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Predicting attachment in Portuguese infants born very or extremely preterm: Understanding the roles of infant regulatory behavior, maternal sensitivity, and risk factors

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Abstract

A growing body of research shows that early attachment relationships are foundational for children's later developmental and psychosocial outcomes. However, findings are mixed regarding whether preterm birth predicts later attachment, but insecurity is generally more prevalent among infants at higher medical and/or social/familial risk. This longitudinal study aimed to identify specific relational, familial/demographic, and perinatal predictors of attachment in a sample of 63 Portuguese infants born very or extremely preterm (VEPT, <32 gestational weeks) and their mothers from diverse socioeconomic backgrounds. One-third of the mothers had social/family risk factors (e.g., single parent, immigrant, unemployed, low education, and/or low income). At 3 months (corrected age), dyads were observed during social interaction in the Face-to-Face Still-Face paradigm (FFSF) and during free play. At 12 months, mother-infant dyads were observed in Ainsworth's Strange Situation. Over half (58.7%) of the infants were classified as insecurely attached. Social-Positive Oriented regulatory behavior pattern, higher maternal sensitivity, higher infant cooperation during free play, number of siblings and an absence of social/family risk factors were associated with attachment security. Perinatal variables were unrelated to attachment. Findings indicate that both relational and social contextual factors contribute to attachment in this biologically vulnerable sample.

KEYWORDS

family/social risk, mother-infant attachment, patterns of regulatory behavior, perinatal risk, very/extreme prematurity

1 | INTRODUCTION

Despite major advances in neonatal care and medicine, preterm birth (delivery before 37 gestational weeks: GW) continues to be a significant public health problem and a leading cause of death for children under the age of five (Perin et al., 2022). According to the World Health Organization (WHO, 2015), the global prevalence of preterm birth is approximately 15%, ranging from 5% in Europe to 18% in Africa. In Portugal, about 8% of all live births are preterm, and about 1.2% of infants are born very preterm (VPT, below 32 GW) or extremely preterm (EPT, below 28 GW (Silva et al., 2018).

Although survival rates have improved for infants born VPT or EPT (VEPT), premature delivery continues to be a leading cause of infant morbidity, and the risk for

suboptimal neurodevelopmental and behavioral outcomes increases with decreasing gestational age (i.e., Blencowe et al., 2013). Furthermore, most infants born VEPT have lower birthweight (<1500 g) and more physiological immaturities (Madenn, 2000; McCormick et al., 2011) than infants born full-term (FT), which further contribute to developmental problems. Indeed, infants born VEPT are not physiologically prepared to sustain extra-uterine life, requiring respiratory and nutritional support as well as interventions to maintain metabolic stability post-delivery (Watson, 2011). Other essential functions such as thermoregulation, fluid balance, and hematological stability must also be supported. Despite improved survival rates, these infants are also at risk for co-morbid health conditions such as chronic lung disease (e.g., bronchopulmonary dysplasia), intraventricular hemorrhage, brain injury, necrotizing enterocolitis, sepsis, and retinopathy as well as neurodevelopmental and behavioral problems (revision in McCormick et al., 2011).

To promote survival and reduce morbidity, infants born VEPT are often placed in an incubator in the neonatal intensive care unit (NICU) following delivery, where they are subjected to many life-saving but intrusive and painful interventions, with little physical contact with their parents. Unfortunately, these infants are often hypersensitive and have difficulty tolerating handling associated with NICU treatments (Ionio et al., 2017). These early challenges likely contribute to increased distress and dysregulation and may alter the way these infants learn to regulate their attention and emotions and how they interact with their attachment figures and adjust to life outside the NICU (Brisch et al., 2005; Delonis et al., 2017). These challenges also heighten risk for suboptimal outcomes in later life, such as neurodevelopmental delays and mental health problems (e.g., internalizing behavior) (Groh et al., 2012; Johnson & Marlow, 2011; Moster et al., 2008). When infants born VEPT are raised by families struggling with social risk factors (e.g., single parenthood, poverty), the risk for nonoptimal outcomes is heightened even further (Candelaria et al., 2011). Recent meta-analytic studies also report an increased risk for autism in this population (Laverty et al., 2021).

KEY FINDINGS

1. In this sample with infants born very or extremely preterm (VEPT), we found a high prevalence of insecure attachment, and lower mean values of maternal sensitivity in the current Portuguese multi-risk sample, compared with other Portuguese lower-risk samples, indicating the need for early intervention services for these families.
2. The main predictor of attachment security was maternal sensitivity during free play at 3 months, supporting the hypothesis that neurodevelopment and early life experiences may contribute to the way that infants born VEPT regulate their emotions and behavior during mother-infant interactions, which over time, may contribute to attachment organization.
3. Although many of the infants in the current study were at biological and/or social risk, individually, none of these risk factors was solely or uniquely linked with attachment at 12 months (e.g., birthweight, gestational age, number of days hospitalized, maternal education, marital status), but when social/family risk status was defined as having 2 or more risks, there was a significant association between Social/Family Risk status and attachment quality.

1.1 | Attachment in infants born very or extremely preterm

There is substantial evidence that early attachment relationships promote a broad array of children's developmental and socioemotional outcomes (Cassidy & Shaver, 2008; Sroufe, 2005). Conversely, insecure or disorganized attachment relationships are linked to poor emotion regulation and mental health problems (Groh et al., 2012; Kochanska & Kim, 2013). However, empirical support for the association between preterm birth and insecure attachment is relatively sparse, and specific findings vary across studies. Most prior studies have evaluated attachment in samples from low social risk backgrounds, such as families with middle-class socioeconomic status (SES). Findings from these studies indicate that secure attachment is prevalent among infants born PT (e.g., Butcher et al., 1993; Easterbrooks, 1989; Frodi & Thompson, 1985; Korja et al., 2012; Rode et al., 1981). These results are consistent with those reported for infants born FT from low social-risk backgrounds (Ainsworth et al., 1978; Bilgin & Wolke, 2015; Sroufe, 2005).

Although understudied, similar findings are reported for the prevalence of secure attachment among infants born VEPT from low social risk backgrounds. In one study, infants born VEPT had only a slightly higher incidence of attachment insecurity than infants born FT (Wolke et al., 2014). However, among the infants with an insecure attachment, infants born VEPT were more likely to be

classified as having a disorganized attachment than their FT counterparts (Wolke et al., 2014).

Very few studies have evaluated the attachment distribution in infants born VEPT from low social risk backgrounds. This is unfortunate because the risk of VEPT birth is elevated in under-resourced communities (Smith et al., 2007). In an early study of families from low SES backgrounds (Wille, 1991), a higher percentage of infants born PT (56%) were classified as having insecure attachment than infants born FT (17%). Other research found that sociodemographic and maternal psychosocial risks were stronger predictors of attachment insecurity than infant medical risk factors (Candelaria et al., 2011).

In sum, although some research indicates that VEPT birth is associated with insecure attachment, such studies are sparse and specific findings vary. The inconsistent results likely reflect, at least in part, differences in sample characteristics and methods utilized across studies. Further studies are needed to clarify the relational, demographic, and health antecedents of attachment organization in these biologically vulnerable infants. This research is important because early attachment insecurity is a robust predictor of maladaptive outcomes.

1.2 | Antecedents of attachment among infants born very or extremely preterm

Meta-analytic reviews indicate that parental sensitivity is a robust predictor of attachment security, but the magnitude of this association across studies is small, suggesting that other factors likely also play an important role (de Wolff & van IJzendoorn, 1997; Madigan et al., 2023; ; van IJzendoorn & Sagi, 2008). Results from microanalytic studies show that parent-infant interactions are shaped by both infants' and mothers' contributions and thus are mutually regulated. According to Tronick's Mutual Regulation Model (Tronick & Beeghly, 2011; Tronick et al., 2020), early parent-infant interactions reflect dyadic regulatory or co-regulatory processes that are gradually established between parents and their infants over time. Thus, the extent to which parents and infants co-regulate their behavior and dyadic interactions effectively results from infants' biological and behavioral capacities (e.g., cooperation and responsivity to the parent, and early regulatory patterns) as well as parents' capacity to respond in a sensitive, responsive manner to infants' communicative signals.

Notably, early parent-infant social interactions are not perfectly synchronous but rather are characterized by dynamic, changing periods dyadic coordination (matching) and miscoordination (mismatching). When periods of dyadic miscoordination occur, infants often exhibit distress, dysregulation, or disengagement, and parent-infant dyads must work together to repair and restore the interaction to a positive, mutually engaged state. Due to infants' immaturity, this is often a challenging task (Tronick & Beeghly, 2011).

For infants born PT and their caregivers, the process of establishing and restoring mutual regulation may be even more effortful. Compared to parent-infant interactions with infants born FT, parent-infant interactions with infants born PT tend to be less positive, reciprocal, and attuned (Fuertes et al., 2009; 2022; Holditch-Davis et al., 2007; Korja et al., 2010). For instance, during parent-infant interactions, infants born PT are less attentive, positive, reciprocal, and responsive to their mothers' signals (Forcada-Guex et al., 2011; Fuertes et al., 2009; 2022; Holditch-Davis et al., 2007; Poehlmann et al., 2014; Singer et al., 2010). In turn, mothers of infants born PT tend to be less sensitive and less emotionally involved than mothers of infants born FT (Fuertes et al., 2022; Hsu & Jeng, 2008; Muller-Nix et al., 2004). Analyses using dyad-level measures of parent-infant interaction quality in VEPT samples show similar associations (Delonis et al., 2017). Nevertheless, a recent meta-analysis (Bilgin & Wolke, 2015), which specifically incorporated studies with different control groups, found that parental behavior observed in interactions with children born PT was not less sensitive, facilitative, or responsive when compared to mothers of children born FT. Moreover, the results remained consistent even after considering various moderators such as degree of prematurity, geographical location, infant age, or time of neonatal care. According to our best knowledge, four European comparative studies with FT and PT samples (Forcada-Guex et al., 2011; Muller-Nix et al., 2004, Miljkovitch et al., 2013) used the Care-Index (Crittenden, 2003) as a measure for maternal sensitivity. The Care-Index emphasizes the *dyadic* nature of maternal sensitivity, defining it as any behavior pattern that pleases the infant, enhances their comfort and attentiveness, and reduces her/his distress and disengagement. The results of those European studies indicate that maternal sensitivity and infant cooperative behavior are higher in FT samples than in PT samples. Other studies report that maternal sensitivity, assessed using the CARE-Index, predicts secure attachment in infants born moderate-to-late preterm (MLPT; Fuertes et al., 2009; 2022; 2023a, b).

Fuertes et al. (2009) compared maternal sensitivity assessed using the CARE-Index in four groups varying in preterm status and SES: infants born full-term and their mothers from middle class households, infants born full-term and their mothers from low-income households, infants born preterm and their mothers from middle-class households, and infants born preterm and their mothers from low-income households. Results indicated that

mothers of FT had higher scores for maternal sensitivity on the CARE-Index than mothers in the other groups, but lower scores for maternal sensitivity when mothers were from low-income samples. These findings suggest that parent-infant interactions do not occur in isolation but rather are embedded within broader ecological systems, which transact with parent-infant interactive processes in dynamic ways. Thus, variations in familial-social risk factors and infants' perinatal characteristics also likely play a role in early interactive processes (Beeghly & Tronick, 2011; Bigelow & Power, 2014; Candelaria et al., 2011).

Another important predictor of attachment is infants' ability to regulate their attention and emotions under experimental conditions that elicit stress (Fuertes et al., 2006; 2009; Provenzi et al., 2016; Seixas et al., 2017), such as when they are confronted with parental emotional unavailability during the Face-to-Face Still-Face paradigm (FFSF; Tronick et al., 1978). Compared to their FT counterparts, the socio-emotional regulatory patterns of infants born PT during the FFSF are characterized by a lower prevalence of positive engagement with the parent, greater periods of infant distress and disengagement, and more frequent self-comforting behaviors (Fuertes et al., 2009, 2022; Provenzi et al., 2016). In one study (Hsu & Jeng, 2008), infants born PT between 31 and 34 gestational weeks were more easily distressed in response to maternal unavailability during the still-face episode of the FFSF at 2 months, compared to their FT counterparts. Following exposure to the maternal still-face, infants born PT also had greater difficulty recovering from interactive stress and engaged in more self-soothing behaviors or are more behaviorally withdrawn and emotionally restrained at 9 months (Feldman et al., 2010; Montirosso et al., 2010).

In several longitudinal studies with FT samples, three stable and reliable patterns of infant regulatory behavior with the mother during the FFSF were identified at 3 months that predicted mother-infant attachment at 12 months (e.g., Barbosa et al., 2018, 2019). The most prevalent was a Social-Positive Oriented regulatory pattern, in which infants exhibited predominantly positive social engagement with the parent and fully recovered once mothers resume their normal interactive behavior in the reunion episode of the FFSF. This pattern was associated with secure attachment. The second most prevalent pattern was a Distressed-Inconsolable regulatory pattern, in which infants displayed conspicuous negative affect that persisted or increased across the FFSF episodes. This regulatory pattern was associated with insecure-ambivalent attachment. The least prevalent pattern was a Self-Comfort Oriented regulatory pattern, in which infants primarily engaged in self-comforting behaviors and appeared uncomfortable or withdrawn during all episodes of the FFSF. This pattern predicted insecure-avoidant attachment.

These three patterns have also been identified in a longitudinal sample of infants born low-to-moderate preterm (MLPT, 32–36 weeks of gestation) and infants born FT (Fuertes et al., 2022). As was the case for infants born FT, the most prevalent regulatory pattern for infants born MLPT was the Social-Positive Oriented pattern. However, in contrast to findings for infants born FT, the next most prevalent pattern was the Self-Comfort Oriented pattern followed by the Distressed-Inconsolable pattern. Notably, the percentage of infants displaying the Distressed-Inconsolable pattern was higher among infants born FT than infants born MLPT, and infants born MLPT showed the Self-Comfort Oriented pattern more frequently than infants born FT. These differences were significant. Therefore, we speculate that the early challenges faced by infants born PT (e.g., intrusive and painful neonatal care and extended hospital stays) may partially explain why these infants are more likely to exhibit a Self-Comfort Oriented regulatory behavior pattern than infants born FT. However, less is known about these regulatory patterns among infants born VEPT at 3 months (corrected age) and whether they predict attachment patterns at 12 months.

1.2.1 | Study aims

To address these gaps in the literature, three primary aims were evaluated:

- **Aim 1**: The first aim was to investigate the prevalence of mother-infant attachment patterns observed during the Strange Situation at 12 months in infants born VEPT with low birthweight.
- **Aim 2**: The second aim was to evaluate early relational, familial-demographic, and perinatal variables that predict attachment patterns in this population. To accomplish this second aim, several sets of bivariate analyses were carried out.

First, we evaluated the prevalence of the three infant regulatory behavior patterns observed during the FFSF at 3 months (corrected age) in the present sample.

Second, we tested whether these three infant regulatory patterns were associated with infants' later attachment patterns in the Strange Situation at 12 months (corrected age).

Third, we evaluated whether ratings of maternal and infant interactive behavior observed during free play interactions at 3 months were associated with attachment patterns.

Fourth, we assessed whether demographics or social/familial risk status such as low maternal education, low-income status, and single parenthood were associated with attachment patterns.

Fifth, we evaluated whether infant perinatal risk variables such as gestational weeks at delivery, birthweight, and days hospitalized in the newborn period were associated with attachment patterns.

Sixth, we tested the inter-correlations between early infant-maternal interactive behavior during free play and the association between demographic factors, perinatal variables, infant-maternal interactive behavior and infant regulatory patterns.

Based on findings from prior research on parent-infant interactions and attachment in other populations, we expected that secure attachment in this VEPT sample would be predicted by a higher prevalence of a Social-Positive Oriented regulatory behavior in the FFSF and a greater level of maternal sensitivity and infant cooperation during free play at 3 months.

Further, we hypothesized that lower social/familial or perinatal risk would be associated with attachment security at 12 months, and that greater social/familial or perinatal risk would be associated with a higher prevalence of attachment insecurity. We also expected that higher social/familial and perinatal risk would be associated with mother-infant interactive behavior during play at 3 months.

Aim 3: The third aim was to conduct a covariate-controlled binary logistic regression to identify specific predictors of attachment security using the set of infant and maternal interactive behavior, demographics, and perinatal variables evaluated in Aim 2. All continuous variables that were significantly associated with secure attachment in the Aim 2 analyses were considered as possible factors for inclusion in the binary logistic regression.

2 | METHODS

2.1 | Sample characteristics and recruitment

Participants included 63 infants (41.3% female, 58.7 % male) born VEPT, of whom 57 (90.5%) were born VPT, and 6 (9.5%) were born EPT, and their mothers living in the greater Lisbon/Porto metro area in Portugal. Dyads were recruited in the newborn period during 2017 to 2019 and followed longitudinally from birth to 12 months postpartum (corrected age).

To be eligible to participate in this study, infants had to meet the following inclusion criteria: (i) delivery at less than 32 weeks gestational age; (ii) no evidence of sensory or neuromotor impairments; (iii) absence of severe health conditions (e.g., chronic lung disease) or congenital anomalies, at the time of recruitment. Mothers had to be free of any record of severe mental health problems or drug/alcohol dependence, as determined by medical record review and maternal self-report.

All information regarding the perinatal characteristics of infants was collected from hospital records. Mothers provided demographic information at the time of their recruitment and at each subsequent visit. Descriptive statistics for infant perinatal variables and maternal/familial demographics in this sample are provided in Table 1.

As seen in Table 1, the infants born VEPT in this sample ranged in gestational age at delivery, birth weight, and the number of days they were hospitalized before being released home. Mothers ranged in socioeconomic status from low to middle-class, and 11 (17.46%) were receiving social income or state aid. Most mothers (85.7%) were Portuguese-born and nine (14.3%) were immigrants from other countries. Of these nine, seven were waiting for a residence visa. At the time of the infant's birth, 51 mothers lived with their infant's biological father, and 42 were employed full-time, seven worked part-time, and 14 were unemployed.

Recruitment took place in the NICUs from hospitals in the greater Lisbon metro area 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 and fathers (except for single mothers) provided written informed consent to their and their infant's participation before any assessment or data collection took place.

2.2 | Procedures and measures

At 3 and 12 months postpartum (corrected age), mothers were contacted to schedule a follow-up visit to the laboratory. At the 3-month visit, dyads were videotaped during a 5-minute free play interaction with a standard set of age-appropriate toys and then during an en-face interaction during the FFSF. At the 12-month visit, infant attachment behavior with the mother was observed during

TABLE 1 Descriptive statistics for infant perinatal variables and maternal/familial demographics.

	M.	*SD*	*Min.*	*Max.*
Infant perinatal variables				
Gestational age (weeks)	29.72	2.13	24	32
Birthweight (g)	1181.02	302.22	500	1580
Apgar at first minute	7.03	2.13	1	9
Apgar at fifth minute	8.73	.87	6	10
Number of days hospitalized	55.9	41.1	7	180
Number of days parenteral nutrition	17.36	9.73	2	52
Maternal/Familial Variables				
Number of siblings	.79	.88	0	4
Maternal age (years)	33.11	5.53	18	46
Maternal years of education	13.48	.91	3	23

Ainsworth's Strange Situation. All 63 dyads took part in both the 3-month and the 12-month lab visits.

2.2.1 | Infant regulatory behavior

Face-to-Face Still-Face paradigm (FFSF, Tronick et al., 1978). The FFSF is a videotaped experimental paradigm that includes three successive two-minute episodes: (a) a mother-infant face-to-face play interaction; (b) a maternal still-face perturbation, during which mothers were instructed to become unresponsive to their infant and to refrain from smiling, talking, or touching the infant; and (c) a reunion episode, during which mothers were instructed to resume their regular play interaction with the infant. During the FFSF, mothers were asked to avoid using pacifiers or other objects. The beginning and end of each episode were marked by a 5-second interval during which the mother was asked to turn away from their infant. Mothers and infants were videotaped in the FFSF using two cameras, one focused on the mother's face and upper torso, and the other focused on the infant's face and body. Both cameras were connected to an image mixer that generated a time-synchronized split-screen image of each partner on a single video record.

The *Coding System for Regulatory Patterns in the FFSF* (Fuertes & Lopes dos Santos et al., 2009) was used to score three patterns of infant regulatory behavior across the FFSF: a *Social-Positive Oriented pattern* (i.e., infants exhibit predominantly positive social engagement and fully recover after maternal unavailability in the last episode of FFSF), a *Distressed-Inconsolable pattern (i.e.*, infants display conspicuous negative affect that persists or increases across FFSF episodes), and a *Self-Comfort Oriented* pattern (i.e., infants primarily engage in self-comforting behaviors and are uncomfortable during all episodes of FFSF). This scoring system assesses four behavioral and affective categories across the three episodes of the FFSF paradigm, namely: (a) style of behavior (e.g., positive social behavior, distressed behavior, or self-comforting behavior, or a mixed-pattern behavior); (b) intensity of behavior (e.g., amount of time of fussy behavior the presence prolonged and intense crying); (c) reactivity; and (d) infants' ability to recover from negative affect during the reunion episode of the FFSF. Using this system in each episode of the FFSF, the coders chose the description that best fits each case in observation and then make a final decision regarding the infant's pattern of regulatory behavior.

Three trained and reliable coders masked to background variables and the study's hypotheses scored the videotapes. The global agreement score among coders was calculated using Cohen's kappa coefficient. Results denoted an overall good agreement ($M\,\kappa = .78$). Following the assessment of intercoder reliability, discrepant classifications were discussed and resolved in conference.

2.2.2 | Mother-infant interactive behavior during free play at 3 months

During the free play task, mothers were asked to play with their infant as they usually would at home. No specific instructions were given about how to play. A standard set of age-appropriate toys was provided for the dyad, arranged on a blanket on the floor in a secure and silent room. Also, a chair was available for mothers who preferred to be seated with the infant on their lap. The mother-infant free play interaction was videotaped for 5 min, following Crittenden (2003).

Mother-infant interactive behavior during free play was scored using the CARE-Index (Crittenden, 2003). In the CARE-Index, seven behavioral dimensions of maternal and infant behavior are scored during play interaction,

including: Facial Expression, Vocal Expression, Position and Body Contact, Affective Expression, Turn-taking, Contingency and Developmentally Appropriate Behavior). Notably, each dimension of behavior scoring using the CARE-Index is dyadic in nature, that is, each partner's behavior is scored considering the interactive context and their impact on the other partner.

The points scored for each dimension are then added to yield seven scale scores, including three adult scales and four infant scales. The three adult scales include: Sensitivity, which reflects the level of the adult's warmth, caring, reciprocal, contingent and developmentally appropriate behavior with the infant; Control (includes adult's hostile, controlling, negatively/punitively contingent and overstimulation), and Unresponsiveness (included adult's inattentive, uncaring, passivity, non-contingent and under stimulation). The four independent infant scales include: Cooperative (level of the infants' positive, responsive/reciprocal, comfortable and interested behavior with the adult), Compliant-Compulsive (including compliant, obedient, worried, and fearful behavior), Difficult (including angry, incongruous, fussing and distress behavior) and Passive (including dull, inattentive, uninterested and expressionless behavior).

Intercoder reliability for the CARE-Index scales was evaluated by comparing the two coders' ratings using intraclass correlation coefficients (ICC) (Cicchetti, 1994). The average ICC across all cases was .81, denoting good reliability. Mean kappa for individual scales were .81 for maternal sensitivity, .76 for maternal control, .79 for maternal unresponsivity, .81 for infant cooperative behavior, .71 for infant compulsive compliance, .84 for infant difficultness, and .77 for infant passivity.

The *Strange Situation* (Ainsworth et al., 1978) is a 21-min laboratory-based observational paradigm involving a sequence of eight brief episodes of 3-min (or less if the infant shows signs of distress) of increasing mild stress for the infant, including being introduced to an unfamiliar playroom, interacting with an unfamiliar adult stranger, and two mother-infant separations and reunions.

Videotapes of infants' attachment behavior during the Strange Situation were scored by two trained, blind, and reliable coders, following the procedures developed by Ainsworth et al. (1978) The attachment coders were independent from the coders who scored the FFSF behavior at 3 months. Infants were classified as either securely attached (B), insecure-avoidant (A), insecure-ambivalent (C) or disorganized (D). Because only four cases (6.3%) were scored as D in this sample. Since there were insufficient cases to permit a reliable evaluation of disorganized attachment, the D attachment category was excluded from the analyses in the current study.

Intercoder reliability for attachment was evaluated using Cohen's kappa. Results ($\kappa = .86$) indicated good reliability. After intercoder reliability was established, differences in scoring were resolved in the coders conference.

2.3 | Analytic plan

Prior to conducting the analyses addressing the study's primary aims, the normality of the distribution of the study variables were calculated using the Kolmogorov-Smirnov test. Significance was set at .05.

To address this study's aims, several sets of statistical analyses were conducted. First, the distribution of attachment patterns (secure, ambivalent, and avoidant) in the Strange Situation at 12 months was described using univariate statistics. Second, the prevalence of the three infant regulatory behavior patterns in the FFSF at 3 months was evaluated using univariate statistics.

Third, the association between the three infant regulatory patterns and later attachment quality was evaluated using cross-tabulations and the chi-square test. Additionally, the Bonferroni test correction was used as a measure of proportional reduction in error type I. Cramer's V test was applied to test the effect size. Because the frequencies in some cells in Table 2 were lower than 5, the Fisher-Freeman-Halton was applied.

Fourth, correlations were used to test the association between mothers' and infants' interactive behavior scored with CARE-Index scales at 3 months.

Fifth, bivariate statistics (ANOVA) were used to evaluate the association between: (i) the association between maternal and infant CARE-Index scales and attachment classifications at 12 months, and ii) the association of demographic and perinatal variables with attachment classifications at 12 months. Tukey's post hoc HSD tests were used to examine the significance of differences between attachment patterns and maternal/infant interactive behavior, and between attachment patterns and demographics and perinatal variables. Effect size was calculated using partial eta square. In addition, the bivariate associations between demographic and perinatal variables and infant regulatory patterns and maternal and infant interactive behavior at 3 months were also evaluated. Sixth, based on findings in the prior analyses, a series of binary logistic regressions were carried out to identify specific dimensions of maternal or infant interactive behavior, demographic, and perinatal that predict attachment security. All continuous variables that were non-collinear and significantly associated with secure attachment in previous analyses were considered possible factors for inclusion in the binary logistic regression (Forward WALD).

TABLE 2 Descriptive statistics for attachment classifications at 12 months (corrected age by infant regulatory patterns in the face-to-face still-face paradigm (FFSF) at 3 months (corrected age).

		Attachment classification at 12 months			
		Avoidant	**Secure**	**Ambivalent**	**Total**
Infant regulatory pattern in the ffsf at 3 months	Social-positive oriented	3 (16.8%, −1.8)[a]	17 (65.4%, 3.7)[b]	4 (19.0%, −2.2)[a]	24 (38.1%)
	Distressed-inconsolable	3 (16.8%, −1.8)[a]	6 (23.1%, −2.1)[a]	15 (71.4%, 3.9)[b]	24 (38.1%)
	Self-comfort oriented	10 (62.5%, 4.2)[a]	3 (11.5%, −1.9)[b]	2 (9.5%, −1.9)[b]	15 (23.8%)
Total		16 (25.4%)	26 (41.3%)	21 (33.3%)	63 (100%)

Note: Each cell contains frequency, percentages and residual values. $\chi^2 = 31.394$, $DF = 5$, $p < .001$. Eta = .502. Different superscript letters denote that the frequencies differ significantly from each other.

3 | RESULTS

Aim 1 Results: The first aim was to evaluate the prevalence of attachment security and insecurity in this sample of infants born VEPT. The most prevalent attachment pattern was *secure* attachment (41.3%). This was followed by the *insecure-ambivalent* pattern (33.3%) and the *insecure-avoidant* attachment patterns (25.4%).

Aim 2 Results: The second aim was to evaluate the relational, demographic, and perinatal predictors of attachment in this sample.

The first analysis evaluated the prevalence of the three infant regulatory patterns with the mother during the FFSF at three months and their associations with attachment organization at 12 months. The two most prevalent patterns of infant regulatory behavior observed in the FFSF at 3 months in the current sample were the *Social-Positive Oriented* and the *Distressed-Inconsolable* patterns (both with 38.1% of the cases). In contrast, least prevalent regulatory pattern was the *Self-Comfort Oriented* pattern (23.8%).

Results chi-square analyses revealed significant associations between infant patterns of regulatory behavior pattern and later attachment organization. See Table 2. The *Social-Positive Oriented* pattern was more prevalent among infants in the securely attached group, whereas the *Distressed-Inconsolable* pattern was more prevalent among infants in the insecure-ambivalent attached group. Moreover, the *Self-Comfort Oriented* pattern was more prevalent in the insecure-avoidant attached group. Frequencies and residual values are also presented in Table 2. Results of the Fisher-Freeman-Halton test was 24.144, $p < .001$, confirming the significance of the results.

Additional goals in Aim 2 were to evaluate correlations among the study variables. The magnitude of correlations among the maternal and infant CARE-Index scales assessed during free play at 3 months were carried out, given that these scales are dyadic in nature and evaluated in the same context (and therefore not independent). Maternal sensitivity was highly correlated with infant cooperative behavior ($r = .749$; $p < .001$), indicating that mothers were more sensitive with their infants when infants were more cooperative with them. As expected, maternal sensitivity was moderately, negatively correlated with maternal control ($r = -.400$; $p < .001$), maternal unresponsive ($r = -.314$; $p < .02$), and with infant compulsive-compliant behavior ($r = -.480$; $p < .001$). Similarly, infant cooperative behavior was negatively associated with maternal control ($r = -.445$; $p < .001$) and infant compulsive behavior ($r = -.380$; $p < .002$).

Correlations were also carried out between dimensions of maternal and infant interactive behavior during free play at 3 months and infants' attachment patterns at 12 months. Infants with secure attachment at 12 months were more likely to have had more sensitive mothers during free play at 3 months and to have exhibited greater cooperation with the mother in the same context. In turn, infants with insecure-avoidant attachment exhibited higher levels of compulsive-compliant behavior with their mothers during free play at 3 months and their mothers engaged in more controlling behavior. In turn, infants with insecure-ambivalent attachment displayed more difficult behavior during free play. Bonferroni post-doc tests confirmed the results obtained by the Tukey analyses. See Table 3.

In the third set of analyses in Aim 2, the bivariate association between demographic variables and attachment organization at 12 months was evaluated. Out of all the demographic variables assessed, only the number of siblings in the home was significantly associated with attachment. Specifically, infants with an insecure-ambivalent attachment had more siblings. The Bonferroni post-doc test confirmed the results obtained by Tuckey analyses. See Table 4.

TABLE 3 Means, standard deviations, and MANOVA results for maternal (sensitivity, controlling behavior and unresponsivity) and infant interactive behavior (cooperation, compulsive-compliant, difficult behavior, and passivity) during free play at 3 months, according to attachment patterns during the strange situation at 12 months (corrected age).

Attachment classification							
Free play interactive behavior	**Avoidant *M* (*SD*)**	**Secure *M* (*SD*)**	**Ambivalent *M* (*SD*)**	***F* (3, 50)**	***p***	**ηp^2**	***Tukey HSD***
Maternal sensitivity	6.31 (2.06)[a]	8.5 (2.71)[b]	6.95 (1.66)[a]	5.402	.007	.153	b > a
Maternal controlling behavior	4.94 (3.73)[a]	2.23 (3.08)[b]	3.52 (3.20)[b]	3.389	.040	.102	a > b
Maternal unresponsivity	2.75 (3.79)	2.20 (2.70)	3.52 (3.17)	.248	.791	.008	–
Infant cooperation	6.13 (1.89)[a]	8.33 (2.39)[b]	6.24 (1.86)[b]	7.409	.001	.198	b > a
Infant compulsive-compliant	6.19 (3.97) [a]	1.00 (2.67)[b]	1.70 (2.78)[b]	17.387	.001	.367	a > b
Infant difficult behavior	1.13 (2.45) [a]	3.88 (3.32)[a]	6.00 (3.50)[b]	10.470	.001	.259	b > a
Infant passivity	.56 (.16)	1.74 (.35)	1.18 (.65)	.823	.444	.027	–

TABLE 4 Frequency, percentage, residual values and association of attachment classifications at 12 months by social/family risk status.

		Attachment classification 12 months			
		Avoidant	**Secure**	**Ambivalent**	**Total**
Social/family risk status	0 or 1 risk	7 (46.7%, −2.3)[a]	21 (87.5%, 2.4)[b]	14 (66.7%, −4)[a,b]	42 (70%)
	2 or more risks	8 (53.3%, 2.3)[a]	3 (12.5%, −2.4)[b]	7(33.3%, 4)[a,b]	18 (30%)
	Total	15 (25%)	24 (40%)	21 (35%)	60 (100%)

Note: Each cell contains the frequency and percentages. $\chi^2 = 7.500$, $DF = 2$, $p < .05$. Different superscript letters denote that the frequencies differ significantly from each other. Carmert's V = .354; $p = .024$.

Contrary to expectations, none of the other demographic variables (maternal education, age, single mother status, maternal employment status, need for social support or receipt of social income/state aid) were significantly associated with attachment organization. To further evaluate this association, we created and evaluated a dichotomous family/social status index based on the distribution of risk factors in the current sample. Mothers with two or more of the following risk factors were classified into the Social/Family Risk group: single parenthood, immigrant status, unemployed, receipt of social income (state aid), and low education (i.e., having a less than the federally mandated 9 years of formal education required for individuals apply for a job or obtain a driving license). Mothers who had only a single risk factor or no risks were classified into the No Social/Family Risk group (Table 5).

About a third of mothers in the current sample ($n = 18$) were classified into the Social/Family Risk group. Findings indicated that secure attachment was more frequent among infants of mothers in the No Social/Family Risk group, whereas insecure-avoidant attachment was more prevalent among infants of mothers in the Social/Family Risk group. The Fisher-Freeman-Halton is 7.439, $p < .05$, confirming the significance of these results.

Additional correlational analyses evaluated the association between perinatal risk variables (e.g., gestational weeks at delivery, days hospitalized) and attachment organization at 12 months and with patterns of infant regulatory behavior in the FFSF at 3 months. No significant associations were observed.

In a final set of correlations, the association of perinatal and demographic variables with mother and infant interactive behavior during free play at 3 months was evaluated. One statistically significant correlation was identified: Greater maternal unresponsivity was negatively associated with infant gestational age ($r = .270$; $p = .044$).

Aim 3 Results: The third aim was to build and carry out a covariate-controlled binary logistic regression to identify specific dimensions of infant and maternal interactive behavior during play at 3 months, demographics, and perinatal variables that predicted attachment security at 12 months. All variables evaluated in Aim 2 that were significantly related to secure attachment were considered possible factors for inclusion in the binary logistic regression (Forward WALD). Two maternal interactive scales (maternal sensitivity and maternal

TABLE 5 Summary of binary logistic regression (forward WALD) analyses predicting attachment security.

DV: Attachment security	*B*	*S.E.*	*Wald*	*Exp(B)*	*95% C.I. for Exp(B)*		*p*
					Inferior	*Superior*	
Step 1							
Maternal sensitivity (3 months)	.358	.127	7.920	1.431	1.115	1.836	.005
Constant	-3.060	1.010	9.174	.047			.002
Step 2							
Maternal sensitivity (3 months)	.322	.131	6.024	1.379	1.164	2.073	.014
Number of siblings	−.807	.408	3.911	.446	.281	.993	.048
Constant	−2.226	1.089	4.180	.108			.041

Note: Step 1: Cox & Snell $R^2 = .139$; Nagelkerke $R^2 = .187$. Step 2: Cox & Snell $R^2 = .201$; Nagelkerke $R^2 = .271$.

control) and the number of siblings were included in the binary logistic regressions. Although infant cooperation was a robust predictor of secure attachment, it could not be included because it was too highly correlated with maternal sensitivity, and both maternal and infant scales were evaluated in the same context, and therefore not independent.

The regression results indicated that both maternal sensitivity during free play at 3 months and number of siblings were significant predictors of attachment security, entered in two steps. In the first step of the regression, the pseudo-R-squared value of Cox & Snell was .139 and Nagelkerke was .201, and maternal sensitivity in free play was retained as a significant predictor of attachment security (−2 Log-likelihood = 75.994). In the second step, the pseudo-R-squared values of Cox & Snell increased .187 and Nagelkerke increased .271, indicating that maternal sensitivity in free play interactions and number of siblings both predicted attachment security at 12 months (−2 Log-likelihood = 71.235). Notably, there was no significant correlation between the variable "maternal sensitivity" and the variable "number of siblings" (r = -.216; $p = .089$). Moreover, these two variables were not collinear (*Tolerance* = .953; *VIF* = 1.049).

Because number of siblings was retained as a possible predictor of attachment security, we also investigated the correlation between this variable, other demographic factors and all scales of mother-infant interactive behavior and found no significant associations. We also created a dichotomous variable for siblings ("no siblings" vs. "siblings") and evaluated whether it distinguished the other demographic and mother-infant interaction variables, using t-tests. No significant differences were found. Finally, we found no significant differences regarding the mean number of siblings and the three patterns of infant regulatory behavior observed in the FFSF at 3 month [$F(3, 50) = .458$; $p = .638$; $\eta p^2 = .015$].

In separate analyses, we also evaluated whether the regression results would remain significant after excluding the three mothers with very low levels of literacy or the six infants born extremely preterm from the analyses. The results from these binary logistic regressions were identical to the original; namely, the same predictors of secure attachment were retained in both [$F(3, 50) = .458$; $p = .638$; $\eta p^2 = .015$].

4 | DISCUSSION

The primary goal of this longitudinal study was to identify specific relational, demographic, and perinatal predictors of secure attachment at 12 months in an understudied sample of Portuguese infants born VEPT. Infants varied in level of perinatal risk, and their mothers came from a range of sociodemographic backgrounds.

Our results revealed that more than half of the infants in our sample were insecurely attached based on their behavior with their mother in the Strange Situation at 12 months. These findings contrast with those reported for infants born full-term in prior Strange Situation research in Portugal and in other European and US studies (Faria et al., 2014). In the current sample of infants born VEPT, it is possible that an accumulation of health and social risks contributed to their relatively high percentage of attachment insecurity. According to Sameroff and Fiese (2000), child development is the product of continuous dynamic interactions between biological dimensions and infants' experiences in the proximal caregiving environment, which in turn are affected by influences from broader social and cultural contexts. Cumulative biological and social/family risks may also undermine the parent-infant relationship indirectly, by stressing caregivers, or by depleting familial social and financial capital, and restricting parents' availability for social interactions with their infants. We speculate that the multiplicity of biological and social risk factors associated with VEPT birth

in the current sample likely affected infants' capacity to express and regulate emotions and their parents' ability to respond to infant communicative signals in an appropriate, contingently responsive manner.

Another notable finding in this VEPT sample was the high prevalence of insecure-ambivalent attachment. To our knowledge, only studies with samples with high levels of cumulative risk have shown such a high percentage of insecure-ambivalent attachment (e.g., Candelaria et al., 2011; Lyons-Ruth et al., 1986; Plunkett et al., 1988). We speculate that the vulnerability and stress associated with these vulnerable infants' early life contexts may jeopardize their ability to openly express positive emotions with their caregivers and make it more likely for these infants to search for comfort and care from caregivers in stressful situations. For instance, infants born VEPT are more likely than infants born MLPT or full-term to experience pain and intrusive care in the NICU, and some studies report that infants with ambivalent attachment are more likely than infants with avoidant attachment to externalize their pain and have difficulty regulating negative emotions (for a review, see Failo et al., 2019).

Cultural factors may also contribute to a heightened prevalence of insecure-ambivalent attachment. For instance, in collectivist-oriented societies, such as Japan or the Middle East, a higher prevalence of ambivalent attachment is observed than in individualistic-oriented countries such as in the US, Canada, or northern Europe (van Ijzendoorn, & Sagi-Schwartz, 2008; Zreik et al., 2017). Also, the small number of infants classified as disorganized is difficult to explain. A systematic national study of the prevalence of different attachment patterns in Portuguese society is necessary to understand more clearly how geographical variations (e.g., rural vs. urban areas; island vs. continental areas), sociodemographics, and parents' cultural ethnotheories contribute to attachment formation. This information would also help promote a worldwide discussion on the multiple biological, relational, and socio-cultural factors that predict infant attachment at a global level.

In the current sample of infants born VEPT, we were able to identify the same three patterns of infant regulatory behavior as were observed in prior studies with infants born FT or MLPT (Fuertes et al., 2021), despite these infants' greater biological and neurological immaturity and vulnerability. However, the prevalence of each pattern in the current sample varies from that observed in prior work. The two most prevalent patterns of infant regulatory behavior at 3 months in the VEPT sample were equally the Social-Positive Oriented and the Distressed-Inconsolable patterns. In contrast, the most prevalent pattern in prior work with full-term (Barbosa et al., 2021) and MLPT samples (Fuertes et al., 2022) was the Social-Positive Oriented pattern.

One possible explanation for these differences is that the infants born VEPT have greater neurological immaturity and experienced more challenging perinatal experiences; both may have overwhelmed infants' regulatory abilities and their parents' capacity to scaffold them (Provenzi et al., 2016). However, it is hard to attribute the difference in the results across different studies solely to differences in infants' prematurity status (FT, MLPT, or VEPT), because many of the families in the current sample also were from higher social risk backgrounds. Another study carried out with a low-income Brazilian sample of infants born FT (Fuertes et al., 2021) found a similar prevalence of the three infant regulatory patterns as in the current study. It may be that the cumulative family and social risk factors experienced by some families in the current sample may have indirectly jeopardized parents' ability to support their infants in regulating their emotions during stressful situations, by increasing their allostatic load (Atkinson, Paglia et al., 2000; Diener et al., 2003; Moster et al., 2008).

Regarding the association between infant regulatory patterns and attachment in the current VEPT sample, we found significant associations between infant regulatory behavior patterns in the FFSF at 3 months (corrected age) and attachment organization at 12 months, which were similar to the findings reported in previous work with infants born FT or MLPT (Barbosa et al., 2021; Fuertes et al., 2022). Specifically, a Social-Positive Oriented regulatory pattern during the FFSF was associated with secure attachment; a Distressed-Inconsolable regulatory pattern in the FFSF was linked to insecure-ambivalent attachment; and a Self-Comfort Oriented regulatory pattern in the FFSF was associated with insecure-avoidant attachment.

The current findings also suggest that, not only do specific patterns of infant regulatory behavior during the FFSF contribute to emerging attachment relationships with caregivers, but the quality of maternal and infant interactive behavior in other interactive contexts also is associated with later attachment (Atkinson, Niccols et al., 2000; De Wolff & van, IJzendoorn, 1997).

Infants born VEPT classified as having a secure attachment at 12 months were more likely to have experienced greater maternal sensitivity during free play at 3 months, and they themselves were more responsive and cooperative with their mothers. In contrast, infants with an insecure-avoidant attachment at 12 months were more likely to have experienced greater maternal controlling behavior and the infants themselves were more likely to have exhibited more compulsive-compliant behavior with their mothers during free play at 3 months. Further, infants with insecure-ambivalent attachment at 12 months were more likely to have exhibited difficult behavior during

mother-infant free play at 3 months. These results replicate previous findings regarding the relational predictors of attachment in samples of Portuguese infants born FT or MLPT (Fuertes et al., 2022).

Taken together, our results are consistent with the tenets of the Mutual Regulation Model (Tronick et al., 2020). This model posits that the quality of caregiver-infant interactions is determined by contributions from each interactive partner, including the ability of each participant to regulate emotional states, express communicative messages, and respond to the partner's affective communications, progressively leading to both individual and dyadic forms of organized behavior, and over time, to organized patterns of attachment.

Although many infants born VEPT in the current study were at biological and/or social risk, none of the perinatal risk factors (e.g., birthweight, gestational age at delivery, number of days hospitalized) and only one demographic factor (i.e., number of siblings) were linked with attachment at 12 months (e.g., birthweight, gestational age, number of days hospitalized, maternal age, education, or marital status). Infants with fewer siblings in the current sample were more likely to be securely attached. This is not the first time that this variable has emerged as a significant predictor of attachment in Portuguese research. For instance, in one study, infants classified as Distressed-Inconsolable in the FFSF at 3 months had more siblings than infants classified as Social Positive Oriented (Seixas et al., 2017). But the reason for this association is unclear. One possible explanation is that families with more children must deal with more complex family dynamics than families with fewer children, and consequently have less time and fewer available resources to respond and care for biologically vulnerable infants born VEPT in a consistent, sensitive manner. Although maternal sensitivity or infant cooperation is not associated with number of siblings, some transactional processes related to parenting burden may have contributed to negative relational trajectories over time. Further longitudinal research is needed to explore this possibility.

It is also important that researchers evaluate multiple predictors of attachment control for the large number of variables tested, which may increase the likelihood of Type I errors. Although the results of Bonferroni corrections confirmed the results obtained in the present study, further research in larger, more diverse samples is needed to better understand the impact of multiple biological, relational, and socio-demographic variables and their cross-time transactions on attachment.

Although single demographic variables were mostly unrelated to attachment in the present study, a different pattern of findings was observed when social/family risk status was defined dichotomously (i.e., having 2 or more risks vs. no risks). Infants from families with Social/Family Risk status were less likely to have a secure attachment than infants from families with No or Low Social Family Risk. The cumulative effect of coping with multiple risks, such as low levels of education, job instability, lower income, immigration, and/or single parenting in Portuguese society may affect families' access to resources needed to care for their infants born VEPT (PORDATA, 2019). In the present study, three immigrant mothers had only three years of formal education, and although they were from countries where Portuguese was the official language, some struggled to read and write in Portuguese. Others were waiting for a residence visa to apply for a job. Such difficulties can challenge families' access to services and information needed to provide quality care (particularly health care) for their infants.

The current findings are consistent with results from prior Portuguese studies with infants born FT or MLPT and their mothers (Barbosa et al., 2019; Fuertes et al., 2009, 2016) showing that maternal sensitivity is a primary predictor of attachment security. Notably in the current study with infants born VEPT, both maternal sensitivity and infant cooperation during free play were strong correlates of attachment security. This is not surprising given the dyadic focus of the CARE-Index, which was used to score both variables, and the fact that both were evaluated in the same context and were highly correlated with each other. Maternal sensitivity and infant cooperation are thus not independent, but dynamically related: infant cooperation depends on maternal sensitivity, which in turn may profit from the clear and positive infant responses. These findings support our hypothesis that neurodevelopment and early life experiences may contribute to the way that infants born VEPT regulate their emotions and behavior during mother-infant interactions. In turn, mothers' ability to respond to their infant's emotions and needs over time may contribute to how their attachment relationships are organized (Brisch et al., 2005).

Early intervention teams in Portugal offer a family-based intervention for children under six years old and their families designed to prevent these negative outcomes for infants born prematurely and other at-risk infants. Indeed, there was a negative correlation between maternal passivity and infant gestational age at delivery. These programs aim to promote positive child development, relationships with others, and provision of age-appropriate learning opportunities, as well as to facilitate at-risk families' access to education, health, and social services (Dionisio et al., 2023). For maximum effectiveness, early intervention needs to start as early as pregnancy, preparing parents for their future caregiving roles and offering them needed social support. In recent studies of infants born PT, the frequency of infants with secure attachment is growing,

possibly due to the improvement in staff responses to parents in NICUs (e.g., promotion of *Kangaroo Care* interventions and referral to early intervention services, e.g., Wolke et al., 2014). The same trends are observed in Portugal, although there is still too little psychological support offered for parents during their newborn's stay in the NICU.

The results of our study reinforce the need to support practices and policies designed to empower and enable parents of infants born VEPT to read, respond and engage with their vulnerable infants early in life. According to the CARE-Index manual (Crittenden, 2003), scores ranging from 0 to 6 are categorized as intervention-level (5–6 as "inept" and 0–4 as "at risk"). Scores between 7 and 10 are considered "adequate", while scores from 11 to 14 are labeled as "sensitive" or "cooperative". In the current Portuguese multi-risk sample, mothers of infants with insecure attachment had mean scores for maternal sensitivity around 6 points, and similar levels were observed for infant cooperation. These scores suggest that many of the dyads in the current are at high risk for relational problems. Provision of early intervention services for these families would likely be beneficial (Ribeiro et al., 2020).

4.1 | Study limitations and strengths

The current study has both limitations and strengths. A major limitation of this study is its small sample size, which reduces statistical power and our ability to utilize more complex designs evaluating possible moderation and mediation effects. Another is its focus on an understudied Portuguese sample of infants born VEPT and their mothers from heterogeneous socioeconomic backgrounds, which may limit the generalizability of our findings to other groups. Future research should evaluate the current study questions in larger, more diverse samples.

Strengths of this study include its longitudinal, prospective design, direct observations of mother and infant behavior in multiple contexts (FFSF and free play at 3 months, attachment in the SS at 12 months) during the first year, and the inclusion of both biological and demographic factors as potential predictors of attachment patterns. Despite its limitations, the current findings contribute to the growing knowledge base about early infant regulatory behavior patterns and mother-infant interactions, their associations with perinatal and socio-demographic risk factors, and their links to later attachment organization in an understudied Portuguese sample of infants born VEPT and their mothers.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Our data is available at https://osf.io/y68sf.

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