

Dyadic parent–infant interaction patterns at 12 months: Exploring dyadic parent–infant gender compositions

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Abstract

This study investigates differences in dyadic mother–infant and father–infant interaction patterns at infant age 12 months, and the relation between different parent–infant gender compositions and the dyadic interaction. Data were drawn from a large-scale, population-based Norwegian community sample comprising 671 mother–infant and 337 father–infant interactions. The Early Relational Health Screen (ERHS), a screening method for observing dyadic parent–infant interactions, was used to assess the parent–infant interactions. Scores on the ERHS were employed to investigate dyadic differences in the overall interaction scores, and dyadic interaction on seven sub-dimensions between mother–infant and father–infant pairs. The relation between different parent–infant gender compositions and the dyadic interaction scores was also examined. As expected in a normative sample, most parent–infant interactions received scores in the upper rating levels. Differences between mother–infant and father–infant patterns were generally small, but mother–infant dyads tended to obtain slightly higher scores. The mother–infant dyads received higher scores on the dimensions of engagement and enjoyment, but no other significant differences between the parent–infant pairs were found for the remaining dimensions. We did not find evidence for a moderation effect of child gender. However, parent–daughter dyads received somewhat higher scores than the parent–son dyads.

KEYWORDS

parent–infant interaction, parent–infant gender composition, child development, early childhood, parenting

1 | INTRODUCTION

A broad scientific literature, addressing various aspects of the early dyadic parent–infant interactions, supports the notion that these back-and-forth interactions are

pivotal for child social and emotional development (Amodia-Bidakowska et al., 2020; Bornstein & Tamis-LeMonda, 2010; Harrist & Waugh, 2002; Schore, 2001; Siegel, 2001). In infancy the caregiver often serves as the primary interaction partner and playmate for the infant

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(Amodia-Bidakowska et al., 2020). By the end of the first year of life, infants' emerging capacity to initiate positive dyadic interactions with the caregiver alters the nature of the bidirectional exchanges, and the reciprocity and dyadic mutuality between the infant and the caregiver becomes more evident (Feldman, 2007; Striano, 2001). Dyadic mutuality in the parent–infant interaction has been assumed to consist of several factors including mutual engagement, and shared pleasure (Feldman, 2007; Lindsey & Caldera, 2015; Lindsey et al., 2009), mutual responsiveness, temporal coordination, contingency, and a shared focus of attention (Harrist & Waugh, 2002; Mäntymaa et al., 2006), turn taking (Amodia-Bidakowska et al., 2020; Feldman, 2007), and corresponding activity level, rhythm and pace (Harrist & Waugh, 2002; Stern, 1985). In addition, matching of positive affective states and prosocial interactive behavior in the early parent–infant interaction might be described as interactional or dyadic synchrony consisting of smooth exchanges which involve mutual regulation, reciprocity and harmony (Harrist & Waugh, 2002).

Although the dyadic interaction is jointly constructed, the relationship between the parent and the infant is still asymmetrical, and the main responsibility for maintaining and coordinating the dyadic interaction relies on the caregiver (Harrist & Waugh, 2002). It has been pointed out that the dyadic entity is more than the sum of the parent and the infant behavior (Harrist & Waugh, 2002; G. A. Moore et al., 2013), implying that the match between the parent and infant is of importance, and research suggest that parent–child interactions should be investigated within a dyadic framework rather than by looking at each individual's contributions (Kochanska et al., 2008). Accordingly, the present study aimed to investigate the dyadic mother–infant and father–interaction, and also the match between the parent and the infant dyad in interaction.

So far, dyadic mother–child interactions have received the most attention (Campbell et al., 2007; Feldman et al., 1997; Siqveland & Moe, 2014; Tronick & Cohn, 1989), but currently, the field of father–infant interaction has been increasingly emphasized (Amodia-Bidakowska et al., 2020; Cabrera, 2020; Ramchandani et al., 2013). Whether mother–infant and father–infant interactions are equal or different in terms of dyadic mutuality and reciprocity has also been questioned. Findings from earlier studies suggest that fathers tend to express less positive emotions and engagement than mothers, including less responsivity to infant cues (Belsky et al., 1984; Power, 1985; Power & Parke, 1983), while mothers are more likely to display affection such as holding, smiling, and vocalizing (Lamb et al., 1982). In other reports, parents were found to be equally engaged in exploration, and communicative and relational play while interacting with their infants and toddlers (Golinkoff & Ames, 1979; Hummel, 1982; Power, 1985). In addition,

THREE KEY FINDINGS

- The mother–infant and father–infant interactions received scores in the upper range, but mother–infant interactions tended to receive higher scores.
- The mother–infant dyads obtained higher score in the ERHS dimensions engagement and enjoyment than the father–infant dyads, but there were no such differences in the remaining dimensions.
- Parent–daughter interactions earned higher scores than parent–son interactions suggesting an association between different dyadic gender compositions and the parent–infant interaction.

Statement on the relevance of this research to the field of infant and early childhood mental health

This study examines dyadic interactions as assessed by the ERHS between mothers and fathers and their infants aged 12 months. Results suggest that mother–infant dyads tended to obtain slightly higher scores compared to father–infant dyads, and that parent–daughter pairs received higher scores than parent–son pairs. Findings increase the knowledge base on gender typed differences in dyadic parent–infant interactions during infancy.

mothers were found to use more directives in interactions with daughters than sons (Power, 1985), while fathers display rougher and tumble play with their sons than daughters (Hossain & Roopnarine, 1994; Labrell, 1994). However, these studies are old and might not reflect the contemporary dyadic mother–infant and father–infant interactions, for instance, due to increased father involvement in caregiving from infancy (Amodia-Bidakowska et al., 2020; Hughes et al., 2018). In Scandinavian countries, for example, most mothers are employed, and dual-earner and dual-caregiver families have been facilitated by providing one full year of paid parental leave that can be shared between the parents. As part of such wage-based leave, an individualized and nontransferable paternal quota has been legislated to ensure father involvement in infants' first year of life (Haas & Hwang, 2013). Reports show that extended periods of paternal leave are associated with

more father involvement and care of children (Hook & Wolfe, 2012; Sullivan et al., 2009), and that children whose fathers are involved and engaged during infancy develop fewer behavioral problems later (Ramchandani et al., 2005; Ramchandani et al., 2013).

Other societal changes with increasing maternal employment and a greater emphasis on fathers' involvement with their infant might influence patterns of dyadic mother–infant and father–infant interaction (de Mendonça et al., 2011), and also in the gender-typed interactions. It has also been suggested that mothers and fathers are becoming more similar in terms of the interactional behavior they engage in with their children and in their parental roles, especially in Western countries (Fagan et al., 2014; Raley et al., 2012). Thus, more knowledge is needed about dyadic mother–infant and father–infant interaction patterns in societies where both parents typically are more involved in caretaking of infants.

The present study aimed to investigate dyadic mother–infant and father–infant interaction patterns in a large low-risk community sample from Norway. Consistent with a dyadic construct, dyadic interaction in parent–infant pairs with different parent–gender compositions were also examined. The dyadic parent–infant interactions were observed in a semi-structured play situation at infant age 12 months.

1.1 | Similarities and differences between the dyadic mother–infant and father–infant interactions

Studies on dyad interaction patterns between mother–infant and father–infant pairs give mixed results, and some researchers have asked whether mothers and fathers interact in different ways with their infants (Cabrera et al., 2014; Tamis-LeMonda et al., 2004). One study showed that mothers and fathers were equally responsive in interaction with their infants, but mothers expressed more positive affect during dyadic interactions than fathers (Malmberg et al., 2007). In another report, positive and negative engagement levels within the mother–infant dyads were reported to match levels of engagement in both mothers and infants during interactions. No such associations were found for the father–infant interactions, perhaps reflecting higher mutual emotional engagement in the mother–infant dyads (Nordahl et al., 2014). Other findings have shown that both mothers and fathers display more sensitivity than intrusiveness during dyadic interactions with their infant (Cabrera et al., 2007). Similar patterns of interactional synchrony in mother–child and father–child dyads have also been found (Braungart-Rieker et al., 1998;

de Mendonça et al., 2011). Taken together, these studies suggest equal levels of sensitivity, responsiveness, and dyadic synchrony in the mother–infant and the father–infant dyads, but somewhat more mutual engagement and expressions of positive affect in the dyadic mother–infant than the father–infant interactions (Cabrera, 2020).

In a similar vein, several studies show that mothers display higher levels of sensitivity toward infants and toddlers (Barnett et al., 2008; Hallers-Haalboom et al., 2014; Kwon et al., 2012; Lovas, 2005), and also use more socio-emotional verbal speech relative to fathers during dyadic interactions (Leaper et al., 1998; Nordahl et al., 2014). Mothers have also been found to behave more sensitive in a dyadic play situation compared to fathers meanwhile, the infants were more cooperative in interaction with their mothers than fathers (Fuertes et al., 2016), indicating higher mutuality and easiness in the dyadic mother–infant interactions. In corroboration, one recent study showed that mothers offered more emotional support to the child in dyadic play interactions than fathers; however, no differences in the frequency of support offered by each of the parents were observed (Waldman-Levi, 2021). Similarly, fathers and mothers were assessed to be equally engaged in directing infant attention during dyadic play. Meanwhile the fathers talked less to the infant and were less accessible in the dyadic play situation compared to mothers (Laflamme et al., 2002). These results show that parent–infant dyads seem to be similarly engaged in joint play activities, but different in terms of more emotional support, verbal comments, and more sensitivity in the mother–infant interaction compared to the father–infant interaction. One suggestion is that lower levels of sensitive behavior in the dyadic father–infant interactions might be explained by less paternal experience with the dyadic play context in infant first year of life (Barnett et al., 2008). It has also been questioned whether paternal behavior in interaction with the infant might be qualitatively different from those of mothers, and therefore should be evaluated on their own terms (Barnett et al., 2008). Another point of view is that dissimilarities in mothers' and fathers' interactive styles in the dyadic interaction contribute differently to infant development. For instance, the more physical, arousing, and unpredictable play reported in father–infant interactions (Amodia-Bidakowska et al., 2020; StGeorge & Freeman, 2017), is suggested to impact significantly on the child's later capacity to self-regulate (StGeorge & Freeman, 2017). Furthermore, experiences with differential parental styles might give the infant opportunities to learn about different behaviors and in taking part in the dyadic interaction with each of the parents. These different experiences might in turn contribute importantly to child social and emotional development (Fuertes et al.,

2016; Hallers-Haalboom et al., 2014; Piccinini et al., 2010). To sum up, there is still a lack of knowledge concerning similarities and differences between the dyadic mother–infant and father–infant interaction and more research is needed. However, in future research, the societal context of the parent–infant dyads and the parental roles should be taken into account.

1.2 | Parent–child gender compositions and dyadic interaction patterns

Some research suggests that the dyadic parent–infant interactions are influenced by the gender composition of the dyads (Fuertes et al., 2016; Lovas, 2005). In one study mother–daughter dyads were reported to display more sensitivity, responsiveness and involvement followed by the mother–son dyads, the father–daughter dyads, and finally, the father–son dyads, who were more often assessed with poorer interactional scores compared to the other dyads (Lovas, 2005). No association between higher levels of sensitivity in the mother–infant interactions and child gender was found in another study; however, fathers exhibited more negative intrusiveness towards sons than daughters in the dyadic interaction (Barnett et al., 2008). According to these studies, dyadic father–son interactions may be characterized by less mutual engagement and more intrusiveness compared to other parent–infant dyads, possibly decreasing reciprocity and joint pleasure in these dyadic exchanges, and perhaps resulting in less emotional sharing and less dyadic mutuality (Markova & Legerstee, 2006). In contrast, higher dyadic mutuality in same sex dyads has been suggested, for instance, fathers of boys are found to be more involved and positively engaged relative to fathers of girls in infancy and toddlerhood (Appelbaum et al., 2000; Manlove & Vernon-Feagans, 2002; Nordahl et al., 2014). Father–son dyads are also reported to involve more kissing and caressing than father–daughter dyads (Piccinini et al., 2010), and mother–daughter interactions are shown to be more sensitive than mother–son interactions (Schoppe-Sullivan et al., 2006). Likewise, mothers tend to use more supportive speech with their toddler-aged daughters than with their sons (Leaper et al., 1998). These results showing higher engagement and emotional involvement in mother–daughter and father–son dyads are consistent with suggestions of higher interactional synchrony in same-sex parent–infant pairs (Feldman, 2003). However, other studies suggest that parents display similar levels of positive engagement and emotional availability towards boys and girls during both infancy (Nordahl et al., 2014) and toddlerhood (Robinson et al., 1993). In summary, there is some suggestion that parents display gender-differentiated behavior towards daughters and

sons in dyadic interactions, but the results are inconclusive.

An alternative view is to consider gender-typed child behavior during infancy, and the implication this might have on the dyadic parent–infant interaction. The literature demonstrating gender-typed child behavior during infancy is limited. Some reports show that infant girls are more socially involved and tend to orient more to a face or a voice (Connellan et al., 2000), and to seek more physical and relational contact with their parents than do infant boys in the dyadic interaction (Benenson et al., 1999). Infant girls have also been found to be more able to discriminate between emotional expressions (McClure, 2000), and to display stronger preferences for dolls than do boys (Alexander et al., 2009). Similarly, girls were observed to be more responsive and involved in both mothers and fathers during dyadic interactions than boys (Lovas, 2005). These findings suggest that girls from infancy seem to be more oriented to and actively seek emotional support from the parent during the dyadic interactions than infant boys of the same age. Accordingly, girls aged 12 months are also found to be more responsive and more positively engaged in interactions with both parents (Nordahl et al., 2014) and outperform boys on social communication (Olafsen et al., 2006). Possibly, a girl's heightened social and relational interest will impact positively on the parent's experience of reciprocity in the back-and-forth interactions, that in turn results in more dyadic mutual engagement and enjoyment. It has also been suggested that minor sex differences in neurological maturity and brain organization from birth may influence the dyadic parent–infant interaction (Reinisch & Sanders, 1992). However, since boys and girls are treated differently from birth it is difficult to disentangle the impact of biological versus social contributions (i.e., parental gender-typed expectations) to sex differences observed after birth (D. S. Moore, 2012). To sum up, the literature demonstrating infant gender-typed behavior in the dyadic parent–infant interactions in infancy is scarce and more research to clarify alternative implications of same-sex dyads or child gender-typed behavior is needed.

1.3 | The present study and study aims

The present study is conducted in a dyadic framework and focuses on the parent–infant dyad as a unit of analysis. It includes a large community-based sample comprising mothers, fathers, and their 12-month-old infants. It aims to address some gaps in the literature concerning similarities and differences between mother–infant and father–infant interactions in infancy. Moreover, the study also examines dyadic gender compositions, to

provide new knowledge on a topic with limited documentation concerning the relation between different dyadic gender compositions and interaction patterns during infancy. In this study, the Early Relational Health Screen (ERHS) (Willis, 2007; Willis, Chavez, et al., 2020; Willis, Condon, et al., 2020), a tool for assessing dyadic interactions, was used to assess the overall parent–infant interaction, as well as interaction patterns on seven different dyadic ERHS-dimensions: engagement, enjoyment responsiveness, pacing, attention, imitation, and initiation. A limitation of several observational methods that do exist, is the sole focus on one person at a time within the parent–infant dyad, thus lacking information on the dyad as an entity.

The first aim of this study is to investigate differences and similarities between the mother–infant and father–infant dyads in terms of overall interaction score by using the ERHS (Willis, 2007; Willis, Chavez, et al., 2020; Willis, Condon, et al., 2020), as well as a more fine-grained mapping of dyadic interactions of key ERHS dimensions (engagement, enjoyment responsiveness, pacing, attention, imitation and initiation). The second objective is to examine if different dyad parent–infant gender compositions (mother–daughter and mother–son, father–daughter and father–son) are related to the overall interaction scores.

2 | METHOD

2.1 | Design and participants

This study is part of a Norwegian community-based prospective cohort study (Moe et al., 2019). Recruitment into the study took place between September 2011 and October 2012. Midwives at nine well-baby clinics situated in different parts of the country were informed about the project and asked all pregnant women who attended their first pregnancy checkup if they wanted to be contacted by a local health nurse. These health nurses worked as research assistants, conducted informed consent, and collected all data.

Most of the pregnant women and their partners were enrolled at 16–32 weeks of gestation (range 8–32 weeks); the majority of participants were recruited before the 20th week. A total of 1041 pregnant women were enrolled in the study, but five later withdrew requesting deletion of all data. Thus, there were 1036 women, and ultimately 884 of their partners (878 fathers and six female partners), who consented to participate and contributed their data to the study. A total of 1007 women gave birth to 1017 children, 529 boys, and 480 girls (including 10 pairs of twins).

In the analyses discussed here, 671 mother–infant pairs and 337 father–infant pairs were included. Every twin coded randomly as number one in the pair took part, the other member of the pair was excluded, and a total of seven twins were included at 12 months. Information about parental socio-demographic variables, such as age, education, marital status, parity and ethnicity, was collected from each of the parents at inclusion. At infant age 12 months, the parents and their infant were invited to the well-baby clinic for data collection. The health nurse (working as a research assistant) video-recorded the semi-structured parent–infant play situation. When an infant reached the age of 12 months, fathers were also invited to respond to a web-based questionnaire concerning use of the paternal leave, and how they shared this leave with the mother. This questionnaire was e-mailed to fathers after the data collection at 12 months, and fewer participants answered than who participated in other types of data collection at that point ($n = 261$).

As shown in Table 1, most parents were married or cohabiting, had education at the university level, and had incomes between 300.000 and 600.000 Norwegian kroner (25,000–50,000 Euro). Most of the parents had no previous children, and a high percentage was ethnic Norwegians. Most fathers reported that they had used their quota of parental leave, which is a less extensive leave than the mothers.

2.2 | Procedures

2.2.1 | Parent–child interaction recording procedure

The mother–infant and father–infant interactions were recorded at child age 12 months (± 14 days). The dyads were video recorded in a play situation and the parents were asked to play with their child as they usually would do at home. The research assistant used a handheld camera and stayed in the room without interfering with the interaction while recording. The interaction consisted of 10 min of free play with a specified set of toys (i.e., a koosh ball, several colored blocks, a box, a spoon, and a cup). In analyzing the interactions, the first 5 min were treated as “warm up” and only the last five minutes of each video recording were used for coding. The five last minutes was coded in entirety.

Six mother–infant interactions and ten father–infant interactions were not possible to score and therefore excluded (e.g., if the child was mostly crying, the videotape was too short, the parents terminated the recording, or a sibling interrupted the interaction). The videotapes with female partners were excluded from the analysis, as not to confound being the non-childbearing partner

TABLE 1 Maternal and paternal characteristics at inclusion and paternal leave at 12 months

Demographics	Mother N = 671		Father N = 336	
	M	SD (Range)	M	SD (Range)
Age	29.84	4.81 (17–42)	32.52	5.58 (16–51)
Marital status	<i>n</i>	%	<i>n</i>	%
Partner ^a	647	96.4	331	98.5
Single	24	3.6	5	1.5
Education				
9–10 years	14	2.1	14	4.2
High school	125	18.6	68	20.2
<4 year at university	260	38.7	115	34.2
≥4 year at university	272	40.5	139	41.4
Income				
No income	6	.9	1	.3
<150.000–299.999	196	29.2	46	13.7
300–599.999	429	64.0	215	64.0
>600.000	40	5.9	74	22.0
Parity				
No children	390	58.1	194	57.7
One child	211	31.4	98	29.2
Two children	62	9.2	34	10.1
≥3 children	8	1.2	10	3.0
Ethnicity				
Norwegian	641	95.5	321	95.5
Other	30	4.5	15	4.5
			<i>n</i> = 261	%
Paternal leave				
Used quota	-	-	233	89.3
Partly used	-	-	9	3.4
Not used	-	-	19	7.3
Sharing of leave				
Father less time	-	-	207	86.6
Parents equal time	-	-	16	6.7
Father more time	-	-	16	6.7

^aPartner = married or cohabiting.

with parental gender ($n = 3$). Four video tapes with paternal dyads were excluded because the fathers had not consented to participate at inclusion. In all, a total of 671 mother–infant and 337 father–infant interactions were eligible for further analyses. Some of the infants ($n = 244$) were observed twice if both the mother and the father participated in the dyadic parent–infant play situation. Logistic regressions conducted to examine differences among the parents who participated in the interactions compared to the non-participants, showed that mothers were more likely to participate if they had

higher education (OR = 1.73, $p = .002$) (CI [1.23, 2.43]) or were first-time mothers (OR = .68, $p = .011$) (CI [.50, .91]). Paternal participation was more likely if they had higher education (OR = 1.45, $p = .031$) (CI [1.03, 2.03]).

2.2.2 | The Early Relational Health Screen (ERHS)

The ERHS (Willis, Condon, et al., 2020) is a short video-based coding method for assessing dyadic parent–infant

TABLE 2 Brief description of the dimensions of the ERHS

Dimension	Definition	Scoring
Engagement	Parent and toddler are engaged with each other <i>The parent and the baby show emotional engagement. They are clearly delighted with each other.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Enjoyment	Parent and toddler enjoy each other <i>The parent and baby show enjoyment in one another by pleasant facial expressions, looking at one another, smiling, talking, gently touching each other, and being relaxed.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Responsiveness	Parent and toddler respond to each other, and have back and forth interactions with each other <i>When the parent (or baby) initiates some type of action, affect or vocalization, the baby (or parent) responds; the parent (or baby) responds; and, the baby (or parent) responds again.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Pacing	Parent and toddler show sensitivity to each other's pacing and rhythm <i>The parent and baby recognize and respond to each other's pace, rhythm and timing, evidenced by natural pauses between initiations and responses between the parent and baby. Pacing is predominately an adult characteristic.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Attention	Parent and toddler attend to each other during interaction, as well as each other sights and sounds <i>The parent and baby look at and listen to each other. They turn towards sounds and listen to noises without negative reaction. They include one another in their focus of attention.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Initiation	Parent and toddler initiate interactions with each other <i>The parent and baby use spontaneous gestures, sounds, or gentle touch to begin an interaction.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c
Imitation	Parent and toddler imitate each other's behaviors <i>Both the parent and baby demonstrate the ability to copy the other's behaviors, vocalizations, gestures, facial expressions, or actions.</i>	2. Observed ^a 1. Sometimes observed ^b 0. Not observed ^c

^a“Observed” (2 points): The skill is demonstrated in a positive affective state, and the skill is the predominant characteristic of the interaction.

^b“Sometimes Observed” (1 point): The skill is present, but it is not the predominant characteristic of the interaction. It is weakly demonstrated or present, but the interaction appears uncomfortable or anxious or the child seems wary of the parent. The overarching affect in the interaction is less than positive, or there is uncertainty about whether a skill should be scored “observed” or not.

^c“Not observed” (0 points): The skill is clearly absent during the interaction.

interactions at child age 6, 12, 18, and 24 months. The ERHS addresses the parent–child interaction and focuses on the dyad as a unit (Willis, 2007; Willis, Condon, et al., 2020). The number of dyadic dimensions is increased as the child grows older and obtains more competencies. At 12 months, seven dimensions are coded, namely “engagement,” “enjoyment,” “pacing,” “responsiveness,” “attention,” “initiation,” and “imitation” (see Table 2 for descriptions). Each dimension is scored on a 3-point scale: observed (2 points); sometimes observed (1 point); not observed (0 points), yielding a sum score from 0 to 14. The dyadic interaction must be assessed on all seven dimensions in order to obtain a sum score. The sum score has three different cut off values that may be used to give a clinical recommendation. “Pass” (sum score 11–14) indicates a “good enough” interactional quality, “suspect” (sum score

8–10) indicates some concern for the dyad, whereas “fail” (≤ 7) suggests significant concerns.

The scoring procedure starts by noting whether the overarching affective tone of the relationship is positive or less than positive. A positive overarching affect is identified by specific behaviors observed during the interaction, for instance “smiles both on the faces of the child and the parent,” “positive tone of voice,” “snuggling,” and “caressing.” The observed behaviors suggesting absence of a positive overarching affect are for instance “wariness,” “lack of parental soothing behavior,” and “the child turning away from the parent.” A judgement of the overarching tone as less than positive will sway all subsequent scoring (i.e., all dyadic dimensions must then be scored as either “sometimes observed” [1 point] or “not observed” [0 points]).

2.2.3 | Assessment of inter-rater reliability

A team of five trained and supervised coders scored the taped parent–infant interactions at child age 12 months. The team consisted of students and was trained part-time together as a group. After completing training, they were required to pass a test consisting of seven tapes of parent–infant interactions coded by experts, to achieve satisfactory scores before coding the data material. The scoring of the tapes was completed in approximately one year. Twenty percent of the recordings were successively scored independently by two coders to monitor inter-rater reliability. Reliability recordings were randomly drawn from the sample, with reliability status hidden from the research assistants performing the coding. To maintain a satisfactory inter-rater reliability and avoid drifting, the team attended weekly meetings with a supervisor. Tapes that were difficult to score or had discrepancies in scoring values were discussed after the coding had taken place. In addition, tapes with full consensus were included in these sessions to learn from successfully scored tapes. The coders watched the tapes twice before scoring and without consulting with each other. They had no information about the families and were oblivious to tapes that were randomly selected for reliability purposes. Inter-rater reliability estimated by weighted quadratic Kappa demonstrated that the overall coder agreement was .76. Reliability analyses for the mother–infant interaction gave Cronbach's $\alpha = .72$ and .75 for the father–infant interaction, indicating acceptable internal consistency.

2.3 | Analyses

Background information about the participants obtained at inclusion was examined with descriptive analyses along with data concerning paternal leave at child age 12 months. Preliminary analyses included examining the mean and distribution of ERHS sum scores and cut off scores. Linear mixed-effects (lme) models with fixed effects including parental age, education and child gender were used to analyze differences in sum scores between the mother–infant and father–infant interactions. For this model, a standardized difference is also computed based on the total standard difference for the random effects. This is only included for illustration since there is no general agreement on how to define a standardized difference in models with more than one random effect.

Crosstabs with marginal homogeneity tests were used to analyze differences in each of the ERHS-dimensions

between the mother–infant and the father–infant pairs. Linear mixed-effects models with fixed effects including parental age, education and child gender were used to analyze differences in sum scores between the parent–daughter and the parent–son interactions, as well as differences between mother–daughter/father–daughter and mother–son/father–son interactions. The parent by child gender interaction was subsequently analyzed in a separate linear mixed-effects model.

Logistic regressions were conducted to examine differences among the parents who participated in the interactions compared to the non-participants. Covariates were parental age, education, and parity. Inter-rater reliability was estimated by weighted quadratic Kappa. The significance level was set to $p < .05$, and analyses were performed by using SPSS (IBM SPSS Statistics for Windows Version 26.0.) and R (The R Foundation for Statistical Computing, 2022) packages *nlme* for mixed-effects modeling and *vcd* for estimation of inter-rater reliability.

3 | RESULTS

3.1 | ERHS sum scores, cut off scores, and distribution of scores in the dimensions of the ERHS

As shown in Table 3, most of mother–infant and the father–infant dyads had mean sum scores in the upper end of the scale. A higher percentage of the mother–infant pairs had cut off scores designated as “pass” as well as a lower percentage of cut off scores designated as “fail” compared to the father–infant pairs. A majority of the mother–infant and the father–infant pairs obtained the highest score “observed” (2 points) in the first five ERHS dimensions (see Table 3). In the ERHS “initiation” dimension, the majority of the parental dyads were scored as “sometimes observed” (1 point).

3.2 | Differences between mother–infant and father–infant dyads

Mixed effects models with fixed effects for adjustment of parental age, education and child gender, showed significantly lower mean scores for the father–infant interactions compared to the mother–infant interactions (see Table 4). Analysis with crosstabs showed that the mother–infant dyads earned significantly higher scores on the ERHS dimensions of “engagement” and “enjoyment” compared to the father–infant dyads.

TABLE 3 Mother–infant and father–infant dyads at 12 months: ERHS sum scores, cut off scores and distribution of scores in the dimensions of the ERHS

ERHS Sum scores	Mother–infant dyads <i>N</i> = 671			Father–infant dyads <i>N</i> = 337		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
	11.06	2.29	1–14	10.61	2.43	2–14
Cut off scores	<i>n</i> (%)			<i>n</i> (%)		
Pass: 11–14	453 (67.5)			207 (61.4)		
Suspect: 8–10	156 (23.3)			82 (24.3)		
Fail: 0–7	62 (9.3)			48 (14.2)		
ERHS- dimensions	Observed (Score = 2)	Sometimes ^a (Score = 1)	Not observed (Score = 0)	Observed (Score = 2)	Sometimes ^a (Score = 1)	Not observed (Score = 0)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
1.Engagement	450 (67.1)	217 (32.3)	4 (.6)	207 (61.4)	126 (37.4)	4 (1.2)
2.Enjoyment	465 (69.3)	203 (30.3)	3 (.4)	202 (59.9)	133 (39.5)	2 (.6)
3.Responsiveness	556 (82.9)	110 (16.4)	5 (.7)	269 (79.8)	67 (19.9)	1 (.3)
4.Pacing	545 (81.2)	121 (18.0)	5 (.7)	258 (76.6)	77 (22.8)	2 (.6)
5.Attention	473 (70.5)	195 (29.1)	3 (.4)	226 (67.1)	111 (32.9)	-
6.Initiation	182 (27.1)	286 (42.6)	203 (30.3)	73 (21.7)	148 (43.9)	116 (34.4)
7.Imitation	331 (49.3)	285 (42.5)	55 (8.2)	151 (44.8)	151 (44.8)	35 (10.4)

^aSometimes observed.

3.3 | Parent–child gender compositions and dyadic interactions

Mixed effects models with fixed effects for adjustment for parental age, education and child gender, demonstrated that the mother–daughter pairs scored significantly higher than the mother–son pairs. The father–daughter pairs had significantly higher scores relative to the father–son pairs (see Table 5). Further analysis showed that the mother–daughter pairs scored significantly higher than the father–daughter pairs, and that the mother–son dyads scored significantly higher than the father–son dyads. The parent by child gender interaction was not significant.

4 | DISCUSSION

The first objective of this study was to examine differences in interaction patterns between mother–infant and father–infant dyads at infant age of 12 months, as well as dyadic interactions on seven ERHS-dimensions. Second, we examined if different dyadic parent–infant gender compositions were related to the overall interaction score.

We found that most of the mother–infant and father–infant pairs received high scores, indicating that the majority of the dyads were observed to show mutual engagement, and to have a “good enough” interactional quality. This was expected, as the participants were drawn from a community sample of low risk (e.g., most of the parents were married or cohabiting, they were highly educated,

and mostly had a high income). Other studies also report an association between socioeconomic status and the quality of the dyadic parent–child interaction (Nordahl et al., 2014; Piccinini et al., 2010; Tamis-LeMonda et al., 2004). A high proportion of mother–infant (67.5 %) and father–infant dyads (61.4 %) obtained the highest cut-off score (pass) at 12 months, perhaps indicating a smooth dyadic flow in the observed play situations. A good dyadic quality implies a balanced two-way process with mutual initiations and reciprocal responses, and several studies have shown, that this may serve as a context for the development of later self-regulatory capacities (Harrist & Waugh, 2002; Kochanska et al., 2008; Lindsey & Caldera, 2015; Savonlahti et al., 2005).

The result showing that 9.3% of mother–infant pairs obtained cut-off scores in the “fail” area, indicate less mutuality and responsiveness in the dyadic interactions. Although not directly comparable, it is worth noting that a proportion of similar size was found in a Danish population-based study reporting “relational disturbances” in 8.5% of 18 months-old children (Skovgaard, 2010). Possibly, in a sample with higher risk than in our cohort, one would expect to find more dyads with lower scores on interactional quality. In this vein it has been shown that 48% of clinically referred toddlers had relationship disturbances (Mothander & Moe, 2008). Furthermore, mother–infant interactions including mothers with substance abuse and mental health problems display a significantly lower dyadic mutuality compared to low-risk dyads (Siqveland et al., 2014).

TABLE 4 Differences between mother–infant and father–infant dyads

ERHS sum score			
<i>Mixed effects analyses</i> ^a	Difference ^b	CI	p
Mother–infant versus father–infant	-3.42	-5.59, -1.26	.002
ERHS-dimensions ^c			
Engagement			
Mother–infant versus father–infant			.022
Enjoyment			
Mother–infant versus father–infant			.011
Responsiveness			
Mother–infant versus father–infant			.068
Pacing			
Mother–infant versus father–infant			.32
Attention			
Mother–infant versus father–infant			.17
Initiation			
Mother–infant versus father–infant			.18
Imitation			
Mother–infant versus father–infant			.057

^aAdjusted for parental age, education and child sex. The standardized difference corresponding to the mother–infant versus father–infant difference, using the total standard difference for the random effects, was -.21.

^bFixed effects coefficients.

^cp-values for exact marginal homogeneity tests.

TABLE 5 Differences between the mother–daughter/mother–son and the father–daughter/father–son dyads

Dyadic differences			
<i>Mixed effect analyses</i> ^a	Difference ^b	CI	p
Mother–daughter versus mother–son	3.95	1.44, 6.46	.002
Father–daughter versus father–son	4.16	.61, 7.71	.022
Mother–daughter versus father–daughter	3.32	.26, 6.37	.034
Mother–son versus father–son	3.52	.55, 6.50	.020
Interaction parent by child gender			.92

^aAdjusted for parental age, education and child sex.

^bFixed effect coefficients.

This study also demonstrated that even if the differences were small, the mother–infant dyads earned significantly higher scores as compared with the father–infant ones. These findings concur with previous studies showing that mother–infant dyads tend to score better on interaction quality than do father–infant dyads (Lovas, 2005), and with reports of more mutual engagement in the mother–child than father–child interactions in infancy and toddlerhood (Barnett et al., 2008; Fuertes et al., 2016; Hallers-Haalboom et al., 2014; Kwon et al., 2012; Tamis-LeMonda et al., 2004). Mothers are more often involved in daily child care in the first year of life, and spend more time in close proximity, physical care and infant nursing as compared with fathers, who generally are less involved in the early phases of the child’s life (Laflamme et al., 2002; Nordahl et al., 2016; Piccinini et al., 2010). Accordingly, the parent who spend more hours together with the infant will be better acquainted with infant emotional needs and signals during dyadic interactions (Fuertes et al., 2016). Although most fathers who participated in this study had used their paternal quota, they mainly had acted as the primary caregiver for a shorter period of time than the mothers, whose leave typically was more extensive. The lower scores in the present dyadic father–infant interactions might possibly reflect that these fathers and their infants had spent less time together and had less routine in playing together than the mother–infant dyads (Barnett et al., 2008). More time spent together (and particularly more positive time) will, in keeping with the transactional framework (Sameroff, 2009), promote a sense of familiarity and ease in the dyad, since both parent and child will have a greater opportunity to learn to anticipate each other’s behaviors and responses.

Our results, hinting at somewhat higher scores in some of the dimensions reflecting mother–infant interaction as compared with father–infant interaction, suggest that mothers and fathers may interact somewhat differently with their infants, as reported elsewhere (Barnett et al., 2008; Laflamme et al., 2002; Piccinini et al., 2010). Possibly, mothers and fathers display qualitatively different behavior during the dyadic parent–infant interaction (Barnett et al., 2008), and it is further suggested that such differences in the dyadic parent–infant interactions contribute differently to infant development in the social and emotional domains (Fuertes et al., 2016; Hallers-Haalboom et al., 2014; Piccinini et al., 2010).

The play situations observed in the present study revealed that there were significant but small differences between the mother–infant and the father–infant dyads in the ERHS dimensions of “engagement” and “enjoyment.” These dimensions, tapping emotional connection and delight, as well as pleasant facial expressions and reciprocity in responding, earned higher scores in the mother–infant relative to the father–infant pairs. This is in line

with other reports showing that mother–infant dyads tend to display higher levels of emotional engagement including sensitivity and affection, sharing of affects, smiling and vocalizing more, as well as using more socio-emotionally toned speech compared with father–infant dyads (Barnett et al., 2008; Kwon et al., 2012; Leaper et al., 1998; Lovas, 2005). Reciprocal emotional engagement and sharing of affect have been emphasized as salient aspects of the early dyadic parent–infant relationship and are possibly crucial for infant communication and social-emotional development (Feldman, 2007; Harrist & Waugh, 2002; Lindsey & Caldera, 2015; Lindsey et al., 2009). It has also been suggested that shared pleasure in the dyadic interaction is important for later child healthy psychological development (Mäntymaa et al., 2015), and conversely, that lack of emotional sharing and co-regulation in the dyadic exchanges may compromise a child's social and cognitive development (Markova & Legerstee, 2006; Stern, 1985; Tronick, 1989). It is noteworthy that no significant differences were found between the mother–infant and the father–infant pairs in the remaining dyadic ERHS dimensions, indicating equal amounts of mutual responsiveness and pacing, attending to each other, and in regard to initiatives and imitation in the joint play situation in both the mother–infant and the father–infant dyads. These findings concur with other studies showing that the interactive behaviors in mother–infant and father–infant dyads evidence more similarities than differences (Malmberg et al., 2007; Notaro & Volling, 1999; Tamis-LeMonda et al., 2004), and with reports of similar patterns of interactional synchrony in parent-child dyads (de Mendonça et al., 2011). In summary, the present results imply similarities between mother–infant and father–infant dyadic interactions on several dimensions. However, in line with others studies (Kwon et al., 2012; Lovas, 2005), mother–infant dyads were found to display more engagement and enjoyment during interactions than the father–infant dyads. The present study, investigating interaction in different dyadic parent–infant gender compositions demonstrated that the mother–daughter and father–daughter dyads obtained higher interactional scores compared to the mother–son and father–son dyads. These results are in keeping with another report showing that both parents displayed higher levels of sensitivity in dyadic interactions with their daughters than with their sons (Lovas, 2005) and that mother–daughter interactions includes higher levels of sensitivity (Schoppe-Sullivan et al., 2006), responsiveness, involvement and engagement (Lovas, 2005; Nordahl et al., 2014), as well as more supportive speech than do mother–son interactions (Leaper et al., 1998). However, other observations show that mother–daughter and mother–son interactions display similar levels of posi-

tive engagement and emotional availability (Barnett et al., 2008; Nordahl et al., 2016).

Our results, showing differences in interaction patterns between father–daughter pairs as compared to father–son pairs, are supported elsewhere. Specifically, more negative and intrusive behaviors have been observed in father–son than in father–daughter interactions (Barnett et al., 2008), probably decreasing opportunities for mutual enjoyment and engagement in the father–son dyadic interaction. In addition, father–son dyads are more often found to display poorer interactional quality in terms of more intrusiveness and less structuring compared to father–daughter dyads (Lovas, 2005). Fathers' tendency to be intrusive during play is associated with a lack of attention to infant behavior, which may weaken the paternal ability to perceive signals from the infant and adjust their own behavior according to infant cues in the father–infant interaction (Barnett et al., 2008).

In contrast, other studies have shown that fathers are more positively engaged with their sons and less sensitive with their daughters during dyadic interactions, and that the level of dyadic synchrony tend to be higher in same sex dyads (Feldman, 2003; Lindsey & Caldera, 2015; Nordahl et al., 2014), possibly explained by a better biological match in these dyads (Feldman, 2003). It has also been suggested that fathers' different patterns of play with sons versus daughters might mirror their expectations of gender typed interaction patterns (Lovas, 2005). Thus, fathers who believe that girls are more vulnerable may be less physically and verbally restrictive towards girls than boys in the dyadic interactions (de Mendonça et al., 2019).

Viewed in tandem with the possible influence of parent gender in the parent–infant dyadic interaction, this study shows higher scores in dyadic interactions in the parent–daughter pairs than the parent–son pairs, which might also reflect gender differences between infant girls and boys. For instance, girls are usually found to be more responsive, involved and positively engaged during dyadic interactions with both parents as compared with boys (Lovas, 2005; Nordahl et al., 2014). Infant girls are also shown to orient more to a face or a voice (Connellan et al., 2000) and to evidence a higher occurrence of relational dyadic behavior than infant boys (Benenson et al., 1999), possibly promoting higher dyadic mutuality. Similarly, another study found that infant girls may be more able to discriminate between emotional expressions (McClure, 2000), and tend to display stronger preferences to dolls than boys (Alexander et al., 2009). In corroboration with the present results, these findings suggest that infant girls might show higher social interest that elicits more parental responsiveness and reciprocity in the parent–daughter dyadic interactions. Accordingly, some studies suggest that daughters are more

encouraged to take responsibility for the creation of dyadic mutuality by their mothers, who more actively maintain relational states with their sons in the dyadic interaction (Lovas, 2005; Robinson & Biringen, 1995; Robinson et al., 1993). It has also been pointed out that girls seemingly arrive earlier and remain longer in the developmental period that promotes face-to-face orientation and dyadic social interactions than do boys. Boys seem more quickly to move on to activities that facilitate independence but provide fewer opportunities for dyadic interactions with the parents (Reinisch & Sanders, 1992). Minor sex differences in neurological maturity and brain organization from birth may influence such bidirectional exchanges in the parent–infant dyad (Reinisch & Sanders, 1992), but it is difficult to disentangle the biological and the social contributions to sex differences observed after birth (D. S. Moore, 2012). In accordance, the transactional model of development (Sameroff, 2009), emphasizes that gender differences in infant behavior and responsiveness are augmented through dynamic parent–infant transactions over time, resulting in different developmental, emotional trajectories for girls and boys in their first year of life. To sum up, the present results showing higher scores in the parent–daughter compared to the parent–son interactions might reflect that parents treat girls different from boys, possibly due to gender-typed expectations. Another explanation might be biological gender differences between infant girls and boys, and possibly girls more actively seek emotional support from the parent during the dyadic interactions than infant boys of the same age.

4.1 | Limitations

This study has some limitations. There is a large discrepancy between the number of mothers and fathers who participated in the present study, and this unequal participation rate may lead to bias. However, logistic regression analyses were used to investigate how non-response may be related to background characteristics. Data were from a community-based sample, and most of the dyads earned scores in the upper-level bordering on a ceiling effect, and possibly indicating a good enough dyadic parent–infant interaction in terms of dyadic mutuality. These values would probably have varied more in socially more divergent groups or in samples including clinical groups.

The ERHS method used in present study has previously been little used and needs further validation. The ERHS scoring procedure, assessing the overarching affect prior to scoring the specific dimensions, might have resulted in less nuance in the scoring values. As mentioned above, a one-point score is the highest the parent–dyad could obtain on any of the dyadic dimensions provided a positive

overarching affect was not observed. Consequently, possible strengths in dyads with less than positive overarching affect cannot be revealed, even if they display “pacing”, “attention” or “imitation” outside the range of concern. In clinical practice, it is essential to identify both strengths and weaknesses in dyads at risk. Strengths can serve as a port of entry in a therapeutic setting and may be used to enhance other challenging aspects of the dyadic interaction.

5 | CONCLUSIONS, CLINICAL IMPLICATIONS AND RECOMMENDATIONS

Most of the parent–infant interactions received scores at the upper end of the rating scales, as one would expect in a community sample such as this. The differences between mother–infant and father–infant interaction patterns were generally small, but those involving mother–infant dyads tended to receive higher scores. The mother–infant dyads also obtained higher scores in the ERHS dimensions engagement and enjoyment, probably suggesting somewhat higher dyadic mutuality in these dimensions. The present results show somewhat different dyadic interaction patterns with infant daughters compared to infant sons. They suggest that infant girls evince somewhat differential developmental pathways in the social domain and co-create somewhat different dyadic interactions with their parents compared to boys. However, the documentation on gender typed differences in infancy are scarce, and more research is needed.

This study suggests that the ERHS may be used for the assessment of dyadic parent–infant interactions, however, there is a need for further validation and replication of results. In clinical work with infants and parents, the quality of the early parent–infant interaction is often the main target of intervention. Videotaped observations are often needed for capturing the microscopic moments of dyadic exchanges between the infant and the parent, and there is a need for screening methods in this domain.

This study further suggests that ERHS might be feasible for assessing parent–child interaction in large research samples. The substantial inter-rater reliability that was obtained supports this feasibility. To do this well, it is recommended that researchers monitor inter-rater agreement successively, and that regular meetings are held for consensus discussions and supervision of the coders. In further use of the ERHS, researchers should consider whether overarching affect should be decisive for scoring of the individual dimensions, or rather be a valuable supplement to ensure that the emotional tone of the dyad is considered. Although outside the scope of the present study, the ERHS

coding system needs to be validated against other parent-child assessment tools. Also, the cut-off scores are in need of validation.

This study was restricted to dyads observed in a play situation at child age 12 months. In future studies, dyadic interactions with younger as well as older children ought to be assessed. Further, we suggest that the ERHS should also be employed in higher-risk samples and examined in studies within basic research and clinical practice contexts. In closing, this study contributes to the dearth of literature on dyadic interaction patterns in mother-infant and father-infant dyads in a large low-risk community sample in a contemporary framework. The present study also fills a gap in the literature regarding gender-typed differences in the dyadic parent-infant interactions in infancy.

CONFLICTS OF INTEREST

None

PATIENT CONSENT FOR PUBLICATION

Not required.

DIVERSITY STATEMENT

The study was conducted in Norway, and an important aim was to sample from all geographical regions in Norway to obtain a sample that reflects the population. All pregnant women who attended routine care during pregnancy at nine well-baby clinics were asked to participate, including their partners. These clinics were selected to ensure geographical diversity and representation of all health regions in Norway. There were no criteria for exclusion, but since the questionnaires were either in Norwegian or in English, this might have excluded those who spoke other languages. Most of the participants who consented to participate was ethnic Norwegians, and in future research it will be important to implement strategies to obtain a higher variability in ethnicity. Further, variability in educational level and income reflects the demographic characteristics of the study regions; however, differences between participants living in urban and rural parts of Norway ought to be investigated in future studies.

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