

**HOW PARENT-INFANT INTERACTION ASSOCIATES WITH INFANT SOCIAL-  
EMOTIONAL DEVELOPMENT AND WELL-BEING AMONG MOTHERS WITH  
PRENATAL DEPRESSIVE SYMPTOMS ?**

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KORPIHETE ANNA-KRISTIINA: How mother-infant interaction associates with infant development and well-being among mothers with prenatal depressive symptoms?

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### **Abstract**

The interest of this study is in parent-infant interaction and its relation to infant development and well-being. The study examined first, how the quality of multiple, dyadic mother-infant interaction dimensions were associated with infant social-emotional development. The second interest was, how the quality of these dimensions were associated with infant well-being, indicated by social-emotional competence and problems. The study investigated thirdly, how maternal depressive symptoms were connected to interactional dimensions and infant variables. The participants were 45 mothers and their 12 months old infants in the context of a psychosocial intervention for maternal prenatal depression. The mothers were recruited from five well-baby clinics in Lahti, Finland during their mid-pregnancies, when they all had depression symptoms. In the present study, the mother-infant dyadic interaction, involving the reciprocal dimensions of guidance, emotional engagement, nurture, playfulness and a uniprocal dimension of the mothers' representation of the child, was analyzed by applying The Dyadic Emotional Interaction Style-scoring system. The infant's social-emotional development was assessed with Bayley Scales questionnaire, and the infant's social-emotional competence and problems with BITSEA questionnaire. The mother's depressive symptoms were reported with Edinburgh Postnatal Depression Scale. The results showed that the mother-infant reciprocal interaction characterized by high guidance, emotional engagement and nurture was significantly associated with optimal infant social-emotional development, such as capability of using emotions in a purposeful manner. The results also showed that high level of mother's representation of the child was significantly associated with less infant emotional and behavioral problems, such as nervousness and tantrums. Unexpectedly, no associations concerning mothers depression symptoms were found. The results are congruent with previous empirical evidence in underlining the significance of parent-infant interaction quality to infant social-emotional development and well-being. However, they also add by showing the separate, and

somewhat different significance of the reciprocal interactional dimensions. The knowledge of the quality and content of the multiple level, dynamic and complex interaction dimensions is important in understanding various pathways underlying infant healthy or problematic development. It is also clinically warranted in prevention and treatment when mother has presented depressive symptoms or infant's healthy development is at risk.

*Keywords:* mother-infant interaction, infant social-emotional development, infant emotional and behavioral symptoms, mother's depressive symptoms

## **Introduction**

The importance of parent-infant relationship quality to optimal child development is well-established (Ainsworth, Blehar, Waters, & Wall, 2015). In healthy parent-infant relationship, the interaction is balanced and reciprocal. It contains enough experiences of positive emotional connection and soothing as well as age-appropriate guidance. The central elements of healthy interaction, such as synchrony, sensitivity and responsiveness, associate with multiple positive developmental and mental health outcomes, such as infant self-and emotion regulation capacity, competence of pretend play and various cognitive skills (Biringen, Drescheid, Vliegen, Closson, & Easterbrooks, 2014; Cassidy, 1994; Feldman, 2007a; Pearson et al., 2011).

The parent-child interaction is dyadic by nature. Normally, an infant is capable of active participation in interaction immediately after birth. The way the parent is able to respond to infant's multimodal signals defines the quality of the forming relationship. Both major developmental theories, such as attachment theory, and the current research emphasize the reciprocal nature of parents and infants interaction. In other words, parents and infants influence on each other's behavior, feelings and responses (Stern, 1985; Trevarthen, 1998). However, available studies typically evaluate parent's and infant's responses separately, and often focus into singular interaction dimension, such as sensitivity. They thus lack the acknowledgement of reciprocal and multidimensional perspectives in interaction. The present study adds to the literature by investigating the quality and multidimensional reciprocity of dyadic interaction from behavioral, emotional, and mental perspectives.

Maternal depression may be a risk for the interaction quality, and subsequently, for the infant's development. Depressive mother may be withdrawn and less responsive or, conversely, intrusive (Field, 2010). Evaluations of the prevalence of depression during pregnancy vary from 7-20% of the mothers (Mäkelä, Pajulo, & Sourander, 2010; O'Keane & Marsh, 2007) and in the postpartum period 19% of the mothers (Gavin et al., 2005), indicating that a substantial number of infants grow together with a depressive mother.

Understanding the reciprocal and multidimensional role of mother-infant interaction quality to infant development and well-being in at-risk population of prenatally depressed mothers and their one year old infants, may be of special importance from preventive and treatment perspective.

## **The Reciprocal Nature of Parent-Infant Interaction**

The developmental significance of the parent-infant interaction has been highlighted from the emotional regulation and biopsychological perspectives with the attachment theory as the most significant theoretical foundation. Reciprocity, also conceptualized as synchrony, co-ordination, co-regulation, or mutual responsiveness, has been identified as a core element of early relationships supporting infant social-emotional development (Feldman, Bamberger, & Kanat-Maymon, 2013; Kochanska, 2004; Tronick, 1989). In an optimally reciprocal, synchronized parent-infant interaction, the dyad is engaged and contribute to the mutual exchange by harmonious body movements and verbal and non-verbal communication (Feldman, 2007a; b; c). During short, intense playful interaction moments, the dyad's affective states, behavior and biological rhythms match. The dyad-specific pattern of gaze, vocalization, touch, arousal, proximity and positioning form from the repetitive-rhythmic shared moments from the very beginning of the relationship (Feldman, 2007b). The reciprocal, synchronic interaction is a time-bound, co-regulatory, lived experience (Feldman, 2007c). Normally, the interaction includes moments of interactive success, errors and frequent reparations of the errors. In healthy relationships, the emotional tone of the engaged moments is mainly positive (Tronick, 1989).

The interactional relationship between mother and infant begins during pregnancy from the initial consolidation of biological rhythms (Feldman, 2007a). An important phase begins during the second trimester, when the mother is able to sense the fetal movements and the fetus may sense and react to maternal signals, such as emotions (Vänskä, 2017). Mother's psychological relationship to the baby develops with the progress of the pregnancy (Siddiqui & Hagglöf, 2000).

The specific postnatal parent-infant communication dynamic develops with parent's adaptation and infant maturation (Avril et al., 2014; Feldman, 2007a). Normally, immediately after the birth of the child, the infant stimuli activate specific maternal nurturing and caregiving responses (Swain, 2007). In the reciprocal process, the maternal behavior and the infant's physiological state and social signals coordinate in a unique way (Atzil, Hendler, & Feldman, 2014; Baram, 2012).

The reciprocal nature of dyadic interaction is evident from the very beginning of life. A typically developing infant is able and active participant of the interaction right after the birth. The biobehavioral model of the social engagement system (Porges, 2003) describes the sequential development of the neural structures that provide a newborn infant with the ability to regulate physiological state in response to a dynamically changing early environment. As cortical regulation

of the brainstem improves during the first year of life, reciprocal social behavior displaces feeding as the primary regulator of physiological state (Porges & Furman, 2011, p.106).

The social engagement system enables the infant to use social gesture and orientation and to filter social stimuli. The infant is able to turn and tilt head, regulate the muscles of the head for social gaze and gesture, make emotional expressions of the face and extract human voice from background sound. The infant is also able to ingest, suck, vocalize, swallow and breath. As a whole, the social engagement system provides the infant with tools for positive engagement with the social environment. The social reciprocity with the parent calms and balances the infant's physiological state supporting better infant regulation of behavior and attention and positive interaction. The infant's independence in self-regulation increases gradually, simultaneously with the expansion of social communication skills. (Porges, 2003; Porges & Furman, 2011.)

The neurobiological findings fit with the attachment theory tradition where parental sensitivity, attunement and responsiveness are stated essential in healthy parent-infant interaction and secure attachment development. In Bowlby's (1969; 1973; 1982) and Ainsworth's (1968; 1979) epochal work the attachment was seen to perform a natural, healthy function from infancy to adulthood. Bowlby concluded that to achieve mental health, an infant should have warm, continuous, satisfactory and enjoyable relationship with his mother. Ainsworth classified the secure, insecure and disorganized mother-infant attachment styles (Bretherton, 1992).

Attachment theory provides a good example of the significance of reciprocal development of early relationships. The secure attachment bond form from the emotional communication of psychologically and biologically attuned parent with the dynamic changes in the infant's bodily-based internal states. In the reciprocal dialog of social engagement, the parent contingently tunes her/his activity level to the infant, allows the infant to recover in moments of disengagement, and attends to the infant's cues of initiation for re-engagement (Schoore & Schoore, 2008). Within the attachment relationships, children gradually learn self-regulation skills. Research has confirmed that compared to children with the insecure attachment patterns, the emotion regulation strategies of securely attached children are more effective and adaptive (Brumariu, 2015).

The sensitive parent interaction behavior is responsive and contingent in acknowledging and responding to the infant's bids in an individually suitable pace (Smith, Landry, & Swank, 2006; Landry, Smith, Swank, Assel, & Vellet, 2001). The sensitive parent is also able to perform affect mirroring, a parent's external reflection of the infant internal state (Gergely & Watson, 1999). The parent embodied mentalization refers to parent's ability to modify own kinesthetic interactive

behavior in response to the infant's nonverbally manifested mental state. Parent's ability to repair the interactive dyadic ruptures and to respond more accurately is of special importance. (Shai & Belsky, 2017).

The current study is operationalizing the reciprocal and multidimensional nature of the parent-infant interaction by employing The Dyadic Emotional Interaction Style -scoring system (The D-EIS, Salo & Mäkelä, 2018). It comprises reciprocal dimensions of guidance, emotional engagement, nurture and playfulness and a uniprocal dimension of parent's representation of the child, reflecting central interaction elements of parent-infant early relationship. The dimension of guidance, as an example, comprises the parent's active attempts and successes in guiding the infant, and from the child's side, it means the ability of the infant to settle responsively into adult's lead (Salo & Mäkelä, 2018).

### **Early Dyadic Interaction and Child Development**

Longitudinal studies have shown that positive interaction experiences in infancy can have long term beneficial impacts on children's social-emotional, cognitive and mental health development (Sroufe, 2005), some of them reaching until adolescence (Feldman, 2010). Research confirms that optimal mother-infant interaction comprising the emotional aspects of relationship highlighted by attachment theory and its derivatives - high synchronization, sensitivity and responsiveness - associate with child advanced self- and emotional regulation, empathy development, social engagement and social skills (Brophy-Herb et al., 2011; Feldman, et al., 2013; Feldman, 2007d; Landry et al., 2001; 2003; Spinrad, Stifter, Donelan-McCall, & Turner, 2004; Treyvaud et al., 2009). Further, high parental emotional availability enhances infant emotional competence (Volling, McElwain, Notaro, & Herrera, 2002) and child socio-emotional adaptation, (Biringen, Skillern, Mone, & Pianta, 2005) as well as infant social-cognitive understanding (Licata et al., 2013). Emotional availability constructs of parental sensitivity, structuring, nonhostility and nonintrusiveness strengthen the infant's self-regulation skills as well as responsive and involving interaction behavior (Biringen, 2014). They also support forming of a secure attachment relationship (Ziv IV et al., 2000). Maternal sensitivity together with structuring capabilities predict children's social competence and complexity of peer play (Howes & Hong, 2008). High infant affective synchrony with both parents relate to the high complexity (creativity, playfulness and rich symbol use) of the toddler's symbolic play (Feldman, 2007c).

Similarly, parent–infant synchrony and parental sensitive, contingent and responsive behaviors associate with optimal child overall cognitive development (Eshel, Daelman, de Mello, & Martines, 2006; Evans & Porter, 2009; Pearson et al., 2011; Smith et al., 2006; Treyvaud et al., 2009) and specific skills, such as executive functions (Bernier, Carlson, & Whipple, 2010), language development (Tamis-LeMonda & Bornstein, 2002), and competence in problem solving skills (Landry et al., 2006).

### **Early Dyadic Interaction and Child Well-Being**

Early mother-infant relationship dysfunction, indicated by affect dysregulation, low maternal sensitivity and stimulation and high negative affect, can have long term negative effects on child well-being (NICHD Early Child Care Research Network, 2004). The interaction that contained emotional dyssynchrony, less shared positive emotion and more mutual anger, characterized dyads with child stable conduct problem (Cole, Teti, & Zahn-Waxler, 2003). Children’s externalizing problems, such as aggressive and destructive behavior, associate with dyadic rigidity (Hollenstein, Granic, Stoolmiller, & Snyder, 2004), negative affect (Lunkenheimer, et al., 2011), maternal hostility and intrusiveness (Mäntymaa et al., 2004), maternal insensitivity, and passive/withdrawn behavior (Easterbrooks, Bureau, & Lyons-Ruth, 2012), and paternal disengagement and remoteness (Ramchandani, et al., 2013).

Lower quality of mother-infant dyadic emotional interaction may also lead to internalizing problems, such as emotion over-regulation (Martins et al., 2012). A longitudinal study confirmed that children of mothers with more motor and less facial responsiveness were more socially withdrawn in the middle childhood (Gerhold et al., 2002). Emotional availability dimensions of maternal insensitivity, hostility and passive/withdrawn behavior related to increased child depressive symptoms (Easterbrooks et al., 2012).

Dysfunctional mother-infant interaction can also have negative impacts on neurophysiological and somatic health. Parent non-directiveness and sensitive responsiveness differed in relation to the child later autism spectrum disorder diagnostic outcome (Wan et al., 2013). Poor dyadic mother–infant interaction assessed at infant age of two months associated with the chronic or recurrent child physical health problems two years later (Mäntymaa et al., 2003).

## **Maternal Depression on Interaction, Child Development and Well-being**

Research show that maternal depression can interfere with the development of optimal parent-infant relationship. The effects have been found also with mild depressive symptoms (Behrendt et al., 2016). The dyadic interaction with mothers suffering from depression may contain less engagement, more irritation and hostility and withdrawn or, conversely, intrusive behavior (Field, Diego, & Hernandez-Reif, 2009; Field, 2010). It may also reduce likelihood of secure attachment development (Martins & Gaffan, 2000). Depressive mothers show reduced affective touching, have more problems in sensitive attunement and may use more negative vocal behavior and less infant-directed speech (Field, 2010).

Children of depressed mothers are vulnerable to compromised developmental outcomes. They have expressed low social engagement, more immature regulatory behaviors and negative emotions (Feldman et al., 2009). They also have a heightened risk for cognitive delays (Deave, Heron, Evans, & Emond, 2008). Maternal depression associate with more child internalizing and externalizing problems, as well as general psychopathology (Barker, Jaffee, Uher, & Maughan, 2011; Goodman et al., 2011).

The current study focuses maternal depression in the context of a psychosocial intervention study designed for prenatally depressed mothers. It analyses associations of maternal depressive symptoms at the follow-up study phase, five months after the intervention has ended.

## Research Questions

The research questions and hypotheses are the following:

1. How the quality of mother-infant interaction associates with infant social-emotional development at the infant age of 12 months?

1.1. I hypothesize that high levels of dyadic, reciprocal guidance, emotional engagement, nurture, playfulness and mother's representation of the child would be associated with acquisition of optimal, age-appropriate social and emotional skills, such as capability of using emotions in a purposeful manner.

2. How the quality of mother-infant interaction associates with infant well-being at the infant age of 12 months ?

2.1. I hypothesize that high levels of dyadic, reciprocal guidance, emotional engagement, nurture, playfulness and mother's representation of the child would be associated with a) adequate levels of social-emotional competence, such as compliance and play skills, and b) low levels of social-emotional or behavioral symptoms, such as nervousness and tantrums.

3. How mothers depressive symptoms are associated with mother-infant interaction, infant social-emotional development and well-being at the infant age of 12 months ?

3.1. I hypothesize that higher levels of depressive symptoms at 12 months are associated with lower levels of the dyadic interaction quality, i.e. dyadic, reciprocal guidance, emotional engagement, nurture, playfulness and mother's representation of the child, with lower level of infant social-emotional development and social-emotional competence and higher levels of emotional or behavioral problems.

## Method

### Participants

The participants were 45 women with their infants (age:  $M = 12$  months). The sample of the present study is from a follow-up study phase of the larger RCT study of ‘The Baby Magic’ – project (Salo et al., 2018). The women were recruited from five well-baby clinics in Lahti, Finland during routine pregnancy visit between 22-31 gestational weeks. The women had met the study inclusion criteria of low to moderate depression in the routine depression screening by well-baby clinic nurse. Most of the women, 66.7%, were primiparous, 22.2% had one child and 11.1% two or more children. 35.1% of the participants were married, 54.1% co-habiting and 10.8% were single. Majority of the women had education of at least high school level. (See table 1). 4 women had individual psychiatric contact during the project.

### Procedure

All women in their mid-pregnancies who scored a cut-off point of depressive symptoms screening ( $EPDS > 9$ ) during routine visit to well-baby clinics in Lahti, Finland, were invited to participate in the ‘Baby Magic’ - study project. The aim of the project was to study the transition to motherhood among depressed mothers, and to develop a preventive Nurture and Play mentalizing-based parenting group intervention for these mothers (Salo et al., 2018). The women were given written information about the study aims, the number of individual meetings during pregnancy, a home visit after the delivery and follow-up meetings when the child was 12 months. They also knew that the group intervention related to the project would be offered randomly to some but not all. About 90% ( $N = 45$ ) of the invited mothers agreed to participate (oral information, Poutiainen 2016; Salo et al., 2018).

All of the participating 45 women were offered three individual meetings during pregnancy, one home visit after the birth, and two follow-up meetings when the children were 12 months. The study interviews, interaction observations and filling of questionnaires were conducted during these visits. Three social or mental health care professionals working in the project were trained to use all the clinical assessments, and to conduct the intervention. Each mother met her own project worker three times during pregnancy weeks 24-32. During the first two meetings mothers filled out

questionnaires and participated in the interviews belonging to pre-test phase (baseline). (Salo et al., 2018).

The participants were randomly assigned to the intervention group (n=24) and a-treatment-as-usual group (n=21). The mothers in the intervention group participated in the manualized, short-term Nurture and Play (NaP) Pregnancy and Baby Group intervention, while the control group mothers continued in the routine care of monthly check-up's at the well-baby clinics. The mothers of the intervention group had 11 group meetings, four during the pregnancy and seven with the baby, beginning at the infant age of three months and until seven months of age. Each group session lasted for 1.5 hours and were held twice a month. Four mothers and two interventionists participated in each group. The structure of each NaP session was to strengthen both the emotional and experiential as well as imaginary relationship with the baby by utilizing attachment-based, playful activities and mentalizing techniques. The sessions also included cognitive strategies concerning depression. The interventionists conducted a home visit after the babies were born. During this visit the birth experience and initial settling into living with the baby was discussed with the aim of providing support for the developing emotional relationship with the baby. The other check-ups focusing on the baby's well-being and growth was provided at the well-baby clinic as treatment-as-usual for both the intervention and the control groups. (Salo et al., 2018).

The follow-up study phase concerning the present study was conducted to all 45 participants at the infants' age of 12 months. It comprised a video-taped observation of mother-infant interaction, questionnaires filled by mothers of infant development, of infant well-being and of their own depression symptoms and a mother's' reflective function interview.

The 'Baby Magic' - project was run by a non-profit third sector organization Diacony Foundation of Lahti, and funded by the Finnish Slottery Machine foundation 2011-2015. The ethical committee of the City of Lahti had approved the study plan.

## Measures

**Demographic characteristics.** At the baseline phase, the participants reported their marital status, number of children and level of education.

**The mother-infant interaction quality.** The mother-infant interaction quality at the infant age of 12 months was assessed by the Marschak Interaction Method (the MIM, Marschak, 1960), a

semi-structured video-recorded observation procedure with age-appropriate interaction tasks. The mothers and the infants were invited to play together at the project's room. The mothers were asked to read the seven tasks aloud and follow the instruction with the child ( e.g. 'play together a familiar play'; 'teach something new to the child'; 'tell the child of the time she/he was a small baby'). The project worker who video-recorded the interaction stayed in the other room. Each dyad proceeded at their own pace, the overall situation lasted typically approximately 15 minutes.

The MIM observations were analyzed by the Dyadic Emotional Interaction Style -scoring system (The D-EIS; Salo & Mäkelä, 2006; 2018) assessing dyadic dimensions of guidance, emotional engagement, nurture and playfulness separately for mothers and infants and a uniprocal dimension of parent's representation of the child for mothers. The assessment scale is continuous. The lower end scores indicate problematic interaction, the higher end scores refer to positive, healthy interaction. A score of five "good", and four "adequate", indicate normal, sufficient, positive dyadic interaction. The score of five does not mean perfect or error-free interaction, but it is differentiated from a four by a particularly positive moment. A score of three "variable" indicates that there is concern about the interaction. It is differentiated from a score of two "inadequate" in that there seems to be more potential for therapy, for example positive exceptions from overall concern in some individual moments. A score of two indicates clear, overall concern within the particular interaction dimension. A score of one "non-existent" indicates critical concern. As the scale is continuous, also half-points are possible. (Salo & Mäkelä, 2006, p. 39).

The D-EIS was developed for clinical purposes, to aid in the interpretation of the MIM assessment and in the planning of interaction therapy, such as Theraplay (Booth and Jernberg, 2009). It is conceptually and theoretically based on the Theraplay therapy dimensions. The validity and reliability of the D-EIS scale have been evaluated with four independent samples (Salo & Booth, 2018). The results lend support to convergent validity of the D-EIS system.

The author of the study conducted the scoring of the interaction tapes. The author was trained and checked reliable by the D-EIS developer Saara Salo, who also performed as an inter-rater for the 10% of the tapes. Inter-rater reliability was .88 for guidance, .92 for engagement, .87 for nurture, .91 for playfulness and .94 for parent's representation. The author was blind to the depressive status of the women, furthermore she did not know whether the mother was in the intervention or control group.

**Infant social-emotional development.** The infants' social-emotional development at 12 months was assessed by the Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III; Bayley, 2006), Social-Emotional Development Index. It is an adaptation of the Greenspan Social-Emotional Growth Chart: A Screening Questionnaire for Infants and Young Children (Greenspan, 2004) that assess the acquisition of social and emotional milestones of 0-42 month old children. The ratings of the five-point Likert scale range from 0=I can't tell, 1=never, 2=sometimes, 3=half of the time, 4=most of the time to 5=all the time. The items assess the child's mastery of functional emotional skills, such as self-regulation and interest in the world; communicating needs; engaging with others and establishing relationships; using emotions in an interactive, purposeful manner; and using emotional signals or gestures to solve problems. (Bayley-III; Bayley, 2006.) The mothers completed 17 questions concerning 12-14 month old infants. The maximum sum score when all 17 items are added together is 85. The standardized average developmental stage of 10-14 month old infants equals for sum score of 74-76, respectively. For the statistical purposes of the present study, numbers were changed to 1-6, making maximum total score 102. The Cronbach's alfa was .82.

**Infant well-being.** The infants' well-being was assessed by the Brief Infant-Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2002). It is a 42-item measure for identifying delays and deficits in social-emotional competence and existence of social-emotional and behavioral problems in 12-35 months old children. The 11 competence items include compliance, mastery motivation, prosocial peer relations, empathy, imitation/play skills and social relatedness. The 31 social-emotional and behavioral problem indices comprises externalizing, internalizing, dysregulation, maladaptive and atypical behavior. The mothers estimated each description according to their occurrence concerning their infant as 0="rarely," 1="sometimes," or 2="often". The maximum score for 11 competence indices are 22 and for 31 problem indices 62. The cut-off point for average competence at 12 months is 12. Thus, below the score of 12, the acquisition of competence may be delayed or there may be deficits. For problem items, the cut-off point is 13, scores over that refer to a risk for problematic social-emotional development. The Cronbach's alfa was .88.

**Depressive symptoms.** The symptoms of maternal depression were screened by using the pregnancy version of the Edinburgh Postnatal Depression Scale (EPDS; Murray & Cox, 1990). The

EPDS is a 10-item self-report that asks about feelings of happiness and sadness, fears, self-blame, sleeping problems, and thoughts about harming oneself during the previous week. The present study analyzed the postpartum depression at the infant age of 12 month, and used a clinical significance score, based on the cut-off for the presence of mild depressive symptoms at 9/10 (Murray & Cox, 1990). The Cronbach's alfa was .80.

### **Statistical analysis**

The descriptive statistical analysis with the means, standard deviations and minimum and maximum scores of the background and study variables, was made. The Pearson's product model correlations between all study variables were computed separately. The distributions of demographic characteristics are presented in percentages. To answer the first and the second research questions and to test hypotheses, the univariate analysis of variance (ANOVA) was applied. The independent variable was the mother-infant dyadic interaction and the dependent variables were infant social-emotional development (Bayley scales/child, first hypothesis), infant well-being, competence (Bitsea, competence/child, second hypothesis) and infant well-being, problems (Bitsea, problems/child, second hypotheses).

To achieve the dyadic interaction variables, four dimensions from the individual D-EIS variables were formed (MIM Guidance, MIM Engagement, MIM Nurture, MIM Playfulness) by combining mothers' and children scores in these dimensions. The fifth dimension (MIM Representation) remained uniprocal because it is scored only for parent. The combining of independent variables was also important because of the small sample size and high intercorrelation between separate interaction variables (D-EIS 1-9). The combined dyadic interaction dimensions and a uniprocal dimension were categorized into high and low quality of dyadic interaction in a given variable by value of 3,5, which is considered clinically a cut-off point. All the interaction dimensions scored 3,5 and above (3,5-5) were rated to high quality of interaction category and the interaction dimensions scored 3 and below (3-1) were rated to low quality of interaction category.

To answer the third research question about the associations between maternal depression and dimensions of mother-infant-interaction (guidance, emotional engagement, nurture, playfulness and mother's representation of the child), cross table analyses with  $\chi^2$  statistics were applied. To analyse the associations between maternal depression and infant social-emotional development and infant well-being, ANOVAs were applied, using the clinically significant depression classification as

independent variable and social-emotional development and competence and problems as dependent variables.

The number of missing data is informed in Table 1. The effect of the intervention was controlled with adding a co-variate in the analyses. The statistics were run with IBM SPSS 24.0.

## Results

### Descriptive Statistics

Table 1 presents the demographic information of the mothers. The majority of them (67 %) were primiparous, lived in co-habiting or in matrimony and had educational level of minimum of high school.

Table 1

*Mother-related demographic Information*

	Participants	
	%	n
Family structure		
Married	35.1	13
Co-habiting	54.1	20
Single	10.8	4
Number of children		
First time mother, primiparous	66.7	30
One child	22.2	10
Two or more children	11.1	5
Education		
Elementary school	10.5	4
High school/Trade	44.7	17
University degree	34.2	13
Doctoral degree	10.5	4

Notes: N varies 37-45 due to missing data: 37 for Family structure, 45 for Number of children, 38 for Education

The characteristics of all study variables used in the analyses are shown in Table 2. All of the mean values of the separate interactional variables (D-EIS variables 1-9), were under the score of 3,5 (SD .67-.83). The clinical cut off score is 3,5 and scores below that refer to a concern in a given area of interaction.

In The Bayley Scales Social-Emotional Development Index, the sample mean was 86.26, (SD 6.89). Maximum sum score with the adjusted scores of 1-6 was 102. In the original scores from 0-5 scale, the maximum is 85. The mean value with the original sum scores was 70.58. The result lies in an average range of the developmental stage of 10-14 month old infants. (Standard point 10 equals for sum score of 74-76, sp 7-13 64-82, respectively).

In The Brief Infant-Toddler Social and Emotional Assessment (BITSEA) questionnaire, the sample mean for sum score of competence items was 15.07 (SD 3.14). The cut off sum score for 12-17 month old infants is 12, thus sum scores below 12 means that there is a risk for deficit or delay in infant social-emotional competence. The sample mean for sum score of problem items was 9.97 (SD 4.31). The cut off sum score for 12-17 month old infants is 13, thus sum scores above that means there is a risk for the social-emotional and/or behavior problems. The results of the study sample means did not refer to a risk in these areas.

For mothers' EPDS values, the mean value was 8.39 (SD=3.44) and below the cut-off point of 9/10 for mild to medium depression symptoms. Thus, in average, the symptoms of depression of these mothers was mild or absent at the infant age of 12 months compared to pregnancy period.

Table 2

*Means and standard deviations of single study variables.*

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Variables	N*	M	SD	MIN	MAX
D-EIS 1 guidance/mother	33	2.98	.71	1.50	4.50
D-EIS 2 guidance/child	33	3.00	.67	1.50	4.00
D-EIS 3 engagement/mother	33	2.98	.80	1.00	4.50
D-EIS 4 engagement/child	33	2.82	.79	1.00	5.00
D-EIS 5 nurture/mother	33	2.85	.82	1.00	5.00
D-EIS 6 nurture/child	33	2.85	.76	1.00	4.50
D-EIS 7 playfulness/mother	33	3.29	.80	1.00	5.00
D-EIS 8 playfulness/child	33	3.00	.83	1.00	4.50
D-EIS 9 representation of the child	31	2.58	.71	1.00	4.00
Bayley scales/child	31	86.26	6.89	73.00	102.00
Bitsea competence/child	29	15.07	3.14	8.00	21.00
Bitsea problems/child	29	9.97	4.31	4.00	20.00
EPDS/mother	38	8.39	3.44	2.00	21.00

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\*Number of cases for which this information was available; numbers vary because of missing information

Table 3 presents the correlations of the separate variables. The child interaction variable of emotional engagement correlated significantly with infant social-emotional development variable ( $r(27)=.50, p<.01$ ).

Table 3

*Pearson's product model correlations between single interaction dimensions, infant development, well-being and mother's depression variables.*

<i>Mother-infant interaction</i>		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	D-EIS 1 guidance/mother													
2.	D-EIS 2 guidance/child	.75**												
3.	D-EIS 3 engagement/mother	.85**	.79**											
4.	D-EIS 4 engagement/child	.62**	.82**	.77**										
5.	D-EIS 5 nurture/mother	.77**	.69**	.85**	.57**									
6.	D-EIS 6 nurture/child	.71**	.86**	.82**	.86**	.77**								
7.	D-EIS 7 playfulness/mother	.80**	.78**	.80**	.63**	.80**	.81**							
8.	D-EIS 8 playfulness/child	.64**	.84**	.71**	.75**	.64**	.84**	.79**						
9.	D-EIS 9 representation of the child	.53**	.33	.43*	.22	.47**	.34	.48**	.36*					
<i>Infant social-emotional development</i>														
10.	Bayley scales/child	.19	.34	.28	.50**	.21	.34	.20	.31	.23				
<i>Infant well-being</i>														
11.	Bitsea competence/child	.09	.03	.08	.19	-.10	-.01	-.10	-.16	-.20	.50**			

12	Bitsea problem/child	-.14	-.30	-.19	-.21	-.14	-.22	-.31	-.25	-.33	-.11	.11		
<i>Mother's depression</i>														
13	EPDS/mother	-.05	.05	.06	.19	.02	.11	-.02	.07	.23	-.06	-.08	.09	.06

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Note: \* < .05; \*\* p < .01; (two tailed; N =26-33)

## Dyadic interaction in relation to infant social-emotional development and infant well-being

In Table 4, the results of the univariate analyses (ANOVA) between the dyadic and categorized interaction variables and the infant social-emotional development and well-being variables are presented.

Table 4.

*The dyadic mother-infant interaction dimensions associating with infant development and well-being: means (M), standard errors (SE) and ANOVA statistics.*

	Infant social-emotional development		Infant well-being, competence		Infant well-being, problems	
	M	SD	M	SD	M	SD
<b>MIM Guidance</b>						
Low	84.27	5.90	14.48	3.33	9.86	4.23
High	89.43	7.14	16.57	2.15	8.86	2.97
<i>F</i> -values (1,26/25/25)	5.85*		3.08		0.34	
<b>MIM Engagement</b>						
Low	84.14	5.94	15	3.21	9.90	4.18
High	89.86	6.62	15	3.32	8.71	3.15
<i>F</i> -values (1,26/25/25)	4.16*		0.00		0.45	
<b>MIM Nurture</b>						
Low	84.20	6.14	15.21	3.05	10.26	4.00
High	88.44	6.62	14.56	3.57	8.22	3.60
<i>F</i> -values (1,26/25/25)	4.17*		0.13		1.69	
<b>MIM Playfulness</b>						
Low	84.28	6.42	15.44	3.18	9.94	4.09
High	87.55	6.35	14.20	3.16	9.00	3.74
<i>F</i> -values (1,26/25/25)	2.40		0.88		0.36	

MIM Representation						
Low	84.61	5.31	15.27	2.90	10.59	3.80
High	90.50	8.89	13.75	0.96	5.75	1.70
<i>F</i> -values (1,24/23/23)	1.78		1.26		5.78*	

In accordance with the first hypothesis, high level of guidance (MIM GUIDANCE) in mother-infant dyadic interaction was associated significantly with the infant optimal, age-appropriate social-emotional development (Bayley scales, child)  $F(1, 26) = 5.85, p < 0.5$ .

Also, as hypothesized, high levels of emotional engagement (MIM ENGAGEMENT)  $F(1,26) = 4.16, p \leq 0.5$  and nurture (MIM NURTURE)  $F(1,26) = 4.17, p \leq 0.5$  in mother-infant dyadic interaction were associated significantly with infant optimal, age-appropriate social-emotional development (Bayley scales, child).

However, against to the hypothesis, high levels of dyadic playfulness and mother's representation of the child did not associate significantly with infant optimal, age-appropriate social-emotional development.

Secondly, supporting the hypothesis, high levels of mothers' representation of the child (MIM representation) was associated significantly with the existence of less infant social-emotional or behavioral problems.  $F(1,23) = 5.78, p < 0.5$ .

Against to the hypothesis, dyadic guidance, emotional engagement, nurture and playfulness did not associate with infant competence or problems. Further, mother's representation of the child did not associate with infant competence.

### **Mothers depression symptoms in relation to dyadic interaction, infant social-emotional development and infant well-being**

In contrary to the third hypotheses, no associations were found between maternal depression symptoms and mother-infant interaction, indicated by statistically non-significant associates with reciprocal guidance,  $\chi^2(33) = 2.39, p = .12$ , emotional engagement  $\chi^2(33) = 2.32, p = .13$ , nurture  $\chi^2(33) = 0.75, p = .38$ , playfulness  $\chi^2(33) = 1.45, p = .23$  and mother's representation of the child  $\chi^2(33) = 1.34, p = .25$ . Further, against to the hypothesis, maternal depression did not associate with infant age-appropriate social-emotional development, indicated by statistically non-significant term

$F(1,29) = 2.63, p = .12$ . Also against the hypothesis, maternal depression did not associate with infant well-being, competence  $F(1,29) = 0.69, p = .41$  or well-being, problems,  $F(1,29) = 2.77, p = .11$ .

## Discussion

The purpose of this study was to investigate multidimensionally the quality of mother-infant reciprocal interaction in relation to infant social-emotional development and well-being. An interest was also, how mother's depression symptoms were connected to dyadic interaction, infant social emotional development and well-being. The results showed that mother-infant interaction characterized by high guidance, emotional engagement and nurture was significantly associated with optimal, age-appropriate infant social-emotional development. The results also showed that high level of mother's representation of the child was significantly associated with less infant emotional and behavioral problems, such as nervousness and tantrums. Unexpectedly, it was not found any associations concerning mothers' depression symptoms.

The results are congruent with previous research of positive dyadic interaction being beneficial for child healthy development. According to the attachment theory, both the safe haven (emotional attunement) and secure base (encouragement and structuring for the child's independence and mastery) behaviors are important features in interaction and form the basis for later optimal child development (Ainsworth et al., 2015). In addition to the attachment perspective, the findings of the Emotional Availability research (Biringen & Easterbrooks, 2012) emphasize that both parental sensitivity and structuring, as well as child responsiveness and initiativeness in dyadic interaction are important for the development of child's adaptive social-emotional skills.

The present study confirmed first, that when the mother-infant interaction contained good enough levels of reciprocal guidance, ie. maternal active attempts in guiding the infant and successes in organizing the infant's behavior with matched co-operation on the part of the infant, then the infant had more likely optimal, age-appropriate social-emotional skills. Secondly, when the interaction also contained enough experiences of reciprocal emotional engagement, ie. joint emotional openness and reciprocity, matching of affective states, performance of joint emotion regulation and repairing of emotional ruptures, then the infant's social-emotional development was more likely at the optimal, age-appropriate level. Thirdly, high dyadic nurture was associated with optimal infant social-emotional development. The good quality of nurturing behavior in this study meant maternal capability of noticing the infant distress and soothing by sensitively offering appropriate amount of physical closeness and gentle touch with matched emotional and vocal expressions. However, the child's ability to settle into receiving the comfort was as important. The result concerning nurturing accords closely with the attachment theories propositions, but also with

the emotion regulation theories (Feldman et al., 2002; Jean, Stack & Arnold, 2014). In the development of child's self-regulatory skills, the support from the maternal nurturing behavior is well needed.

The results did not confirm the hypothesis of the fourth interactional dimension, high dyadic playfulness, being associated with the optimal infant social-emotional development. The lack of association concerning playfulness in interaction may relate to developmental and parental issues. It is possible, that at the age and developmental stage of 12 months, the aforementioned attachment related aspects of interaction are more influential contributors to the infant social-emotional capability, and the role of play be more salient later. Also, mothers and fathers may have different functions considering play and sensorimotor training in infancy. The participants of the current study were mothers, whereas the significance of playfulness in interaction may be manifested more clearly with fathers, as was in the recent study, where especially fathers' play, such as rough and tumble, associated with children's social competence (StGeorge & Freeman, 2017). These children, however, were also older.

The hypothesis concerning the fifth dimension, high level of mother's representation of the child being associated with optimal infant development, was not confirmed either. This result contradicts earlier studies, where parents' representations of their infants have been found to influence the manner in which they respond mentally and behaviorally to the infant communication in mutual interaction, and this further influencing the infants' emerging self-regulatory capacities consequently providing a critical context for infant emotional development (Rosenblum et al., 2006). In the present study, the singular maternal representation task was part of the actual dyadic interaction situation, whereas in many of the previous studies the representations have been investigated separately through more extensive verbal narratives. This may have had an effect on the result.

The results showed, however, interestingly that maternal representations were associated expectedly in regard to infant well-being. Thus, the high quality of the mothers' representations associated with low levels of infant social-emotional or behavioral symptoms. Inversely, the low quality of representations, here negative, empty or impersonal narrative about the time when the child was a little baby, was associated with the existence of more infant problems. The result is in accord with the earlier studies, in which the relation between maternal negative representations and child's problematic behaviors has emerged, for example, in the context of early social-emotional difficulties and mental health referrals (Dollberg et al., 2010). The poor performance concerning

representations may refer to the inadequate maternal nurturing behavior, but also to the weak mentalization capacity. The mentalization theory research has shown that low level of parental reflective functioning is connected with child symptoms of psychopathology (Sharp & Fonagy, 2008). It may be, that the present cross-sectional study setting was more suitable to reach the associations between maternal representations within the actual interaction situation and infant symptomatic behavior compared to infant development, where a longitudinal setting may have been more informative.

The infant well-being was indicated by a) social-emotional competence and b) emotional or behavioral problems. In addition to representations, the dyadic, reciprocal dimensions of guidance, engagement, nurture and playfulness were investigated in relation to well-being. Unexpectedly, no associations were found. The BITSEA questionnaire used in this study might not have been distinctive enough. It applies children of 12 to 35 months of age and the items of the questionnaire concern all ages. At the age of 12 months, the descriptions especially of child competence remain rather general. Maybe also the small range (0-2) of the scale had an effect. It would have been useful, if also a more specific, preferably professional evaluation of the infant social-emotional competence and problems had been available alongside with the parental report.

The result regarding infant symptoms is interesting. The uniprocal dimension of mother's representation of the child was expectedly associated with infant emotional and behavioral problems, whereas the dyadic reciprocal interactional dimensions of guidance, emotional engagement, nurture and playfulness were not. Could it be that at the age of 12 months, if an infant has emotional or behavioral problems, the quality of the mother's representations would be more significant than the quality of dyadic interaction? Maybe the result is explained by the mothers' of low quality representations having more negative prone evaluations of their infants problems. Or perhaps the effect of interaction quality with infant problems would emerge later, as was in a longitudinal study of interaction where the infants of dyads with longer moments of shared joy and pleasure in interaction with their mothers at two months of age had fewer internalizing and externalizing problems two years later (Mäntymaa et al., 2015).

Finally, against to the third hypothesis and the previous studies, no significant associations between the maternal depressive symptoms and mother-infant interaction, infant development nor well-being were found. The sample of the study consisted originally only of mothers with medium range of prenatal depressive symptoms. By the time of the follow-up study phase - and recordings of the mother-infant interaction sessions concerning the present study- the depressive symptoms

were milder or absent with most of the mothers. Thus, although all the mothers in the present sample exhibited depressive symptoms beyond the cut-off point when being enrolled to the study during pregnancy, by the infant age of 12 months, most mothers did not. This may be a positive effect of the intervention in which approximately half of the mothers took part, although depressive symptoms were alleviated also in the control group. Nevertheless, maybe the narrow range of depressive symptoms and the small sample size effected the results regarding the present findings.

The fact that the sample was not originally gathered for the purposes of the present study is a main limitation of the study. The sample consisted of participants of the larger RCT intervention study aimed at improving mother-infant emotional availability and maternal reflective functioning and in decreasing depressive symptoms. The mothers were randomly assigned to the intervention group (n=24) and a-treatment-as-usual group (n=21). The mothers of the intervention group participated in the 11 manualized, Nurture and Play group sessions utilizing attachment-based, playful activities, mentalizing techniques, and cognitive strategies from pregnancy until the babies were seven months old. The preliminary results of the intervention study show that the intervention group scored higher in maternal sensitivity and reflective functioning and a lower in depressive symptoms than the treatment-as-usual group. However, the effects were similar in both groups and the control group also showed improvements. (Salo et al., 2018).

In the current study, the effect of the intervention was controlled statistically to ensure that the associations between the dyadic interactional, infant and maternal variables would not differ between the intervention and control groups. Further, the author, who analyzed the interactions, was blind to the RCT and depressive status of the mothers, which may add the reliability of the results. According to the results of the original intervention study, the intervention improved part of the mothers' sensitivity and reflective functioning. This possibly reflected positively on dyadic interaction and the effect may have lasted till the follow-up-study phase, when the interactions were video-taped. However, five months after the end of the intervention, at the infants age of 12 months, the interaction quality in this sample was in average rather low. Nevertheless, the interest of the present study was in associations, not in change of the levels.

The optimal sample regarding the present study's main interests would consist of larger, normative well-baby center population without prior interventions. The study setting would also be stronger, if a professional evaluation, ie. psychological assessment or kindergarten teacher's observation of infant social-emotional skills and symptoms, was also available. Further, although emotional and social aspects of development are especially central during the first year of life, it

would be important to investigate reciprocal, multidimensional parent-infant interaction also in relation to child cognitive or sensorimotor development. Investigating these phenomena in different age groups, preferably longitudinally, would be beneficial as well.

The strengths of the study include that the interaction was analyzed by clinical child psychologist (the author), which may add the objectivity of the results compared to parental reports of interaction with their infant. The present study is also among the first using the D-EIS- method. The MIM -and the D-EIS- are clinical tools used quite widely among Finnish small children's and families' special care contexts in social and health practices. However, the scientific research is few. It is important to gather scientific as well as clinical knowledge about the psychological methods in use. It now appeared that the differentiated knowledge of the central parent-infant interaction dimensions and their reciprocal nature reachable with the D-EIS, is useful also for study purposes.

So far, the studies applying the MIM have mostly been made with small, clinical samples. In the future, it would be important to investigate both these interactional phenomena and methods within normative parent-infant population including fathers to achieve wider perspective on children's developmental pathways in our society. The knowledge would also be relevant from preventive perspective, in planning of modern social and health services.

The clinical implications of the study include that in order to offer effective assistance, in prevention or in treatment, it is essential to recognize the need for many-sided consideration of the situation of the parent-infant dyad and noticing both the reciprocity in interaction and the separate roles of different interaction dimensions. The study opens the view, that for example in the context of small children's psychiatric care, where the channel of treatment is in many cases through the interaction within the attachment relationship, at least among prenatally depressed mothers, the interaction therapy with focus on reciprocal guidance, emotional engagement and nurture could be of aid if the infant's social-emotional development is delayed. On the other hand, if the infant presented problematic behavior, it could be beneficial to consider mother's reflective function and if necessary, strengthen positive representations. It may also be argued based on this study, that in primary health care services at well-baby and family guidance centers, alongside often used maternal support through supportive conversations or psycho-education, systematic, comprehensive tools for straight interactional work with the parents and infants together would be of importance in preventing later child compromised development.

Taken together, the results suggest that for a child to develop better capabilities of communication, self-regulation and other indicators of good social-emotional competence, the different characteristics of healthy attachment figure's interactive behaviors are all needed. The primary caregivers are the critical external factor shaping the development of infant effective biological and emotional systems (Waxler et al., 2011). However, the relationship with the child develops reciprocally. The present study is congruent with previous empirical evidence in underlining the significance of parent-infant interaction quality to child's social-emotional development and well-being. However, it also adds by showing the separate, and somewhat different, significance of different interactional dimensions and at the same time highlights the reciprocal nature of the dyadic interaction. The knowledge of the quality and content of the multiple-level, dynamic and complex interaction dimensions is important in understanding various child developmental pathways.

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