Early Human Development 189 (2024) 105943

Contents lists available at ScienceDirect

Early Human Development

journal homepage: www.elsevier.com/locate/earlhumdev

Attachment and mother-infant interactions in dyads with infants born full-term, moderate-to-late preterm, and very-to-extreme preterm

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ARTICLE INFO

Keywords:
Early infant interactive behavior
Maternal interactive behavior
Stability and transitions
Mother-infant attachment

ABSTRACT

Background: The impact of prematurity status on attachment quality remains indeterminate. Some studies found no differences between infants born preterm (PT) and infants born full-term (FT), while other investigations present opposite results.
Aims: We aim to contribute to this body of research by studying mother-infant interactive behaviors and quality of attachment in 3 independent samples: Full-Term (FT), Moderate-to-Late Preterm (MLPT) and Very-to-Extreme Preterm (VEPT).
Study design: This is a longitudinal laboratory study conducted from 3 to 12 months of age (corrected-age in the case of infants born PT).
Subjects: The participants are 213 Portuguese infants (FT = 105; MLPT = 52; VEPT = 56) and their mothers.
Outcome measures: Mother-infant interactive behavior was observed in free-play at 3 and 9 months (corrected-age). Infant attachment was observed in Strange Situation at 12 months.
Results: Secure attachment is more prevalent in infants born FT, and ambivalent attachment is more prevalent in infants born VEPT. Infants with a secure attachment have higher gestational age and weight at birth. Infant and maternal interactive behavior quality is associated with attachment patterns and varies according to infant prematurity status. Last, the results indicate changes in maternal sensitivity and infant difficult behavior from 3 to 9 months of infant's age.
Conclusions: Our findings indicate that prematurity status impacts attachment quality. Changes in maternal and infant behavior from 3 to 9 months suggest a period of rapid non-linear development, supporting a transactional multilayered approach to the study of mother-infant relationship.

1. Introduction

Early human attachment relationships are associated with children developmental and socioemotional outcomes [30]. A secure attachment is linked to better emotion regulation, school, and mental health outcomes [1,2]. Despite the significance of early attachment, the quality of the mother-infant relationship according to prematurity status and its association with later attachment quality remains unclear.

Prematurity impacts infant development and relationships according to gestational age. There are three sub-categories of preterm birth (PT), based on gestational age: extremely preterm (EPT, < 28 weeks), very preterm (VPT, 28 to 32 weeks), and moderate-to-late preterm (MLPT, 32 to 37 weeks) [3]. Because infant born EPT are rare (about 1 % of survival births), many studies combine EPT and VEPT in one category (Very-to-Extreme Preterm, VEPT). These categories reflect different neuronal and metabolic maturation at birth [4,12].

Children born PT are at a heightened risk for lower cognitive, motor, and language performance compared to their FT counterparts [4–9], but children born VEPT consistently demonstrate even poorer performance than those born MLPT [8,9]. Compared with infants born full-term [FT],

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https://doi.org/10.1016/j.earlhumdev.2024.105943
Received 1 September 2023; Received in revised form 27 December 2023; Accepted 11 January 2024
Available online 17 January 2024

interactions with infants born PT tend to exhibit lower levels of positive affect, shared attention, reciprocity, and congruence [10,13–23]. Correspondingly, mothers of PT infants tend to display lower sensitivity and emotional engagement than mothers of FT infants [16,24,25]. From a sociodemographic perspective, the principal risk factors associated with prematurity (e.g., maternal age, maternal years of formal education, family SES, single motherhood) exhibit modest associations with MLPT births and robust association with VEPT births [11].

In this study, we aim to investigate mother-infant interaction and attachment in infants with different birth status (FT, MLPT & VEPT).

1.1. Maternal and infant interactive behavior and prematurity

Considering that preterm infants typically require prolonged hospitalization, separation from their mothers is inevitable. The hospitalization experience can disrupt the physical contact and natural interaction between the mother and the infant. Also, parents of infant born VEPT often experience heightened levels of stress and anxiety as they worry about their infant's survival, well-being, and future development [26,47]. These conditions ultimately lead to problems in mother-infant interaction, namely lower maternal sensitivity. Yet, there is a degree of inconsistency in the literature.

A recent meta-analysis by Bilgin and Wolke [27], which expressly incorporated studies with control groups, revealed that maternal behavior observed in interactions with their PT infants did not exhibit lower sensitivity or responsiveness than mothers of infants born FT. Furthermore, these results were sustained even after accounting for various moderators like degree of prematurity, geographical location, infant age, or time stay in NICU. Nevertheless, this analysis did not differentiate between late-moderate, very-extreme PT, which could yield different outcomes.

These results might also vary based on the assessment methods employed (parental reports or observational methods) and the measures used (e.g., AMBIANCE, Ainsworth Scales, or CARE-Index). In our study, the Crittenden CARE-Index was utilized to assess infant and maternal interactive behavior. Prior comparative studies with FT and PT samples using the CARE-Index [15–19,22,28,29], have shown that maternal sensitivity and infant cooperative behavior are higher in FT samples compared to PT samples.

1.2. Infant attachment and prematurity

In the case of infants born PT, several challenges hinder the development of a secure attachment, such as: i) instead of usual parental care, they are subjected to various intrusive and painful medical interventions; ii) during infants stay in the neonatal intensive care unit (NICU), parents have limited physical contact due to medical devices which reduce opportunities for parents to engage in nurturing touch and soothing gestures; iiii) parents might not have the chance to engage in everyday caregiving routines which play a vital role in developing a secure attachment and also can make it challenging for parents to intuitively respond to their infants' cues; iv) extended stays in NICU and medical complications, can become significant stressors for parents that worry about their infant's survival, health, and future development [28]. Accordingly, Mangelsdorf et al. [33], reported a higher risk of attachment insecurity among North American infants born VPT. In their study, only 47 % were classified with secure attachment, whereas 26.5 % were classified as insecure-avoidant and 26.5 % as insecure-ambivalent. However, comparative studies with infants born VPT or EPT are relatively scarce. For example, findings from a recent UK geographical, prospective population-based study confirm that many infants born MLPT (67 %) experience outcomes comparable to those of infants born FT [34].

In contrast, a Portuguese study [17] found that secure attachment was more prevalent in the FT group (62.5 %) than in the MLPT group (40.5 %). Other Portuguese study [20], found that secure attachment was more prevalent in infants born FT (61.4 %) than in VPT (31.4 %), while insecure-avoidant attachment was more likely in infants born VPT. Similarly, Wolke et al. [35] found a higher attachment insecurity prevalence in infants born VPT than in infants born FT. In summary, the research suggests an increased risk for insecurity in PT samples. Still, findings are often inconsistent and lack comparative studies. Further research with independent samples is necessary to learn about attachment quality in infants born FT, MLPT and VEPT.

1.3. Study aims

The present study is organized into four main aims: *aim 1*) to study the prevalence of attachment patterns according to prematurity status (FT, MLPT & VEPT) and the association of attachment pattern with demographic variables; *aim 2*) to assess the quality of maternal and infant interactive behavior according to prematurity status (FT, MLPT & VEPT) and according to attachment pattern; *aim 3*) to study the mean differences of maternal and infant behavior in two lad visit separate 6 months apart, i.e., stability from 3 to 9 months. Changes in maternal and infant behavior may support dyadic and transactional approaches of infant and maternal relationships. According to this perspective, relationships function as systems and are developed on the ongoing transactions between the interacting partners, and under the influence of life contexts [36,37]. Rather than each person's independent contribution, these transactions are shaped by reciprocal influences. Moreover, dyadic interactions are dynamic and include periods of individual organization, mutual organization, disorganization, and reorganization [38]. In opposition, the stability and continuity in infants and mothers' interactive behavior may favor a deterministic view of mother-infant relationships resulting from each partner's independent influence (e.g., infant temperament), and aim 4) to study the determinants of attachment quality using a multinominal logistic regression.

Although both maternal and paternal attachments are critical for child development, most studies in attachment field are performed with mothers, mainly for three reasons. The first reason is historical research, the body of knowledge on mother-infant attachment is far larger than the research on infant-father attachment. Second, because in many cultures, mothers have traditionally assumed the role of the primary caregiver, particularly during an infant's early years. Third, mothers tend to be more available than fathers since in many societies they have extended maternity leave and return later to their jobs.

The study of both maternal and paternal attachment is the most appropriate option, and contemporary research aims to understand the dynamics of attachment within diverse family structures. Our decision on studying mother-infant attachment is mostly based on easing the research conditions.

2. Materials and methods

2.1. Samples

Participants are 213 Portuguese infants and their mothers, distributed by 3 independent samples: (1) the FT sample which includes 105 infants born full-term (50 girls; 55 boys), (2) the MLPT sample which consists of 52 infants born moderate-to-late preterm (22 girls; 30 boys), and (3) the VEPT sample which includes 56 infants born very-to-extreme preterm (26 girls; 30 boys). According to health records, no infants had any known sensory or motor impairment, brain injury, severe illnesses, or congenital anomalies at delivery. Also based on Hospital records, no parents had any history of mental health problems, clinical depression, and/or substance abuse. Moreover, only 11 mothers (5.2 %) were not married or living in cohabitation with the infant's father, which nine from VEPT sample. About half (101) of the mothers were primiparous, 92.1 % were Portuguese Caucasian in race/ethnicity (almost equally distribute in each sample and from countries), all from the middle or upper-middle-class socioeconomic backgrounds.

Table 1 presents the demographics for each sample.

2.2. Procedures

Recruitment took place in hospitals in urban areas of Lisbon and Port and was carried out by three trained female researchers. Mother-infant dyads who met inclusion criteria were invited to participate. All procedures were approved by the Ethics Committees of all Health Units and Hospitals involved and by the Portuguese Data Protection Commission according to the ethical guidelines presented in the Declaration of Helsinki. All eligible, recruited mothers provided a written informed consent to their and their infant's participation before any assessment or data collection took place.

When infants were 3 and 9 months (corrected age), mothers, recruited at birth, were recontacted to schedule a follow-up lab visit with their infants. At these visits, mother-infant dyads were videotaped in a free-play interaction. At 12 months (corrected age), infants were observed during the Strange Situation Paradigm.

2.2.1. Free-play interaction

Using CARE-Index infant and mother interactive behavior was observed and coded from videotaped free-play interactions. Following the guidelines outlined in the CARE-Index manual [39], each dyad was recorded engaging in a 5-minute play inter-action. Parents were encouraged to interact with their infants as they typically would at home. A standard selection of age-appropriate toys was provided, although parents were not required to do so. These toys were placed on the floor, on top of a blanket with a surrounding pillow. Furthermore, a chair was made available for the mother, offering the option to sit on the chair with the infant on her lap or to stand on the floor during the interaction.

The CARE-Index includes three adult scales, namely Sensitivity, Control, Unresponsiveness, and four infant scales, Cooperativity, Compliant-Compulsive, Difficulty, and Passivity [39]. Each scale was scored from 0 to 14-points. These scales (maternal and infant scales) were scored in terms of facial expressions, verbal expressions, position and body contact, affection, turn-taking, control contingencies, and choice of activity (for example, zero points absence of indicators of maternal sensitivity while 14 points is total quality in each dimension - facial, verbal, physical, affective, reciprocity, contingency, and play). CARE-index is a dyadic measure, meaning that assessing each partner interactive behavior implies considering the interactive context and its influence on the other partner.

Infant and maternal behavior were scored by two reliable and blind (against the study hypotheses) coders. Intercoder reliability was evaluated by comparing the two coders' ratings using ICC-intraclass correlation coefficients [40]. The obtained overall average ICCs was 0.82. After each coder independent scoring, the results were compared and discussed in coders conference. The final scores were obtained by agreement of both coders.

2.2.2. Infant attachment assessment

Infant attachment observation was conducted using the Strange Situation [41], a 21-minute laboratory-based observational paradigm. This method involves a series of eight brief episodes, each lasting 3 min, or less if the infant dis-plays distress. The episodes gradually introduce mild stressors to the infant, including entering an unfamiliar playroom, interacting with an unfamiliar adult (the stranger), and experiencing two separations and subsequent reunions with the mother. Based on videotaped observations, trained coders, blind against the study hypotheses, scored the infants' attachment behavior during the Strange Situation using Ainsworth et al. [41] scales. Infants were categorized into three groups: securely attached (B), insecure-avoidant (A), and insecure-ambivalent (C). Intercoder reliability was established as satisfactory, with a Cohen's kappa coefficient of 0.79.

2.3. Analytic plan

According to the *first aim*, the distribution of attachment patterns for the three samples was obtained using SPSS crosstab. To test for differences in the prevalence of attachment across the three samples, Fisher exact test was used. Furthermore, ANOVA statistics were performed to test for differences among the demographic variables and attachment patterns according to each sample (FT, MLPT, and VEPT). To accomplish the *second aim*, also ANOVA statistics were performed to: i) evaluate the mean differences for infant and maternal interactive behavior according to each sample; ii) test for differences between infant and maternal interactive behavior according to attachment pattern. In one-way ANOVA, Tukey's post hoc tests were used to test differences according to attachment pattern (ABC) and according to sample (FT, MLPT, and VEPT). Size effect analyses were conducted to evaluate the magnitude of differences. For *third aim*, we used paired *t*-test analyses to evaluate potential differences in maternal and infant interactive behavior from 3 months to 9 months of infant's age. In the fourth aim, a multinominal logistic regression was used to test for possible covariates of attachment patterns.

All statistical analyses were carried out using SPSS for Windows, version 27. Alpha was set at 0.05. Prior to analyses, the assumptions of normality and homogeneity of variances were tested.

Table 1
Demographics for the FT, MLPT and VEPT sample.

	FT	MLPT	VEPT	*F*	*p*	*Tukey HSD*	η^2
	N = 105	*N* = 52	*N* = 56				
	M (SD)	*M (SD)*	*M (SD)*				
Maternal variables							
Maternal age (years)	31.58 (4.04)[a]	30.79 (5.75)	33.43 (5.89)[b]	4.08	0.018	a < b	0.89
Maternal years of education	14.66 (3.49)[a]	14.75 (3.98)	13.14 (3.74)[b]	3.61	0.029	a < b	0.83
Infant variables							
Number of siblings	1.50 (1.05)[a]	0.48 (0.87)	0.75 (0.90)[b]	21.35	0.001	a > b	0.04
Gestational age (w)	39.47 (1.89)[a]	33.84(1.70)[b]	29.45 (1.90)[c]	860.9	0.001	a > b > c	0.03
Gestational weight (g)	3303 (424)[a]	2108 (510)[b]	1155 (289)[c]	506.3	0.001	a > b > c	0.18
Apgar first minute	7.87 (0.61)[a]	8.30 (1.28)[b]	8.33 (2.26)[c]	56.05	0.001	a > b > c	0.35
Apgar fifth minute	9.33 (0.21)[a]	9.47 (0.79)[b]	9.44 (1.19)[c]	67.41	0.001	a > b > c	0.39

Note: Each superscript letter (a, b, & c) denotes a subset of Attachment at 12-months categories whose column proportions differ significantly from each other. FT means Infants born Full-Term; MLPT means Infants born Moderate-to-Late Preterm; VEPT means Infants born Very or Extreme Preterm.

3. Results

3.1. Distribution of attachment pattern according to prematurity status and demographic variables

Table 2 presents the distribution of attachment pattern according to prematurity status. A secure attachment is significantly more prevalent in infants born FT, and an insecure-ambivalent attachment pattern is significantly more prevalent in infants born VEPT. Avoidant attachment is sub-significantly more prevalent in the MLPT group than in the other groups.

We tested the association between demographic factors and attachment quality, using a range of birth, health and family/social factors namely: number of stay days in NICU, number of stay days in incubator, number of days in oxygen support, days of intravenous nutrition, cephalic perimeter, diseases, Apgar scores, medication, number of daycare attendance, infant sex, nationality, ethnicity, marital status, number of siblings, maternal age, maternal education, parental employment status, and others. Here, we include the factors that are significantly associated with attachment. Using ANOVA and post hoc Tukey analyses, we found that infants with a secure attachment with their mothers had higher gestational weight and age at birth than infants with an insecure-avoidant attachment pattern.

3.2. Differences in mothers and interactive behavior at 3 and 9 months according to infant attachment pattern

According to Tables 3, infants with a Secure attachment were more likely to exhibit cooperative behavior and their mothers to present sensitive interactive behavior in free play at 3 and 9 months. Also, these infants displayed less difficult and conflicted behavior than avoidant attached infants at 3 months, than avoidant and ambivalent attached infants at 9 months.

At 9 months, infants classified with an avoidant attachment were less cooperative, and their mothers were less sensitive than dyads with infants ambivalent attached. Infants with an avoidant attachment displayed more compulsive/compliant behavior, and their mothers exhibited more controlling and punitive behavior. Only at 9 months, maternal and infant passivity were associated with ambivalent attachment.

3.3. Differences in mothers' and infants' interactive behavior at 3 and 9 months according to prematurity status

Tables 4 show that maternal and infant interactive behavior varied according to prematurity status. At 3 months, maternal sensitivity was higher in dyads with infants born FT, followed by dyads with infants born MLPT. Last, dyads with infants born VEPT had lower scores than the other two groups. At 9 months, differences between FT and MLPT regarding maternal sensitivity were no longer statistically significant. Both at 3 and 9 months, infant cooperativity was higher in dyads with infants born FT than in the other two groups.

Infants born VEPT were more difficult and less passive than the other two groups at 3 and 9 months, and their mothers were more unresponsive. At 9 months, infants born MLPT were less passive than infants born VEPT, but not at 3 months. Only at 9 months, infants born MLPT displayed more compulsive/compliant behaviors than infants born FT.

Table 2
Frequency of attachment patterns at 12 months of corrected age according to prematurity status.

		Prematurity Status		
		FT	MLPT	VEPT
Attachment	Secure	61 (58.1 %, 3.4)[a]	19 (36.5 %, −1.7)[b]	19 (33.9 %, −2.2)[b]
	Avoidant	28 (26.7 %, −0.8)[a]	18 (34.6 %, 1.0)[a]	16 (28.6 %, −0.1)[a]
	Ambivalent	16 (15.2 %, −3.1)[a]	15 (28.8 %, 0.9)[b]	21 (37.5 %, 2.7)[a,b]

Note: The Fisher-Freeman-Halton test for infants is 14.721, $p < .005$, Cramer's V = 0.186; $p = .005$. Each superscript letter (a, b, & c) denotes a subset of Attachment at 12-months categories whose column proportions differ significantly from each other; $p < .05$ (column proportions test with Bonferroni adjustment). FT means Infants born Full-Term; MLPT means Infants born Moderate-to-Late Preterm; VEPT means Infants born Very or Extreme Preterm.

3.4. Differences in mothers and infants' interactive behavior from 3 to 9 months

Student's *t*-test for paired samples analyses, indicate a discontinuity of maternal sensitivity [$t(2) = 2.600$; $p = .01$] and infant difficulty [$t(2) = 2.782$; $p = .006$] from the age of 3 to 9 months, while infant compulsive behavior changed sub-significantly ($p = .07$) between those ages.

3.5. Determinants of attachment patterns

According to a logistic multinominal regression, only maternal sensitivity is selected as determinant of attachment security and infant ambivalence (results in Table 5).

4. Discussion

Our study expands the current knowledge by finding that attachment patterns prevalence varies according to each sample: FT, MLPT & VEPT. These differences are related to infant and maternal interactive behavior, and prematurity status.

Not only did prematurity impact attachment outcomes, but there were significant differences between moderate and very/extreme prematurity. Indeed, secure attachment was significantly more prevalent in infants born FT compared with other groups, and ambivalent attachment was significantly more prevalent in infants born VEPT than others. Although avoidant attachment pattern is more prevalent in infants born MLPT than in other infants, this result is not significant.

While previous literature suggests that poor caregiving and infants' behavioral problems are largely dependent on the degree of prematurity, gestational weight, and medical complications [4]. However, contradictory results have been reported for attachment incidence in PT samples. In some studies attachment security is higher in FT samples than in PT samples [19,35], while others found no differences (e.g., [34]). One possible explanation can rely on specific aspects of Portuguese culture. Somehow, the support provided to Portuguese families with infants born preterm may be less than necessary to prevent insecure attachments. It is possible that the support provided to these families is focused on health and other developmental domains rather than on parental relationships and attachment [42,43]. Notably, only a few studies included three independent samples with different prematurity statuses allowing us to ponder about the distinctive impact of late-to-moderate and very-to-extreme prematurity. Accordingly, we also found that higher gestational age and weight at birth were positively associated with attachment security. Our study provides critical information that adds to the current state of literature. Still, more research with different PT subsamples performed in different cultures is necessary to comprehend attachment quality and developmental outcomes in infants born preterm.

As found in prior studies with CARE-Index (e.g., [15–19,22,28–29]), maternal sensitivity and infant cooperative behavior were associated and predicted with secure attachment, whereas avoidant attachment was associated with maternal control and infant compulsive/compliant behavior. Both interactive partners seem to adapt their behavior to each other and to their social interactive context [36,50]. Faced with maternal sensitivity, infants easily adapt and respond with warm,

Table 3
Means, standard deviations, and MANOVA results for infant and maternal interactive behavior in free-play at 3 and 9 months according to infant attachment pattern.

	Insecure-Avoidant N = 52 *M (SD)*	Secure *N* = 99 *M (SD)*	Insecure-Ambivalent *N* = 62 *M (SD)*	*F*	*p*	*Tukey HSD*	η^2
3 months							
Maternal interactive behavior							
Sensitivity	7.12(2.20)[a]	9.13 (2.77)[b]	8.68 (2.75)[c]	10.12	0.001	a < b,c	0.088
Control/ Intrusivity	4.69 (3.22)[a]	3.45 (2.96)[b]	3.21 (2.93)[c]	3.96	0.02	a > b,c	0.036
Unresponsivity	2.98 (3.02)	1.39 (2.59)	2.63 (2.99)	2.27	0.11	–	0.021
Infant interactive behavior							
Cooperativity	6.58 (3.46)[a]	9.26 (2.95)[b]	8.63 (2.66)[c]	16.40	0.001	a < b,c	0.135
Compulsivity/ Compliance	3.13 (3.51)[a]	2.12 (3.13)	1.37 (2.74)[b]	4.61	0.01	a > b	0.042
Difficulty	2.87 (3.68)[a]	1.20 (2.20)[b]	2.29 (3.00)	6.50	0.002	b < a	0.058
Passivity	1.17 (1.96)	1.44 (2.11)	1.89 (2.27)	1.68	0.19	–	0.016
9 months Maternal interactive behavior							
Sensitivity	6.40(1.71)[a]	8.95 (2.57)[b]	8.00 (2.42)[c]	20.13	0.001	b > a,c &a < c	0.161
Control/ Intrusivity	4.96 (3.37)[a]	3.52 (2.87)[b]	3.24 (2.77)[c]	5.51	0.005	a > b,c	0.050
Unresponsivity	2.54 (3.25)	1.55 (2.02)[a]	2.71 (2.65)[b]	4.86	0.009	b > a	0.044
Infant interactive behavior							
Cooperativity	6.38 (1.46)[a]	9.16 (2.40)[b]	7.92 (2.63)[c]	24.54	0.001	b > a,c &a < c	0.191
Compulsivity/ Compliance	3.10 (3.62)[a]	1.57 (2.88)[b]	0.90 (2.02)[c]	8.62	0.001	a > b,c	0.076
Difficulty	3.60 (3.66)[a]	1.51 (2.08)[b]	3.23 (3.12)[c]	11.93	0.001	b < a,c	0.102
Passivity	1.06 (1.81)[a]	1.91 (2.06)	2.08 (2.29)[b]	3.62	0.029	b > a	0.033

Note: Each superscript letter (a, b, & c) denotes a subset of Attachment at 12-months categories whose column proportions differ significantly from each other.

Table 4
Means, standard deviations, and MANOVA results for infant and maternal interactive behavior in free-play at 3 and 9 months according to prematurity status.

	FT	MLPT	VEPT	*F*	*p*	*Tukey HSD*	η^2
	N = 105	N = 52	N = 56				
3 months	*M (SD)*	*M (SD)*	*M (SD)*				
Maternal interactive behavior							
Sensitivity	9.24(2.91)[a]	8.15 (2.50)[b]	7.46 (2.26)[c]	8.75	0.001	a > b > c	0.077
Control/ Intrusivity	3.70 (2.88)	3.81 (3.17)	3.54 (3.32)	0.110	0.896	–	0.001
Unresponsivity	1.10 (2.00)	1.88 (2.29)[a]	3.00 (3.28)b	10.87	0.009	b > a	0.094
Infant interactive behavior							
Cooperativity	9.33 (3.19)[a]	7.90 (2.58)[b]	7.20 (2.20)[c]	11.70	0.001	a > b, c	0.100
Compulsivity/ Compliance	1.72 (2.61)	2.85 (3.53)	2.30 (3.59)	2.34	0.099	–	0.022
Difficulty	1.05 (2.21)[a]	1.52 (2.26)[b]	3.95 (3.65)[c]	22.27	0.001	c > a,b	0.175
Passivity	1.86 (2.33)[a]	1.77 (2.10)[b]	0.61 (1.42)[c]	7.21	0.001	c < a,b	0.064
9 months Maternal interactive behavior							
Sensitivity	8.75(2.35)[a]	7.98 (2.63)[b]	6.80 (2.37)[c]	11.82	0.001	c < a,b	0.101
Control/Intrusivity	3.38 (2.54)	4.17 (2.96)	4.20 (3.32)	1.88	0.155	–	0.018
Unresponsivity	1.79 (2.00)[a]	1.90 (2.29)[b]	2.98 (3.82)[c]	4.30	0.015	c > b	0.039
Infant interactive behavior							
Cooperativity	8.87 (2.09)[a]	7.77 (2.30)[b]	7.05 (3.42)[c]	10.68	0.001	a > b, c	0.092
Compulsivity/ Compliance	1.11 (2.43)[a]	2.60 (3.48)[b]	2.14 (3.41)[c]	5.58	0.006	b > a	0.047
Difficulty	1.65 (2.18)[a]	2.42 (2.80)[b]	4.23 (3.70)[c]	15.58	0.001	c > a,b	0.210
Passivity	2.55 (2.27)[a]	1.52 (2.15)[b]	0.46 (1.32)[c]	19.79	0.001	c < b < a	0.243

Note: Each superscript letter (a, b, & c) denotes a subset of Attachment at 12-months categories whose column proportions differ significantly from each other. FT means Infants born Full-Term; MLPT means Infants born Moderate-to-Late Preterm; VEPT means Infants born Very or Extreme Preterm.

responsive, and attentive behavior. In turn, mothers also respond similarly, reinforcing infants' behavior. However, some behavioral adaptations suggest malfunctioning interactive experiences. In fact, faced with negative affect, intrusiveness, or demanding behavior from their caregivers, some infants tend to comply and reduce their solicitations, avoiding negative responses. These behavioral adaptations result from infants' interactive experiences and can become internalized if these experiences are prolonged and traumatic [44].

Nevertheless, these cycles are dynamic and open to change over infant development. In fact, at 9 months new associations between maternal and infant behavior and attachment patterns were found. For instance, maternal and infant unresponsivity were associated with ambivalent attachment at 9 months, but not at 3 months. It seems that the 9-month observation (compared with the one performed at 3 months) explained better attachment quality. These results support the perspective that "is clear that attachment is a process, not a static bond; it is an ongoing, dynamic interaction between infant and mother in which they cycle in and out of each other's company or attention repeatedly, many times a day, potentially for many years because infants, mothers, and the environments in which they interact are highly variable, there is a considerable range of individual differences in the patterns of attachment that are generated by these cycles of interaction."

Table 5
Summary of multinominal logistic regression results predicting infants' attachment at 12 months.

Infant attachment patterns		*B*	*SE*	*Wald*	*df*	*p*	Exp(B)	95 % CI for Exp(B)	
								Lower Bound	Upper Bound
Secure attachment	*Intercept*	−0.852	3.020	0.080	1	0.778			
	GA	−0.025	0.118	0.046	1	0.831	0.975	0.774	1.228
	GW	0.000	0.000	0.207	1	0.649	1.000	0.999	1.001
	Maternal sensitivity	0.243	0.082	8.751	1	0.003	1.275	1.085	1.497
	Infant difficultness	−0.134	0.061	4.866	1	0.027	0.875	0.776	0.985
Ambivalent attachment	*Intercept*	−4.071	3.366	1.463	1	0.228			
	GA	0.124	0.132	0.888	1	0.346	1.132	0.874	1.467
	GW	−0.001	0.001	2.301	1	0.129	0.999	0.998	1.000
	Maternal sensitivity	0.202	0.092	4.783	1	0.029	1.223	1.021	1.465
	Infant difficultness	−0.001	0.064	0.000	1	0.993	0.999	0.881	1.134

a. The reference category is: Avoidant Attachment.

(p.4, [45]). Supporting these results and perspective, we found, in paired analyses, that maternal sensitivity and infant difficult behavior were significantly different from the 3 to 9-month observation.

These findings support the thesis that mother-infant interactions are flexible, open to change, and result from each partner's adaptation. Thus, more studies are necessary to identify the factors involved in these changes. Of course, from 3 to 9 months of age, several critical motor, language, and cognitive developmental shifts occur but it also corresponds to a period wherein families, after 6 months, face new challenges. For in-stance, according to Portuguese law after 6 months of paid maternity license, employed mothers return to their jobs.

We found that prematurity status was associated with infant patterns of attachment, and with maternal and infant interactive behavior scores. Both at 3 and 9 months, infant cooperativity, was higher in dyads with infants born FT than in the other two groups. But as already discussed, maternal sensitivity shifted from 3 to 9 months. It seems that some of these changes vary according to infant prematurity status. In fact, maternal sensitivity at 3 months was higher in the FT sample, followed by the MLPT sample, and last, by the VEPT sample. However, the differences between FT and MLPT, at 9 months, were no longer significant.

Interestingly, the means of maternal sensitivity decreased from 3 to 9 months, however, the decrease for mothers of infants born MLPT was lower than the FT infants' mothers, leveling these two groups. But more changes occurred in the MLPT sample within these two timepoints. Infants born MLPT shifted from being more passive than infants born FT at 3 months, to display more compulsive/compliant behaviors than infants born FT at 9 months. Most premature births (over 80 %) occur between 32 and 36 gestational weeks [1]). Until recently, infants born MLPT were thought to be at low risk for negative developmental sequelae. Still, current studies found that they are at risk for behavioral problems (e.g., self-oriented regulation, externalization difficulties) (e.g., [17,19,46]).

The group more stable, across observations, was the VEPT. At 3 and 9 months, infants born VEPT were more difficult and less passive than the other infants, while their mothers were less responsive and sensitive. It seems that the dyads of this group struggle more than others to recover from dyadic maladaptive cycles of interaction. Infants born VEPT are at higher risk for death, morbidities, and short and long-term developmental impairments than other infants [31,32]. This information is often presented to families who describe the neonatal experience as frightful and traumatic [14,47]. The neonatal experience is generally prolonged (e.g., longer than 200 days in NICU) and often associated with medical complications. Postnatally, survivors of VEPT prematurity may have several early childhood or life-long medical difficulties, such as significant metabolic problems (e.g., respiratory, cardiac), sensory impairments, feeding difficulties, and cognitive or gross motor delays, and increased risk for emergency hospital readmission and extra medication [48]. Families must learn how to cope with their infants' long-term medical complications such as requiring supplemental oxygen or tube feedings. In result, many of these parents report high levels of stress [49], and economic problems that make it challenging to access proper medical care and developmentally supportive therapies [43]. This unique, uncertain, stressful and traumatic parental experience combined with infant health and painful conditions, may explain the lower levels of maternal sensitivity and infant higher scores in the difficult behavior scale in the VEPT sample. It also provides insight into the reason why it is so hard for these dyads to ameliorate the quality of their interactions in the first nine months of age. It is important to stress that mothers with mental problems and clinical depression were excluded from our study. However, it remains crucial to assess maternal stress and describe family needs, strengths, and resources in future studies. This approach will provide a contextual framework for the findings gathered during interactional observations.

Our findings emphasize the need for early intervention practices and family policies to empower and enable parents to actively engage in sensitive, rewarding, reciprocal, and affectional relationships with their infants from birth [50,51]. For maximum effectiveness, early intervention should start as early as pregnancy, preparing parents for their future caregiving roles and offering them social/economic support [50]. Postnatally, parents may require guidance to provide their infants with medical aid and development support toward compensating prematurity downsides. These preventive and early interventions are generally more effective than remediation practices [43,51]. However, insecure attachment is not a fixed bond, and at any point in time, family-based intervention can help dyads recover from negative interaction cycles.

4.1. Study limitations, strengths, and future directions

When assessing the findings of this research, it is crucial to consider both limitations and strengths. First, most were Portuguese-Caucasian in race/ethnicity and from working to middle class, urban backgrounds. Findings therefore may not generalize to mother-infant dyads in other geographical areas, ethnic/racial groups, or socioeconomic backgrounds. The second limitation concerns the different size of the samples and the low-size effects regarding interactive behaviors. Thus, the results must be read with caution. Although mothers with mental problems and clinical depression were excluded from the study, in future studies, is important to include maternal stress and depression measures (to detect subclinical values).

The strengths include a longitudinal study with direct observations of mother-infant interaction at 3 and 9 months and laboratorial observations of infant attachment at 12 months. Also, we include 3 independent samples with different prematurity status. We believe the current findings contribute to the growing knowledge about prematurity, infant attachment, and mother-infant interactions.

5. Conclusion

In conclusion, infant birth status affects attachment security. The incidence of insecurity is higher infants born VEPT compared to infants born MLPT or FT. This is concerning because the literature suggests that

attachment security is linked to improved developmental, social, academic, and health outcomes [52]. Attachment insecurity is largely dependent on the quality of mother-infant interactions. In this research, we found that infants born VEPT display more difficult and less cooperative behaviors, and their mothers are less sensitive in free play than other mothers.

Prematurity is a multifactorial risk, associated with health risks (e.g., gestational age, gestational weight, brain injury), relational problems resulting from long stay in NICU and parental stress [31,32]. Thus, multisystemic family-based center practices may be necessary to promote infant development and support parents.

Statement

All authors have read and agreed to the published version of the manuscript.

Informed consent statement

Written informed consent has been obtained from the participants or their parents (in the case of infants) to participate in this study and publish the results.

AI declaration

The authors declare that they made no use of AI tools to analyze and draw insights from data as part of the research process. The authors used these technologies only to improve readability and language.

Authors declaration

This paper is original and was not submitted elsewhere.

Funding

This study was funded by the Portuguese Foundation for Science and Technology (PTDC/MHC-PED/1424/2014), (UID/00050/2020) & (2022.07322.PTDC).

CRediT authorship contribution statement

Marina Fuertes: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Inês Martelo:** Writing – review & editing, Visualization, Validation, Investigation, Data curation. **Rita Almeida:** Writing – review & editing, Visualization, Validation, Investigation, Formal analysis. **Joana L. Gonçalves:** Writing – review & editing, Visualization, Validation, Software, Investigation. **Miguel Barbosa:** Writing – review & editing, Visualization, Validation, Resources, Investigation, Data curation.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgments

We are grateful to families for participating in the study and to health professionals who facilitated the data collection.

References

[1] A.M. Groh, G.I. Roisman, M.H. van Ijzendoorn, M.J. Bakersman-Kranenburg, R. Pasco Fearon, The significance of insecure and disorganized attachment for children's internalizing symptoms: a meta-analytic study, Child Dev. 8 (2012) 591–610, https://doi.org/10.1111/j.1467-8624.2011.01711.x.

[2] G. Kochanska, S. Kim, Early attachment organization with both parents and later behavior problems: from infancy to middle childhood, Child Dev. 84 (2013) 283–296, https://doi.org/10.1111/j.1467-8624.2012.01852.x.

[3] World Health Organisation (WHO), Available online. http://apps.who.int/classifications/apps/icd/icd10online/?go60.htm+o60.

[4] E.H. Chung, J. Chou, K.A. Brown, Neurodevelopmental outcomes of preterm infants: a recent literature review, Translational Pediatrics 9 (2020) S3–S8, https://doi.org/10.21037/tp.2019.09.104.

[5] E. Arpi, F. Ferrari, Preterm birth and behavior problems in infants and preschool-age children: a review of the recent literature, Developmental Medicine & Child Neurology 55 (2013) 788–796, https://doi.org/10.1111/dmcn.12142.

[6] E. Boyle, E. Draper, T. Evans, D. Field, B. Manktelow, N. Marlow, S. Seaton, L. K. Smith, S. Johnson, Infant neurodevelopmental outcomes following late and moderately preterm birth, Arch. Dis. Child. Fetal Neonatal Ed. (2014) 99, https://doi.org/10.1136/archdischild-2014-306576.7.

[7] N.M. Talge, C. Holzman, J. Wang, V. Lucia, J. Gardiner, N. Breslau, Late-preterm birth and its association with cognitive and socioemotional outcomes at 6 years of age, Pediatrics 26 (2010) 1124–1131, https://doi.org/10.1542/peds.2010-1536.

[8] D.L. Putnick, M.H. Bornstein, S. Eryigit-Madzwamuse, D. Wolke, Long-term stability of language performance in very preterm, moderate-late preterm, and term children, J. Pediatr. 181 (2017) 74–79, https://doi.org/10.1016/j.jpeds.2016.09.006.

[9] M.A. Quigley, G. Poulsen, E. Boyle, D. Wolke, D. Field, Z. Alfirevic, J.J. Kurinczuk, Early term and late preterm birth are associated with poorer school performance at age 5 years: a cohort study, Arch. Dis. Child. Fetal Neonatal Ed. 97 (2012) F167–F173, https://doi.org/10.1136/archdischild-2011-300888.

[10] M. Fuertes, M. Beeghly, P. Lopes-dos-Santos, E. Tronick, Both infant and dyadic factors contributes to infants´ coping styles during still-face in sample of prematurely born Portuguese infants, Análise, Psicológica 4 (XXIX) (2011) 553–556, https://doi.org/10.14417/ap.103.

[11] P.-Y. Ancel, M.-J. Saurel-Cubizolles, G. Carlo Di Renzo, E. Papiernik, G. Breart, Very and moderate preterm births: are the risk factors different? BJOG 106 (1999) 1162–1170, https://doi.org/10.1111/j.1471-0528.1999.tb08142.x.

[12] M. Dibble, J.Z. Ang, L. Mariga, E.J. Molloy, A.L.W. Bokde, Diffusion tensor imaging in very preterm, moderate-late preterm and term-born neonates: a systematic review, J. Pediatr. 232 (2021) 48–58.e3, https://doi.org/10.1016/j.jpeds.2021.01.008.

[13] M. Barbosa, M. Beeghly, J. Moreira, E.Z. Tronick, M. Fuertes, Emerging patterns of infant regulatory behavior in the still-face paradigm at 3 and 9 months predict mother-infant attachment at 12 months, Attach. Hum. Dev. 23 (2021) 814–830, https://doi.org/10.1080/14616734.2020.1757730.

[14] M. Fuertes, C. Ribeiro, J.L. Gonçalves, C. Rodrigues, M. Beeghly, P. Lopes-dos-Santos, D.A. Lamônica, Maternal perinatal representations and their associations with mother–infant interaction and attachment: a longitudinal comparison of Portuguese and Brazilian dyads, Int. J. Psychol. 55 (2) (2020) 224–233, https://doi.org/10.1002/ijop.12577.

[15] M. Fuertes, P. Lopes-dos-Santos, M. Beeghly, E.Z. Tronick, Infant coping and maternal interactive behavior predict attachment in a Portuguese sample of healthy preterm infants, Eur. Psychol. 14 (2009) 320–331, https://doi.org/10.1027/1016-9040.14.4.320.

[16] M. Fuertes, A. Faria, H. Soares, P. Crittenden, Mother-child patterns of interaction: the impact of premature birth and social economical background, Actha Ethologica 12 (2009) 1–11. http://hdl.handle.net/10400.21/1666.

[17] M. Fuertes, L. Gonçalves, J., Barbosa, M., Almeida, R., Lopes-Dos-Santos, P., & Beeghly, M., A self-comfort oriented pattern of regulatory behavior and avoidant attachment are more likely among infants born moderate-to-late preterm, Infancy 27 (2022) 159–180, https://doi.org/10.1111/infa.12437.

[18] M. Fuertes, A. Faria, J.L. Gonçalves, S. Antunes, F. Dionisio, The association between prematurity, antibiotic consumption, and mother-infant attachment in the first year of life, Antibiotics (2023) 12, https://doi.org/10.3390/antibiotics12020309.

[19] M. Fuertes, A.R. Almeida, S. Antunes, M. Beeghly, Cross-modal coherence and incoherence of early infant interactive behavior: links to attachment in infants born very preterm or full-term, Attachment and Human Development 25 (2023) 390–416, https://doi.org/10.1080/14616734.2023.2210122.

[20] D. Holditch-Davis, T. Schwartz, B. Black, M. Scher, Correlates of mother-premature infant interactions, Research 30 (2007) 333–346, https://doi.org/10.1002/nur.20190 (PMID:17514707).

[21] R. Korja, S. Ahqvist-Björkroth, E. Savonlahti, S. Stolt, L. Haataja, H. Lapinleimu, J. Piha, L. Lehtonen, Relations between maternal attachment representations and the quality of mother-infant interaction in preterm and full-term infants, Infant Behav. Dev. 33 (2010) 330–336, https://doi.org/10.1016/j.infbeh.2010.03.010.

[22] M. Forcada-Guex, A. Borghini, B. Pierrehumbert, F. Ansermet, C. Muller-Nix, Prematurity, maternal posttraumatic stress and consequences on the mother-infant relationship, Early Hum. Dev. 87 (2011) 21–26, https://doi.org/10.1016/j.earlhumdev.2010.09.006.

[23] J. Poehlmann, C. Burnson, L.A. Weymouth, Early parenting, represented family relationships, and externalizing behavior problems in children born preterm, Attach. Hum. Dev. 16 (2014) 271–291, https://doi.org/10.1080/14616734.2014.884610.

[24] L.T. Singer, S. Fulton, H.L. Kkirchner, S. Eisengart, b. Lewis, E. Short, M.O. Min, S. Satayathum, C. Kercsmar, J.E. Baley, Longitudinal predictors of maternal stress and coping after very low-birth-weight birth, Arch. Pediatr. Adolesc. Med. 164 (2010) 518–524, https://doi.org/10.1001/archpediatrics.2010.81.

[25] H. Hsu, S. Jeng, Two-month-olds' attention and affective response to maternal still face: a comparison between term and preterm infants in Taiwan, Infant Behav. Dev. 31 (2008) 194–206, https://doi.org/10.1016/j.infbeh.2007.10.008.
[26] A. Staneva, F. Bogossian, M. Pritchard, A. Wittkowski, The effects of maternal depression, anxiety, and perceived stress during pregnancy on preterm birth: a systematic review, Women Birth 28 (3) (2015) 179–193, https://doi.org/10.1016/j.wombi.2015.02.003.
[27] A. Bilgin, D. Wolke, Maternal sensitivity in parenting preterm children: a meta-analysis, Pediatrics 136 (2015) e177–e193, https://doi.org/10.1542/peds.2014-3570.
[28] C. Muller-Nix, M. Forcada-Guex, B. Pierrehumbert, L. Jaunin, A. Borghini, F. Ansermet, Prematurity, maternal stress, and mother-child interactions, Early Hum. Dev. 79 (2004) 145–158, https://doi.org/10.1016/j.earlhumdev.2004.05.002.
[29] M. Fuertes, S. Antunes, I. Martelo, F. Dionisio, The impact of low birthweight in infant patterns of regulatory behavior, mother-infant quality of interaction, and attachment, Early Hum. Dev. (2022) 172, https://doi.org/10.1016/j.earlhumdev.2022.105633.
[30] J. Cassidy, P.R. Shaver, Handbook of Attachment: Theory, Research, and Clinical Applications, 2nd ed., The Guilford Press, New York, United States of America, 2008.
[31] M.C. McCormick, J.S. Litt, V.C. Smith, J.A.F. Zupancic, Prematurity: an overview and public health implications, Annu. Rev. Public Health 32 (2011) 367–379, https://doi.org/10.1146/annurev-publhealth-090810-182459.
[32] H. Blencowe, S. Cousens, D. Chou, M. Oestergaard, L. Say, A.B. Moller, M. Kinney, J. Lawn, the Born Too Soon Preterm Action Group, Born too soon: the global epidemiology of 15 million preterm births, Reprod. Health (2013) 10, https://doi.org/10.1186/1742-4755-10-S1-S2.
[33] S. Mangelsdorf, Plunkett, C. Dedrick, M. Berlin, S.J. Meisels, J.L. McHale, M. Dichtellmiller, Attachment security in very low birth weight infants, Dev. Psychol. 32 (1996) 914–920, https://doi.org/10.1037/0012-1649.32.5.914.
[34] S. Johnson, N. Marlow, Preterm birth and childhood psychiatric disorders, Pediatr. Res. 69 (2011) 11–18, https://doi.org/10.1203/PDR.0b013e318212faa0.
[35] D. Wolke, S. Eryigit-Madzwamuse, T. Gutbrod, Very preterm/very low birthweight infants' attachment: infant and maternal characteristics, Archives of Disease in Childhood – Fetal and Neonatal Edition 99 (2014) F70–F75, https://doi.org/10.1136/archdischild-2013-303788.
[36] A.J. Sameroff, B.H. Fiese, Models of development and developmental risk, in: C. H. Zeanah Jr. (Ed.), Handbook of Infant Mental Health, The Guilford Press, New York, United States of America, 2000, pp. 3–19.
[37] A. Sameroff, A unified theory of development: a dialectic integration of nature and nurture, Child Dev. 81 (2010) 6–22, https://doi.org/10.1111/j.1467-8624.2009.01378.x.
[38] Tronick, E., Barbosa, M., Fuertes, M., & Beeghly, M. Social interaction. In Encyclopedia of Infant and Early Childhood Development, 2nd edition; Benson, J. B., Ed.; Elsevier: Amsterdam, Netherlands, 2020; Volume 3, pp. 207–220.
[39] P.M. Crittenden, CARE-Index Manual, Miami, United States of America, Family Relations Institute, 2003.
[40] D.V. Cicchetti, Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology, Psychol. Assess. 6 (1994) 284–290, https://doi.org/10.1037/1040-3590.6.4.284.
[41] M.D.S. Ainsworth, M.C. Blehar, E. Waters, S. Wall, Patterns of Attachment: A Psychological Study of the Strange Situation, Lawrence Erlbaum, Hillsdale, United States of America, 1978.
[42] A. Lavallée, M. Aita, A. Bourbonnais, G. De Clifford-Faugère, Effectiveness of early interventions for parental sensitivity following preterm birth: a systematic review protocol, Syst. Rev. (2017) 6, https://doi.org/10.1186/s13643-017-0459-x.
[43] F. Dionisio, F. Baquero, M. Fuertes, Psychological and cultural factors influencing antibiotic prescription, Trends Microbiol. 31 (6) (2023) 559–570, https://doi.org/10.1016/j.tim.2022.12.010.
[44] P.M. Crittenden, Danger and development: the organization of self-protective strategies, Monogr. Soc. Res. Child Dev. 64 (1999) 145–171. http://www.jstor.org/stable/3181562.
[45] J.S. Chisholm, The evolutionary ecology of attachment organization, Hum. Nat. 7 (1996) 1–37, https://doi.org/10.1007/bf02733488.
[46] P.E. Shah, N. Robbins, R.B. Coelho, J. Poehlmann, The paradox of prematurity: the behavioral vulnerability of late preterm infants and the cognitive susceptibility of very preterm infants at 36 months post-term, Infant Behav. Dev. 36 (2013) 50–62, https://doi.org/10.1016/j.infbeh.2012.11.003.
[47] J.L. Gonçalves, M. Fuertes, M.J. Alves, S. Antunes, A.R. Almeida, R. Casimiro, M. Santos, Maternal pre and perinatal experiences with their full-term, preterm and very preterm newborns, BMC Pregnancy Childbirth (2020) 20, https://doi.org/10.1186/s12884-020-02934-8.
[48] M. Fuertes, J.L. Gonçalves, A. Faria, P. Lopes-dos-Santos, I.C. Conceição, F. Dionisio, Maternal sensitivity and mother-infant attachment are associated with antibiotic uptake in infancy, J. Health Psychol. 27 (2022) 2197–2210, https://doi.org/10.1177/1359105320941245.
[49] E.D. Gerstein, J. Poehlmann-Tyson, Transactional processes in children born preterm: influences of mother-child interactions and parenting stress, J. Fam. Psychol. 29 (2016) 777–787, https://doi.org/10.1037/fam0000119.
[50] P. McHale, G. Maudsley, A. Pennington, D.K. Schlüter, B. Barr, S. Paranjothy, D. Taylor-Robinson, Mediators of socioeconomic inequalities in preterm birth: a systematic review, BMC Public Health 22 (1) (2022) 1134, https://doi.org/10.1186/s12889-022-13438-9.
[51] J. Barlow, M. Sleed, N. Midgley, Enhancing parental reflective functioning through early dyadic interventions: a systematic review and meta-analysis, Infant Ment. Health J. 42 (2021) 21–34, https://doi.org/10.1002/imhj.21896.
[52] S. Madigan, R.M.P. Fearon, M.H. van IJzendoorn, R. Duschinsky, C. Schuengel, M. J. Bakermans-Kranenburg, A. Ly, J.E. Cooke, A.-A. Deneault, M. Oosterman, M. L. Verhage, The first 20,000 strange situation procedures: a meta-analytic review, Psychol. Bull. 149 (2023) 99–132, https://doi.org/10.1037/bul0000388.