement and verbalisation” (S1), “Maternal negative affect and behaviour” (S2), “Maternal intrusiveness, insensitivity and inconsistency” (S3); three infant subscales: “Infant positive affect, communicative and social skills” (S4), “Infant quality of play, interest and attentional skills” (S5), “Infant dysregulation and irritability” (S6); and two dyadic subscales: “Dyadic mutuality and reciprocity” (S7), and “Dyadic disorganisation and tension” (S8). In all, these contained 21 maternal, 19 infant and 8 dyadic variables (see Table 1.1 in Supplementary File 1).

The validated 12-month scale is not suitable for investigating how interactions develop from 3 to 12 months because it contains variables that are unrateable at age 3 months. Additionally, the validated scale that was used in our previous study at 3 months (Anke et al., 2019a), does not contain all variables that are of interest at 12 months. Thus, for exploration of patterns of change in the interactions, PCERA variables that are rateable at both 3 and 12 months were clustered into subscales equivalent to behavioural, affective and communicative categories in the manual (Clark, 1985, 2006, 2009, 2010). The same procedure has been used in another study (Siqueland et al., 2014). The clustered subscales comprise four maternal subscales: “Maternal tone of voice”, “Mother’s characteristic mood”, “Maternal affective and behavioural involvement”, “Maternal style”; three infant subscales: “Infant expressed affect and characteristic mood”, “Infant behavioural and adaptive abilities”, “Infant communication”, and two dyadic subscales: “Dyadic affective quality” and “Dyadic

mutuality”. In all, these include 23 maternal, 18 infant and 8 dyadic variables (see Table 1.2 in Supplementary File 1).

For further details on the organisation of PCERA variables into subscales, see Supplementary File 1.

Statistical analyses

Demographic and clinical data are presented as either proportions, means with their standard deviations (SD) and range, or medians with 25th and 75th percentiles.

Group differences, using PCERA mean scores on the subscales at 3 and 12 months, were analysed by independent samples t-tests. The chi-square test for contingency tables or Fisher exact test was used to detect associations between categorical variables and the BD vs. the non-clinical sample. Correlation analyses were performed separately for the BD and non-clinical samples using Pearson's correlation coefficient (r). Mann-Whitney U test was used to test the difference between the BD and non-clinical sample on the subscale “Infant dysregulation and irritability” (S6) at 12 months, since it was skewed.

To identify possible confounders, we studied variables that could influence the outcome, such as maternal age, education, employment status, parity, infant gestational age, infant gender, birth weight and infant exact age at interaction sessions. Only variables with significant relationships with both the exposure (BD vs. non-clinical) and the outcome variables (PCERA maternal, infant and dyadic subscales) at 12 months were considered possible confounders and included in the multiple linear regression analysis. Median regression was applied to adjust for confounding factors when studying subscale 6 at 12 months, since it was skewed.

Paired sample t-tests were used to estimate the mean change from 3 months to 12 months within the BD and the non-clinical sample on the clustered subscales. Independent sample t-tests were conducted to test whether the mean change on any clustered subscale measures from 3 to 12 months differed between the BD and the non-clinical sample. Multiple linear regression analyses were performed to test for differences in the mean change between groups while adjusting for confounding factors. Confounding factors were identified using the same procedure as described above.

Overall, a significance level of 0.05 was used. Effect sizes were calculated by Cohen's d or the correlation coefficient r . For Cohen's d , small effect sizes were defined as 0.20, medium

as 0.50 and large as 0.80 and higher (Ellis, 2010). For the correlation coefficient r , small effects were defined as 0.1, medium effects were 0.3, and large effects were 0.5 (Ellis, 2010). The internal consistency of the subscales was examined using Cronbach's α . An α value > 0.70 was considered satisfactory, and α values ≥ 0.90 were considered excellent (See Supplementary File 1 for Cronbach's α values.).

Data were analysed using IBM SPSS statistics for Windows version 25 (Armonk, NY, USA: IBM Corp). Median regression was performed using STATA version 15 (StataCorp, College Station, Texas, USA).

Results

Sample characteristics

Table 1 presents the maternal and infant characteristics of the two samples.

Insert Table 1 here

The non-clinical sample of mothers was significantly older, had higher level of education and employment status than the BD sample. The infants' gestational age and birth weight were within the normal range for both samples, and there were no significant group differences. Within the BD sample, the symptom load increased over time, with more women having moderate to severe affective symptoms at 12 months than at 3 months, 54 % vs. 34 %, respectively.

Mother-infant interactions at 12 months

Table 2 and Figure 1 show the results for both samples on the validated 12-months PCERA scale. There were significant group differences with large effect sizes (Cohen's d 0.97 – 1.78) on all subscales except on “Infant dysregulation and irritability” (S6), which had a small effect size (r 0.28).

Insert Table 2 here

Insert Figure 1 here

Maternal subscales

The BD sample scored significantly lower than the non-clinical sample on all three maternal subscales (S1-S3). No confounding effects were found for “Maternal positive affective involvement and verbalisation” (S1). The associations remained significant after adjusting for maternal employment status on “Maternal negative affect and behaviour” (S2), (adjusted

mean difference (Δ_{mean}): -0.37, 95 % confidence interval (CI): -0.61 to -0.14, $p = 0.002$) and maternal age on “Maternal intrusiveness, insensitivity and inconsistency” (S3), (adjusted Δ_{mean} : -0.61, 95 % CI: -0.84 to -0.37, $p < 0.001$).

Infant subscales

The BD sample scored significantly lower than the non-clinical sample on all three infant subscales (S4-S6). The associations remained significant after adjusting for maternal employment status on all subscales (“Infant positive affect, communicative and social skills” (S4): adjusted Δ_{mean} : -0.41, 95 % CI: -0.78 to -0.04, $p = 0.029$; “Infant quality of play, interest and attentional skills” (S5): adjusted Δ_{mean} : -0.28, 95 % CI: -0.50 to -0.07, $p = 0.01$; “Infant dysregulation and irritability” (S6): adjusted median difference: -0.17, 95 % CI: -0.32 to -0.02, $p = 0.02$).

Dyadic subscales

The BD sample scored significantly lower than the non-clinical sample on both dyadic subscales (S7, S8). The associations remained significant after adjusting for maternal employment status (“Dyadic mutuality and reciprocity” (S7): adjusted Δ_{mean} : -0.84, 95 % CI: -1.28 to -0.40, $p < 0.001$; “Dyadic disorganisation and tension” (S8): adjusted Δ_{mean} : -0.72, 95 % CI: -1.00 to -0.44, $p < 0.001$).

Development of mother-infant interactions from 3 to 12 months

Table 3 demonstrates within- and between-group changes, based on the group mean values at 3 and 12 months on the nine clustered subscales. The group mean values at 3 and 12 months are also illustrated in Figure 2.

Insert Table 3 here

Insert Figure 2 here

Maternal subscales from 3 to 12 months

On the subscale “Maternal tone of voice”, the BD sample had a significant negative change, whereas the non-clinical sample had a significant positive change. Thus, the groups developed in opposite directions, resulting in a significant mean between group change.

On the subscales “Mother’s characteristic mood” and “Maternal style”, the BD sample had no changes, whereas the non-clinical sample had significant positive changes, resulting in significant mean between group changes.

On the subscale “Maternal affective and behavioural involvement”, there were neither significant within nor between group changes from 3 to 12 months.

There were no confounding effects of any of the possible confounders on the maternal subscales.

Infant subscales from 3 to 12 months

On the subscales “Infant expressed affect and characteristic mood” and “Infant behavioural and adaptive abilities”, both samples had significant positive changes, and there were no significant mean between group changes.

On the subscale “Infant communication”, there were neither significant within nor between group changes from 3 to 12 months.

A confounding effect of maternal employment status was found on “Infant communication”, but it did not change the results. No other confounding variables were revealed for the infant subscales.

Dyadic subscales from 3 to 12 months

On the subscales “Dyadic affective quality” and “Dyadic mutuality”, there were neither significant within nor between group changes from 3 to 12 months.

A confounding effect of maternal employment status was found on “Dyadic affective quality”, but it did not change the results. No other confounding variables were found for the dyadic subscales.

Discussion

The purpose of the current prospective study was to contribute to knowledge of early environmental influences for bipolar offspring, as expressed in mother-infant interactions in the first year of life. We investigated the patterns and development of mother-infant interactions from 3 to 12 months in dyads where the mothers had BD, compared to dyads where the mothers had no mental disorders.

In line with our anticipation, there were significant group differences at 12 months in all three domains that were studied: maternal behaviour, infant behaviour and dyadic coordination, with more interaction difficulties in the BD group. Although there were positive changes in some infant behaviour from 3 to 12 months, the majority of concerning interaction behaviours at 3 months did not have positive changes to 12 months in the BD group. The main findings and implications are discussed below.

Dyadic coordination

The results showed strongest support for BD dyads having concerning interaction behaviours in the dyadic coordination domain.

At 12 months, the largest group mean differences across the eight validated subscales were found in the dyadic subscales “Dyadic mutuality and reciprocity” (S7) and “Dyadic disorganisation and tension” (S8), implying that the dyadic domain differentiated the BD sample from the non-clinical sample the most. Furthermore, on “Dyadic mutuality and reciprocity” (S7) the BD group mean was in the area of concern, meaning that these interaction behaviours were evidently problematic for the BD dyads. On “Dyadic disorganisation and tension” the BD group mean was in the area of some concern (S8), thus demonstrating challenges. The respective group means for the non-clinical sample were in the area of some concern (S7) and strength (S8) (Table 2).

Although none of the samples demonstrated any significant change on the subscales “Dyadic affective quality” and “Dyadic mutuality” from 3 to 12 months, the BD dyads had sustained, and significantly lower group means than the comparison dyads (Table 3). A closer inspection of the dyadic scales at 3 and 12 months, revealed that the BD sample had mean values in the area of concern on the variables “flat, empty, constricted dyadic affect”, “mutual enthusiasm, joyfulness” and “reciprocity”, whereas the mean values on dyadic “frustration, anger, hostility” and “tension, anxiety” were in the area of strength (see Tables 2.1 and 2.2 in Supplementary file 2). Hence, in the first year, the main dyadic challenge for the mothers and infants was to “find” each other and share a positive “rhythmic dance”, rather than their exchanges being affected by anger and tension. Importantly, the establishment of dyadic coordination and synchrony seems to be of particular significance during a sensitive period between two and nine months (Feldman, 2015), which aligns with the timespan of the current study. There is a biobehavioural shift in infant development at 2-3 months, when infants

become “ready” to participate in recurring patterns of coordinated social “give-and-takes” (Zeanah et al., 1997). As these provide critical building blocks for infants’ evolving social capacities and emotion regulation, poor dyadic coordination may have negative developmental influence (Feldman, 2007a, 2007b, 2015; Granat et al., 2017; Leclere et al., 2014; Weinberg & Tronick, 1997).

Our significant findings in the dyadic domain support previously reported trends of dyadic difficulties among BD dyads at 12 months (Logsdon et al., 2015). Further, one may speculate whether these dyadic challenges are precursors to complications in cooperation and resolution of conflict, observed in BD dyads later in infancy/toddlerhood (Kochanska et al., 1987).

Maternal interaction behaviour

The BD sample scored significantly lower than the non-clinical sample on all validated maternal subscales at 12 months (S1-S3) (Table 2). This concurs with reported trends (Logsdon et al., 2015) and significant findings (Hipwell et al., 2000) on impairments in BD mothers’ interaction behaviours at 12 months.

When applying the PCERA areas of concern/strength in the interpretation of the findings, the group differences appear most consequential on the subscale “Maternal positive affective involvement and verbalisation” (S1). On this subscale, the BD mothers had their lowest group mean value, in the area of some concern (vs. area of strength for the non-clinical sample), revealing challenges with expression of positive affect, infant attuned verbalisations and involvement. Contrasting, on the subscale “Maternal negative affect and behaviour” (S2), the BD sample had a mean value well within the area of strength, showing that the BD mothers expressed little negative affect, such as anger, disapproval and irritability (Table 2).

From 3 to 12 months, the BD sample showed no significant changes on the subscales “Maternal affective and behavioural involvement”, “Mother’s characteristic mood” and “Maternal style”, whereas the non-clinical sample had significant positive changes on the two latter subscales (Table 3). We find the BD sample’s lack of change on “Maternal affective and behavioural involvement” concerning. Here, the BD sample’s mean value was significantly lower than the non-clinical sample’s mean value at both 3 and 12 months (area of some concern vs. area of strength), and it was the lowest mean value across the maternal subscales at both time points (Table 3). Hence, these findings indicate continuous challenges among the BD mothers in expression of affective and behavioural involvement, such as social initiatives, reading infant cues and responding contingently, mirroring, structuring and mediating.

Notably, the affective quality of “Maternal tone of voice” developed in opposite directions for the two groups (Table 3). Even though the non-clinical sample had a significantly warmer and more emotional tone of voice than the BD sample at 3 months (area of strength), it became even more so at 12 months. In contrast, the tone of voice in the BD sample changed significantly towards more flatness and less emotionality. Although the BD group mean changed to just beneath the area of strength, we find the decline worthy of some reflections. First, the quality of voice and its’ emotional prosody is regarded as an indicator of the individual’s underlying affective state (Belin et al., 2004; Scherer, 1986, 1995, 2003). For instance, studies have shown that the tone of voice and speech patterns change with depressive mood (Cannizzaro et al., 2004; Ellgring & Scherer, 1996; Garcia-Toro et al., 2000). The severity of depressive symptomatology did increase in our BD sample in the first year. At three months, 34 % of the BD mothers had moderate to severe depressive symptoms, whereas this increased to 46 % at 12 months (Table 1). It is possible, or even likely, that the significant change in tone of voice is a reflection of the deterioration in maternal affective state.

Second, qualities and characteristics of maternal voice and speech are important in mother-infant interactions (Saint-Georges et al., 2013). A flat tone of voice with reduced emotionality lacks the acoustic cues that are ingredients in infant directed speech - i.e. motherese or “baby-talk” - an emotional form of speech attuned to the infant with specific linguistic, prosodic and affective characteristics (Saint-Georges et al., 2013). Still, tone of voice is only one aspect of motherese. Other aspects of motherese are captured by the maternal variable “quality of verbalisation”, which had a group mean value in the border area of concern/some concern at 12 months (group mean value 3.1). Together, these data suggest challenges in motherese in the BD sample. Since motherese has been found to promote different infant behaviours, such as attention (Senju & Csibra, 2008; Werker & McLeod, 1989; Zangl & Mills, 2007), responsiveness (Saint-Georges et al., 2013; Werker & McLeod, 1989), language learning (Golinkoff et al., 2015; Thiessen et al., 2005) and infant expression of positive affect (Saint-Georges et al., 2013), the current results on maternal tone of voice and quality of verbalisations may signal enhanced developmental risk for the infants. Reduced motherese has also been found among mothers with unipolar depression (Bettes, 1988; Herrera et al., 2004; Kaplan et al., 2002; Kaplan et al., 2001).

Infant interaction behaviour

The BD sample scored significantly lower than the non-clinical sample on all validated infant subscales at 12 months (S4-S6) (Table 2). Following the same logic as above, when applying the PCERA areas of concern/strength in the interpretation of the findings, the group differences appear most consequential on the subscale “Infant positive affect, communicative and social skills” (S4). On this subscale, the BD infants had their lowest mean value, in an area of some concern, whereas the mean values for the other two subscales (S5-S6) were in an area of strength. Particularly, on the subscale “Infant dysregulation and irritability” (S6), the BD sample had a high mean value in an area of strength (Table 2). Thus, similar to their mothers, the BD infants displayed little negative affect and irritability.

From 3 to 12 months, both infant samples showed significant positive change on subscales “Infant expressed affect and characteristic mood” and “Infant behavioural and adaptive abilities” (Table 3). Given that mother-infant interactions influence the infant’s development (Crockenberg & Leerkes, 2000; Nelson & Bosquet, 2000; Tronick, 2007), and that infants are highly sensitive to maternal affective state (Cohn & Tronick, 1989; Cohn & Tronick, 1983), the BD infants’ positive change seems counterintuitive in relation to the maternal behaviours of concern (i.e. subdued positive affect and underinvolvement). However, a closer inspection of the scales in question, revealed that the group mean values for the variables of “expressed positive affect”, “happy, cheerful mood”, “social initiatives” and “social responses”, were all in the range of 2.6 – 3.3 (i.e area of concern to area of some concern) at both 3 and 12 months (see Tables 3.1 and 3.2 in Supplementary file 3). Hence, the BD infants displayed corresponding challenges with expression of positive affect and interactional involvement as the BD mothers. Basically, it is difficult for infants to build positive arousal and maintain positive affect without adult assistance (Feldman, 2003, 2007b; Weinberg & Tronick, 1997). The current findings give support to previously reported trends of decreased infant expressivity (Hipwell et al., 2000) and findings of avoidant infant behaviour (Gaensbauer et al., 1984).

The BD infants’ positive change was best demonstrated on the variables of “alertness, interest” and “robustness”, and a decrease in “expressed negative affect”. On these variables, the BD infants reached high group mean values in an area of strength from 3 to 12 months. The data also provided few signs of “emotional lability”, “anxious” or “irritable mood” among the BD infants, as these variables showed high group means in an area of strength from 3 to 12 months (see Tables 3.1 and 3.2 Supplementary file 3).

Taken together, several infants in the BD sample showed subdued affect and little social turn-taking, but were toy oriented with interest and alertness. To what extent the BD infants' state and toy involvement reflect a genuine positive development or a defensive self-regulatory behaviour, because of maternal underinvolvement, is unclear (Granat et al., 2017; Hart et al., 1999; Hipwell et al., 2000; Weinberg & Tronick, 1997).

None of the infant samples demonstrated change on the subscale "Infant communication", from 3 to 12 months. Notable, the BD infants' mean value of 3.3 was the lowest group mean value across the infant subscales and significantly lower than for the comparison infants at 12 months. This comprised both the clustered scale "Infant communication" (Table 3) and the validated scale "Infant positive affect, communicative and social skills" (S4) (Table 2). The data thus imply weak communication among the BD infants, which also has been reported among infants of depressed mothers (Field, 1995; Granat et al., 2017; Tronick & Reck, 2009). Communication is a collaborative process where weak infant communication may result from insufficient maternal responsiveness and motherese in interactions (Bornstein et al., 2008; Golinkoff et al., 2015; Tamis-LeMonda et al., 2014).

Interaction patterns across the three domains

To summarise, the BD sample displayed interaction patterns of subdued positive affect and mutual underinvolvement across the three interaction domains. This condition implies a risk for the dyads being "trapped" in vicious circles. For instance, maternal affective and behavioural underinvolvement make it difficult for the infant to achieve social connectedness, and dyadic reciprocity is undermined (Granat et al., 2017; Weinberg & Tronick, 1997).

The current interaction patterns in the BD sample resemble patterns of dyads with depressed mothers who have downcast affect and a withdrawn behavioural style (Field, 1984; Field et al., 2003; Hart et al., 1999; Malphurs et al., 1996; Tronick & Reck, 2009). As a considerable body of evidence demonstrate the adverse short- and long-term consequences of maternal depression on child development (Goodman et al., 2011; Stein et al., 2014) the resemblance is noteworthy, given that non-optimal interaction patterns are assigned an important explanatory role (Goodman & Gotlib, 1999). It is further suggested that depressive maternal interaction behaviours of either a withdrawn or intrusive style, yield different types of developmental risk for the child (Field et al., 2003; Hart et al., 1999). It is proposed that a withdrawn style increases the risk for impairments in affective and social-emotional development since it

entails little affect sharing and maternal regulation (DeMulder & Radke-Yarrow, 1991; Granat et al., 2017; Hart et al., 1999).

Clinical implications

Given that BD is a severe mental illness with a high postpartum risk for illness relapse, we underscore the importance of addressing both the mother's needs and the mother-infant interactions. This is in agreement with treatment approaches for mothers with postpartum depression and their infants (MacBeth et al., 2015; Nylén et al., 2006; Puckering et al., 2010).

Thus, early detection and treatment of BD postpartum mood deviations is pivotal, including support for the mother's own distress (Puckering et al., 2010). Such interventions contribute to valuable premises for positive mother-infant interactions. However, studies on maternal depression indicate that alleviation of maternal symptoms alone is not sufficient for positive outcome for the infant and mother-infant interactions (Logsdon et al., 2009; Nylén et al., 2006; Puckering et al., 2010). The mother-infant interactions need to be explicitly targeted to promote resilient infant development. Furthermore, well-functioning interactions may reinforce the mother's sense of competence (Stern, 1995; Weatherston et al., 2010), which is a particularly important matter for vulnerable mothers.

Therefore, we suggest interaction interventions that sensitise mothers to their infant's cues on a micro-level. Either through in vivo guidance or through viewing video-recorded interactions, the mothers can get detailed feedback about their infant's communicative cues and be guided in attuned contingent responses. Such approaches may strengthen dyadic coordination and reciprocity. Based on the current findings, the feedback should be attentive to positive affect sharing and mutual involvement. Notably, video feedback guidance has proven effective in enhancing parent-infant interactions in the context of maternal depression (Høivik et al., 2015; Van Doesum et al., 2008) and demonstrated positive effect on maternal depressive symptoms (Høivik et al., 2015).

Strengths and limitations

A main strength of the current study was the inclusion of both maternal and infant behaviour and their dyadic coordination for interaction assessments. Additionally, these behaviours were investigated at two time points, which allowed for a more comprehensive understanding of interaction patterns during the infants' first year of life.

The study is subject to several limitations. First, the coders were not naïve to the mothers' BD status. Counteracting possible biases, the variables in PCERA are strictly operationalised in the manual, with extensive descriptions to enhance the precision of ratings.

Second, almost all BD dyad interactions were carried out in the participants' homes at both time points. In contrast, all healthy dyad interactions were recorded in a professional setting. Given the more vulnerable situation of the BD sample, we found it proper to let mothers with BD choose the location. However, it is likely that the more optimal location for the BD dyads may have reduced the intergroup differences somewhat.

Third, close to all mothers confirmed the representativeness of the interaction sessions.

However, there were a few exceptions in the BD group (one at 3 months, and two at 12 months). We assess that this may have had some, but limited impact on the main findings.

Fourth, the women in the non-clinical sample were older, had a higher level of education and employment status than the women in the BD sample. A confounding effect was found for maternal employment status on some of the subscales, and for maternal age on one subscale, and these were adjusted for. The adjustments did not change the results. Furthermore, the BD sample resembles the general population in Norway. Thus, both samples may be skewed towards the resourceful end of the populations they represent. For the sake of comparison, the resourcefulness of the women with BD was beneficial, but it may limit the generalisation of the findings to less resourceful women with BD.

Fifth, the relatively small sample size implies that the findings need to be interpreted with some caution. A small sample size increases the width of confidence intervals and limits generalisability.

Finally, a large number of statistical tests increase the likelihood of one or more false positives findings. Nevertheless, we have chosen not to adjust for multiple comparisons as correcting for type I errors cannot be done without inflating type II errors (Perneger, 1998).

The limitations of the current study, and the general scarcity of studies on the subject matter, underscore the need for more studies. This includes studies on less resourceful dyads, and dyads with single mothers. We also suggest studies of father-infant interaction when the mother has BD to investigate whether the infant's non-optimal interaction behaviour may be relationship-specific. Also, it is conceivable that well-functioning father-infant interactions may moderate risk in mother-infant interactions.

Conclusion

We found more interactional challenges in the first year among dyads where the mothers had BD, compared to dyads where the mothers had no mental disorder. Subdued expression of positive affect and mutual underinvolvement represented core challenges in maternal and infant behaviours in the BD dyads. Continuous difficulties with dyadic coordination and reciprocity were the most concerning interaction behaviours throughout the first year.

On the positive side, there was little expression of negative affect or tension in maternal, infant and dyadic behaviour, and some positive changes in infant behaviour from 3 to 12 months.

Altogether, we conclude that mother-infant interactions in the context of maternal BD may heighten the risk of an unfavourable developmental trajectory for the bipolar offspring.

Abbreviations

BD: Bipolar disorder **PCERA:** Parent-Child Early Relational Assessment

IDS: Inventory of Depressive Symptomatology **YMRS:** Young Mania Rating Scale

Declarations

Authors' contributions

TA designed the study in collaboration with DVS. TA performed recruitment and data collection. TA and CB performed statistical analyses together. TA is the primary author who wrote the manuscript. KS and DVS critically revised and substantially contributed throughout the compilation of the manuscript. VM and TS designed the study from which the comparison data were derived and performed recruitment and data collection in that study. VM and TS contributed with revisions and valuable input to the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We are grateful to the mothers and infants who generously contributed to enhanced knowledge about early interaction. We also thank MSc Clinical psychologists M. Meier and C. Furmark for their extensive work as PCERA coders.

Competing interests

The authors declare that there are no competing interests.

Availability of data and materials

The datasets generated and analysed for the current study (film recordings) will not be shared or made publicly available since participants may be identifiable. Request of permission to access data may be sent to the corresponding author.

Consent for publication

Participants gave consent for publication.

Ethics approval and consent to participate

The current study, and the study from which the comparison data were derived, were both conducted in accordance with the Declaration of Helsinki. All parents gave informed oral and written consent on behalf of themselves and their infant.

The study from which the comparison group data were derived was approved by the Norwegian Center for Research Data (11724) and the Norwegian Regional Committee for Medical Ethics (2016/1300), which also approved the current study (2014/388).

Funding

The study was supported by Vestre Viken Hospital Trust.

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Table 1. Characteristics of mothers and infants in the BD and the non-clinical sample.

Variable	BD sample		Non-clinical sample		p-value *significant
	N=26		N=28		
Maternal age at inclusion, in years, mean \pm sd; range	30.5 \pm 4.7; 22-37		33.5 \pm 5.1; 27-44		0.03*
	n	%	n	%	
Parity					0.43
Primiparous	13	50	17	61	
Multiparous	13	50	11	39	
Completed education					<0.001*
Primary school	8	31	1	4	
Secondary school	5	19	4	14	
Bachelor's degree	11	42	7	25	
Master's degree	2	8	16	57	
Employment status when not pregnant					0.003*
Working full-time	12	46	21	75	
Working part-time +/- receiving benefits	4	15	2	7	
Receiving benefits only	8	31	0		
Unemployed	1	4	1	4	
School	1	4	4	14	
Infant gender					0.95
Girl	10	38	11	39	
Boy	16	62	17	61	
Infant birth weight, in gram, mean \pm sd; range	3632 \pm 507; 2905-5085		3692 \pm 424; 2911- 4715		0.64
Infant gestational age, in months, mean \pm sd; range	39.5 \pm 1.2; 37.2-41.6		40 \pm 1.2; 37-42		0.17
<i>Clinical characteristics of BD sample</i>					
Primary diagnosis					
BD I	7	27	Not applicable		
BD II	19	73			
Symptom load ¹ at 3 months					
Euthymia	8	31	Not applicable		
Mild depressive	6	23			
Moderate depressive	5	19			
Severe depressive	4	15			
Hypomania	2	8			
Mixed state ² (mild)	1	4			
Symptom load ¹ at 12 months					
Euthymia	8	31	Not applicable		
Mild depressive	4	15			
Moderate depressive	6	23			
Severe depressive	6	23			
Mania ³	1	4			
Mixed state ⁴ (severe)	1	4			

¹ Euthymia = IDS score 0-13 + YMRS score 0-7; Mild depressive = IDS score 14-21; Moderate depressive = IDS score 22-30; Severe depressive = IDS score 31-38. Hypomania = YMRS score 8-20.

² Actual score: IDS = 14, YMRS = 11.5.

³ One mother in recovery from a manic episode with hospitalisation. Not assessed with IDS or YMRS.

⁴ Actual score: IDS = 34, YMRS = 16.

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Table 2. Interaction score comparisons (mean) between the BD and the non-clinical sample on PCERA subscales at 12 months.

Subscale	BD sample n=26 Mean (sd) 95 % CI	Non-clinical sample n=28 Mean (sd) 95 % CI	Mean difference 95 % CI	Significance level	Cohen's <i>d</i>
S1- Maternal positive affective involvement and verbalisation ¹	3.4 (0.57) 3.1 – 3.6	4.1 (0.51) 3.9 – 4.3	-0.74 (-1.03 to -0.44)	<0.001*	1.36
S2- Maternal negative affect and behaviour ¹	4.4 (0.54) 4.2 – 4.6	4.9 (0.22) 4.8 – 5.0	-0.49 (-0.71 to -0.27)	<0.001*	1.19
S3- Maternal intrusiveness, insensitivity and inconsistency ¹	3.8 (0.49) 3.6 – 4.0	4.5 (0.37) 4.4 – 4.6	-0.68 (-0.92 to -0.45)	<0.001*	1.57
S4- Infant positive affect, communicative and social skills ¹	3.3 (0.68) 3.0 – 3.6	3.9 (0.61) 3.7 – 4.2	-0.63 (-0.98 to -0.28)	0.001*	0.97
S5- Infant quality of play, interest and attentional skills ¹	4.0 (0.40) 3.8 – 4.1	4.4 (0.37) 4.3 – 4.6	-0.43 (-0.64 to -0.22)	<0.001*	1.12
S6- Infant dysregulation and irritability ²	4.7 (4.5, 4.8) 4.6 – 4.8	4.9 (4.7, 5.0) 4.6 – 4.9	*	0.04*	0.28 ³
S7- Dyadic mutuality and reciprocity ¹	2.7 (0.74) 2.4 – 3.0	3.7 (0.76) 3.4 – 4.0	-1.03 (-1.44 to -0.63)	<0.001*	1.38
S8- Dyadic disorganisation and tension ¹	3.6 (0.57) 3.4 – 3.9	4.5 (0.41) 4.4 – 4.7	-0.88 (-1.14 to -0.61)	<0.001*	1.78

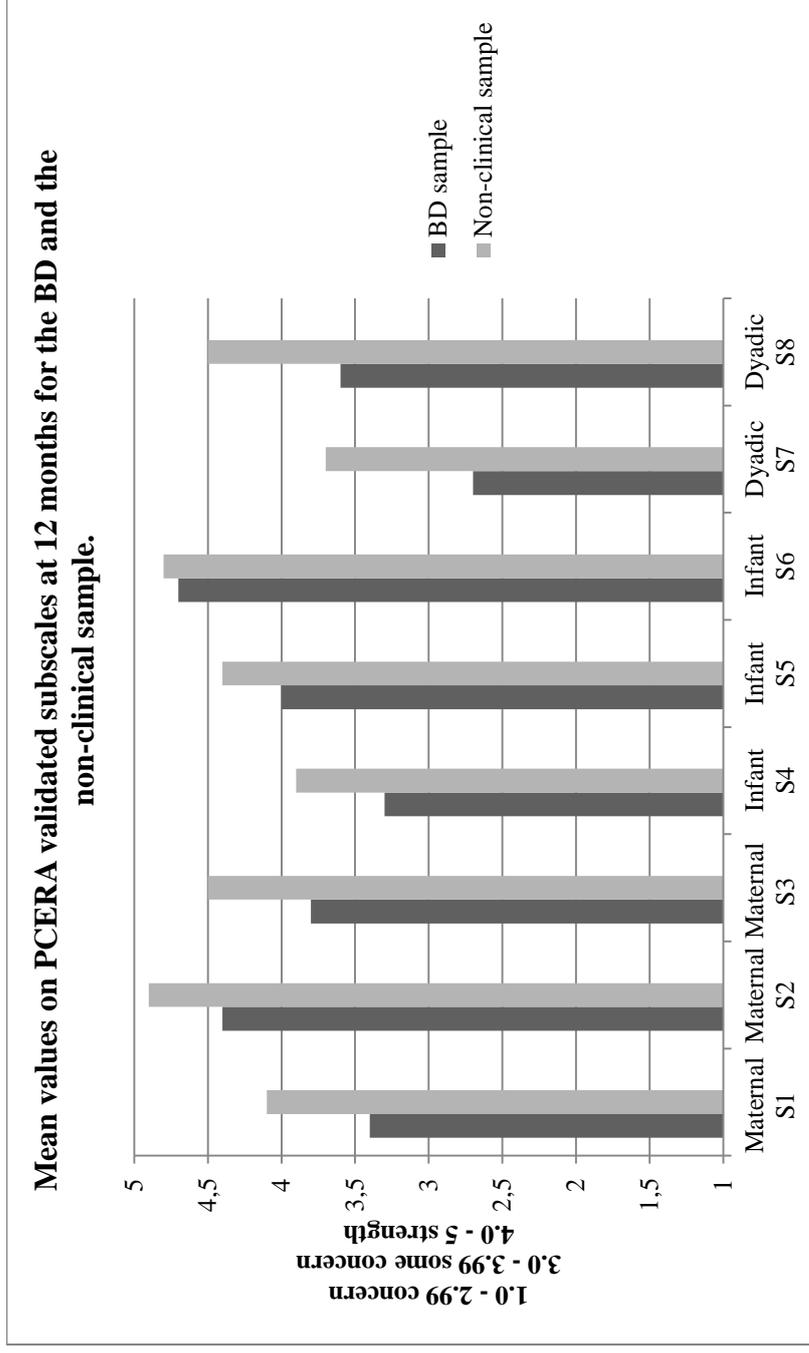
¹Independent samples t-test. ² Non-parametric test, Mann-Whitney U test, because of non-normal distribution of data. The results are presented as median values with interquartile range and range. ³ The effect size for Mann-Whitney U test: $r = \frac{z}{\sqrt{n}}$ * Statistically significant results.

Table 3. Mean values on PCERA-clustered subscales at 3 and 12 months and within- and between-group changes in the BD and the non-clinical sample from 3 to 12 months.

Outcome Variable	Sample size, n	Mean (sd) at 3 months ¹	Mean (sd) at 12 months ¹	Mean within group change 3 - 12 months ² (95 % CI); p-value	Mean between group change 3 - 12 months ¹ (95 % CI); p-value
Maternal tone of voice	26	4.26 [#] (0.41)	3.99 [#] (0.49)	-0.27 (-0.45 to -0.09); 0.006*	-0.54 (-0.84 to -0.23); 0.01*
	28	4.60 (0.51)	4.86 (0.27)	0.27 (0.52 to 0.02); 0.04*	
Mother's characteristic mood	26	4.23 (0.31)	4.09 [#] (0.43)	-0.14 (-0.32 to 0.05); 0.14	-0.49 (-0.76 to -0.22); 0.01*
	28	4.26 (0.50)	4.61 (0.23)	0.35 (0.55 to 0.15); 0.001*	
Maternal affective and behavioural involvement	26	3.61 [#] (0.46)	3.50 [#] (0.56)	-0.11 (-0.34 to 0.12); 0.34	-0.13 (-0.54 to 0.28); 0.53
	28	4.15 (0.70)	4.18 (0.57)	0.02 (0.36 to -0.32); 0.90	
Maternal style	26	3.88 (0.36)	3.94 [#] (0.47)	0.05 (0.26 to -0.15); 0.60	-0.50 (-0.84 to -0.15); 0.005*
	28	4.02 (0.72)	4.57 (0.30)	0.55 (0.83 to 0.27); <0.001*	
Infant expressed affect and characteristic mood	26	3.71 (0.58)	4.13 [#] (0.43)	0.42 (0.67 to 0.18); 0.002*	-0.16 (-0.50 to 0.18); 0.36
	28	3.91 (0.64)	4.49 (0.44)	0.58 (0.83 to 0.33); <0.001*	
Infant behavioural and adaptive abilities	26	3.48 (0.57)	3.87 [#] (0.43)	0.40 (0.64 to 0.15); 0.003*	-0.24 (-0.64 to 0.15); 0.22
	28	3.76 (0.72)	4.39 (0.39)	0.64 (0.95 to 0.32); <0.001*	
Infant communication	26	3.28 (0.77)	3.32 [#] (0.69)	0.04 (0.43 to -0.35); 0.84	-0.03 (-0.57 to 0.50); 0.90
	28	3.73 (0.86)	3.80 (0.53)	0.07 (0.45 to -0.31); 0.70	
Dyadic affective quality	26	3.5 [#] (0.65)	3.46 [#] (0.68)	-0.04 (0.26 to -0.34); 0.79	-0.28 (-0.67 to 0.11); 0.16
	28	4.06 (0.64)	4.30 (0.47)	0.24 (0.51 to -0.03); 0.08	
Dyadic mutuality	26	3.01 [#] (0.63)	2.94 [#] (0.63)	-0.07 (0.23 to -0.36); 0.64	-0.26 (-0.78 to 0.25); 0.30
	28	3.82 (0.88)	4.02 (0.65)	0.20 (0.63 to -0.23); 0.36	

¹ Independent samples t-test. ² Paired samples t-test. [#] Statistically significant mean group difference at 3 months, $p < 0.05$. ^{*} Statistically significant mean group difference at 12 months, $p < 0.05$. ^{*} Statistically significant results.

Figure 1. Mean values on PCERA validated subscales at 12 months for the BD and the non-clinical sample.

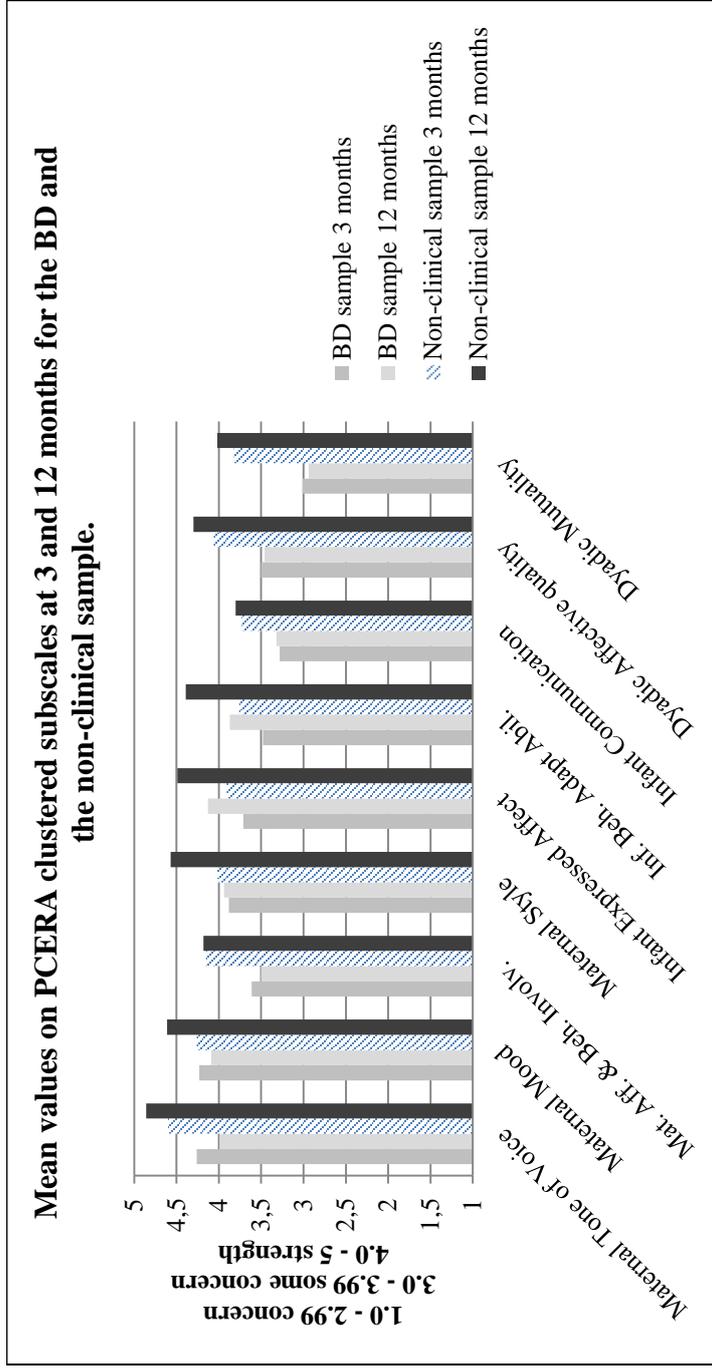


Maternal: S1 - Maternal positive affective involvement and verbalisation; S2 - Maternal negative affect and behaviour; S3 - Maternal intrusiveness, insensitivity and inconsistency.

Infant: S4 - Infant positive affect, communicative and social skills; S5 - Infant quality of play, interest and attentional skills; S6 - Infant dysregulation and irritability.

Dyadic: S7 - Dyadic mutuality and reciprocity; S8 - Dyadic disorganisation and tension

Figure 2. Mean values on PCERA clustered subscales at 3 and 12 months for the BD and the non-clinical sample.



Supplementary File 1. Further description of the organisation of PCERA variables into subscales (see Methods section: PCERA subscales used for analysis).

Two variables from the original validated PCERA subscales for 12 months were excluded in the current study. Variable 20, maternal “Contingent responsivity to child’s perceived negative and/or unresponsive behaviour” was not possible to rate as no such behaviour occurred during the interactions. Variable 48, infant “Persistence” was excluded on recommendation from the coders since it is difficult to evaluate persistence in a situation that allows free, spontaneous play. Thus, the final subscales contained 21 maternal, 19 infant and 8 dyadic variables (see Table 1.1 below).

In the organisation of PCERA clustered subscales for 3-12 months, the maternal subscales “Maternal affect”, “Mother’s expressed attitude toward child” and the infant scale “Activity level” were excluded because of low internal consistency at 3 and/or 12 months (Cronbach’s $\alpha < 0.60$). Furthermore, the following three single variables were excluded. Variable 20, maternal “Contingent responsivity to child’s perceived negative and/or unresponsive behaviour” was not possible to rate as no such behaviour occurred. Variable 13, maternal “Quality and amount of physical contact: Positive” was infrequent/non-existent in both groups at 12 months. This finding is likely attributable to the play situation. Therefore, low scores (1 or 2) could be non-valid with regard to the “true” occurrence of positive physical contact in the mother-infant interactions. Finally, variable 51, infant “Consolability, soothability” was excluded, as it was not possible to rate in the absence of necessary soothing during the interaction. The final clustered subscales comprised four maternal, three infant and two dyadic scales, which include 23 maternal, 18 infant and 8 dyadic variables (see Table 1.2 below).

Supplementary Table 1.1. Validated PCERA subscales for interactions at infant age 12 months.

Subscale	Variables included in subscales	Cronbach's alpha	
		BD sample	Non-clinical sample
S1- Maternal ¹ positive affective involvement and verbalisation	2) ² Flat, unemotional, constricted tone of voice 4) Expressed positive affect 7) Depressed mood 12) Enjoyment, pleasure 15) Amount and quality of visual contact with child 16) Amount of verbalisation 17) Quality of verbalisation 18) Social initiative 21) Structures and mediates environment 24) Mirroring 26) Resourcefulness, creativity	0.94	0.94
S2- Maternal negative affect and behaviour	1) Annoyed, angry tone of voice 5) Expressed negative affect 6) Irritable/ frustrated/angry mood 11) Displeasure, disapproval, criticism 20) ³ Contingent responsivity to child's perceived negative and/or unresponsive behaviour.	0.88	0.79
S3- Maternal intrusiveness, insensitivity and inconsistency	8) Anxious mood 14) Quality and amount of physical contact: Negative 16) Amount of verbalisation 21) Structures and mediates environment 22) Sensitivity and responsivity 25) Flexibility/Rigidity 27) Intrusiveness 28) Consistency, predictability	0.85	0.85
S4- Infant positive affect, communicative and social skills	30) Expressed positive affect 32) Happy, pleasant, content, cheerful mood 33) Apathetic, withdrawn, depressed mood 36) Sober/serious mood 39) Social behaviour of infant - initiates 55) Visual contact 56) Communicative competence 57) Readability	0.93	0.93
S5- Infant quality of play, interest and attentional skills	33) Apathetic, withdrawn, depressed mood 38) Alertness, interest 44) Motoric competence and quality 45) Quality of exploratory play 46) Attentional abilities 47) Robustness 48) ³ Persistence 50) Self-regulation, organisational capacities 56) Communicative competence 57) Readability	0.85	0.85
S6- Infant dysregulation and irritability	31) Expressed negative affect 35) Irritable/frustrated/ angry mood 37) Emotional lability	0.57	0.90

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	43) Assertion/aggressivity 49) Impulsivity 50) Self-regulation, organisational capacities		
S7- Dyadic mutuality and reciprocity	59) Flat, empty, constricted 61) Mutual enthusiasm, joyfulness, enjoyment, a sense of dyadic “Joie de Vivre” 63) Reciprocity 65) Goodness of fit	0.92	0.91
S8- Dyadic tension	58) Frustrated, angry, hostile 60) Tension, anxiety 62) Joint attention, activity 64) Organisation, regulation of interactions 65) Goodness of fit	0.88	0.75

¹ In the manual the word “parental” is used instead of “maternal” (Clark, 2010).

² Variable number in manual (Clark, 2010).

³ Variable excluded from statistical analysis.

Supplementary Table 2. PCERA clustered subscales (with variables applicable for 3 and 12 months).

Subscale	Variables included in subscales	Cronbach's alpha	
		3 months	12 months
Maternal¹ scales			
Tone of voice	1) ² Annoyed, angry tone of voice 2) Flat, unemotional, constricted tone of voice 3) Warm, kind tone of voice	0.63	0.78
Maternal affect ³	4) Expressed positive affect 5) Expressed negative affect	0.48	0.49
Mother's characteristic mood	6) Irritable/frustrated/angry mood 7) Depressed mood 8) Anxious mood 9) Cheerful, animated, enthusiastic mood, "Joie de Vivre" 10) Hypomanic mood/behaviour	0.63	0.75
Mother's expressed attitude toward child ³	11) Displeasure, disapproval, criticism 12) Enjoyment, pleasure	0.43	0.76
Maternal affective and behavioural involvement	13) ⁴ Quality and amount of physical contact: Positive 14) Quality and amount of physical contact: Negative 15) Amount and quality of visual contact with child 16) Amount of verbalisation 17) Quality of verbalisation 18) Social initiative 19) Contingent Responsivity to child's positive and/or age-appropriate behaviour 20) ⁴ Contingent responsivity to child's perceived negative and/or unresponsive behaviour 21) Structures and mediates environment 22) Mother reads child's cues and responds sensitively and appropriately 23) Connectedness 24) Mirroring	0.93	0.94
Maternal style	25) Flexibility/rigidity 26) Resourcefulness, creativity 27) Intrusiveness 28) Consistency, predictability 29) Evidence of behavioural disturbances	0.83	0.87
Infant scales			
Infant's expressed affect and characteristic mood	30) Expressed positive affect 31) Expressed negative affect 32) Happy, pleasant, content, cheerful mood 33) Apathetic, withdrawn, depressed mood 34) Anxious, tense, fearful mood 35) Irritable/frustrated/angry mood 36) Sober/serious mood 37) Emotional lability	0.87	0.82
Behaviour/adaptive abilities	38) Alertness, interest 39) Social behaviour of infant - Initiates	0.91	0.81

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	40) Social behaviour of infant - Responds 41) Avoiding, averting, resistance 46) Attentional abilities 47) Robustness 50) Self-regulation, organisational capacities 51) ⁴ Consolability, soothability		
Activity level ³	53) Passivity, lethargy 54) Hyperactivity/overactivity	<0	<0
Communication	55) Visual contact 56) Communicative competence 57) Readability	0.84	0.82
Dyadic scales			
Affective qualitative of interaction	58) Frustrated, angry, hostile 59) Flat, empty, constricted 60) Tension, anxiety 61) Mutual enthusiasm, joyfulness, enjoyment, a sense of dyadic "Joie de Vivre"	0.82	0.84
Mutuality	62) Joint attention, activity 63) Reciprocity 64) Organisation, regulation of interactions 65) Goodness of fit	0.93	0.94

¹ In the manual the word "parental" is used instead of "maternal" (Clark, 2010).

² Variable number in manual (Clark, 2010).

³ Subscale excluded from statistical analysis, because of Cronbach's $\alpha < 0.60$.

⁴ Variable excluded from statistical analysis.

Supplementary File 2. Tables on mean values of dyadic variables for the BD sample at 3 and 12 months.

Supplementary Table 2.1. Mean values on PCERA clustered subscale “Dyadic affective quality” for the BD sample (n=26) at 3 and 12 months.

Dyadic Variable	Mean value at 3 months	Mean value at 12 months
Frustrated, angry, hostile	4.54	4.69
Flat, empty, constricted	2.85	2.65
Tension, anxiety	4.15	4.19
Mutual enthusiasm, joyfulness, enjoyment, a sense of dyadic “Joie de Vivre”	2.46	2.31

Supplementary Table 2.2. Mean values on PCERA clustered subscale “Dyadic mutuality” for the BD sample (n=26) at 3 and 12 months.

Dyadic Variable	Mean value at 3 months	Mean value at 12 months
Joint attention, activity	3.04	3.08
Reciprocity	2.54	2.46
Organisation, regulation of interactions	3.27	3.04
Goodness of fit	3.19	3.19

Supplementary File 3. Tables on mean values of infant variables for the BD sample at 3 and 12 months.

Supplementary Table 3.1. Mean values on PCERA clustered subscale “Infant’s expressed affect and characteristic mood” for the BD sample (n=26) at 3 and 12 months.

Infant Variable	Mean value at 3 months	Mean value at 12 months
Expressed positive affect	2.58	3.04
Expressed negative affect	3.69	4.65
Happy, pleasant, content, cheerful mood	2.73	3.31
Apathetic, withdrawn, depressed mood	3.65	3.88
Anxious, tense, fearful mood	4.42	4.81
Irritable/frustrated/angry mood	4.42	4.81
Sober, serious mood	3.42	3.46
Emotional lability	4.77	4.96

Supplementary Table 3.2. Mean values on PCERA clustered subscale “Infant behavioural and adaptive abilities” for the BD sample (n=26) at 3 and 12 months.

Infant Variable	Mean value at 3 months	Mean value at 12 months
Alertness/Interest	3.73	4.81
Social behaviour of infant - Initiates	3	2.73
Social behaviour of infant - Responds	2.85	3.12
Avoiding, averting, resistance	3.65	3.62
Attentional abilities	3.58	3.92
Robustness	3.77	4.81
Self-regulation, organisational capacities	3.77	4.12