Depressive symptoms and maternal psychological distress during early infancy: a pilot study in preterm as compared with term mother–infant dyads

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Abstract

Background: Preterm birth does not only affect infants but also represents an unexpected and traumatic event for parents. There are few reports on parenting stress during early infancy comparing preterm and term mothers, with the results being somewhat inconsistent.

Methods: As part of a longitudinal study, preterm mother-infant and term mother-infant dyads were enrolled. Dyads were assessed twice: during hospitalisation in the neonatal intensive care unit (NICU) and at 3 months

of infant age (corrected age for preterm). Each mother completed a self-report set of psychological questionnaire in both time points. All the children underwent a neurological examination at 40 weeks post conceptional age and at 3 months (corrected age for preterm).

Results: 20 preterm and 20 term dyads were included. NICU mothers reported elevated postnatal depressive symptoms and high stress level, even if the preterm infants were with low perinatal risk and normal neurological examination. Comparing preterm infant with low perinatal risk and normal neurological examination with term-born children at 3 months, we found higher parental stress in term mothers than in preterm mothers.

Limitations: This study was limited by a relatively small sample size; findings are preliminary and warrant further investigation in larger-scale study.

Conclusions: Findings confirm that becoming a mother of a preterm infant is an event associated with emotional distress. These symptoms may resolve with time, and sometimes are independent of the infant's clinical severity. Assessing parental sources of stress and subsequent follow-up is essential to promote parental support, both for preterm and term mothers.

Introduction

Preterm birth, defined as a delivery before 37 completed weeks of gestation, is a major challenge in perinatal health care. Despite improvements in medicine and technology have led to significant advances in survival rates and quality of life, infants born preterm are at higher risks than infants born at term for developing neuro motor disabilities, as well as cognitive and behavioural disorders (Gardella et al., 2015).

Preterm birth does not only affect infants but also their families: along with the objective risk for the baby's health and survival, preterm birth is an unexpected and traumatic event for parents, which may leave them

stressful and frightened (Lasiuk et al., 2013). Parents must face an unexpected condition, characterized by feelings of anguish about the unavoidable difficulties of the child or the sudden worsening of the clinical picture (Korja et al., 2012; Lasiuk et al., 2013). Previous research has shown recurrently that mothers of preterm infants experience more severe levels of psychological distress in the postnatal period than mothers of full term infants (Treyvaud, 2014; Vigod et al., 2010). Feeling of helplessness, stress, detachment and increased anxiety and depression are common during the neonatal intensive care unit (NICU) hospitalization and even at the time of hospital discharge, but few studies confirm parental distress even beyond this period (Kersting et al., 2004; Ahlund et al., 2009).

The prevalence rates of postnatal depression in mothers of preterm infants are as high as 30-40% compared to 6-12% in mothers of healthy full term infants (Vigod et al., 2010). In a longitudinal study, Miles et al. found that levels of depressive symptoms persist also after NICU discharge: 63% of preterm mothers had elevated depression symptoms scores during infant hospitalization and 30% still reported elevated depressive symptoms even two months later (Miles et al., 2007). Similarly, Helle et al. (2014) found that depending on the measure, the risk of being postnatally depressed was 4 to 18 times higher in mothers of preterm infants 4 to 6 weeks after discharge. Compared to the extensive number of studies concerning depression, fewer studies have assessed postpartum anxiety disorders in preterm mothers. Literature showed that the rate of maternal anxiety ranges from 35 to 43% during the infant NICU hospitalization (Singer et al., 2003; Padovani et al., 2009) and from 12 to 26% after its discharge (Padovani et al., 2009; Rogers et al., 2013). Regarding parental stress, several studies have demonstrated that the primary sources of stress identified by NICU mothers are related to alteration of their parental role and their infant's behaviour and appearance, indicating that parental stress may be influenced by several clinical variables related both to mother and infant (Miles et al., 1991; Montirosso et al., 2012; Gray et al., 2018). There are limited reports on parenting stress in mothers of preterm infants during early infancy in comparison to mothers of term infants, with the results being somewhat inconsistent (Miles et al., 2007; Gray et al., 2018). The immediate period after the birth of a preterm infants appears to be particularly stressful, though in early infancy appears to lessen with time (Alkozei et al., 2014; Halpern et al., 2001).

Exploring maternal stress and psychological reactions following preterm birth is interesting from a developmental perspective. Maternal mental health is known to affect children's physical and mental

development during the lifespan (Zerach et al., 2015; Spairani et al, 2018); moreover, information about risk and protective factors regarding preterm parenthood are useful to the medical staff involved in these families. According to our knowledge, there are not many studies comparing the psychological wellbeing in term and preterm mothers in early infancy. Furthermore, studies of mental health problems after preterm delivery are in general based on cross sectional data; therefore, no temporal relationships can be established.

The primary aim of the present study is to explore the degree of psychological distress and trauma related stress reactions in mothers who deliver preterm in comparison with mother who deliver healthy full term newborn. Secondarily, we want to explore longitudinally the maternal psychological distress at three months after delivery (corrected age for preterm group) and identify the predictors that may influence stress and maternal mental health problems.

Methods

Participants

This study is part of a longitudinal research performed in the Neonatal Intensive Care Unit (NICU) and Neonatal Unit, and the Department of Obstetric and Gynecology, Fondazione IRCCS Policlinico San Matteo in collaboration with the Child Neurology and Psychiatry Unit at the C. Mondino National Neurological Institute, both in Pavia, Italy (Spairani et al., 2018). The study had ethics committee approval, and all the participating mothers signed an informed consent form.

Between January and June 2017, all dyads consisting of mothers and preterm infants with a gestational age ≤ 32 weeks and/or a birthweight ≤ 1500g whose newborns were admitted to the NICU were enrolled.

During the same time, a control group of mothers with term infants with a gestational age >38 weeks and a birthweight ≥2500g, whose newborns were admitted to the Neonatal Unit, was recruited. Exclusion criteria for infants were congenital malformations and/or infections, and chromosomal abnormalities. The mothers had to be at least 18 years old and free from psychiatric illness and/or drug abuse; they also had to understand Italian and the purposes of the study.

Procedure

111 The infants/mothers dyads were assessed twice: during hospitalisation in the NICU or Neonatal Unit (t0) and
112 at 3 months of infant age (corrected age for preterm groups) (t1).
113 The NICU is open to the parents 24/24h, 7/7 days; parents' presence and parent–infant physical closeness,
114 including skin-to-skin contact and holding, are encouraged by medical staff. One psychologist, one
115 developmental therapist and one neuropsychiatrist are involved in the medical staff, supporting mother-infant
116 dyads. Moreover, NICU developmental care practices were not clustered in a structured program
117 (e.g.,NIDCAP). The Neonatal Unit is characterized by a complete rooming-in care of babies and mothers.
118 At t0, we collected maternal socio-demographic data and obstetric and perinatal data relating to the infants,
119 the latter collected according to the Vermont Oxford Network criteria (Vermont Oxford Network, 2001). The
120 Perinatal Risk Inventory (PERI) was used to obtain a summary score of the severity of perinatal condition and
121 survival risks, scoring ≥10 is considered as high perinatal risk (Scheiner and Sexton, 1998).
122 Each mother completed the following self-report measures during her child's hospital stay: Parental Stressor
123 Scale: Edinburgh Postnatal Depression Scale (EPDS), Modified Perinatal Post-traumatic Stress Disorder
124 Questionnaire (MPPQ); and Multidimensional Scale of Perceived Social Support (MSPSS). Moreover,
125 Neonatal Intensive Care Unit subscale (PSS:NICU) was completed by the mothers of preterm babies. At the
126 clinical follow-up (t1), the mothers again completed the EPDS, MPPQ and MSPSS, and compiled the
127 Parenting Stress Index – Short Form (PSI-SF) and the Maternal Postnatal Attachment Scales (MPAS).
128 All the children underwent a neurological examination (Gosselin and Amiel-Tison, 2007) at 38-40 weeks post
129 conceptional age and at 3 months (corrected age for preterm group). Neurological examinations were classified
130 as normal, in the absence of any pathological neurological sign, or abnormal, in the presence of pathological
131 neurological signs of varying degrees.
132
133 *Measures*
134 *EPDS*: this is a 10-item self-report questionnaire designed to measure emotional and cognitive symptoms of
135 postnatal depression. It asks women to choose the response to a statement that most closely describes how they
136 have been feeling during the past 7 days; each item has four options, which are scored from 0 to 3 according
137 to severity, with total scores ranging from 0 to 30. A validated cut-off score of ≥13 is used to detect probable
138 depression in postnatal women (Cox et al., 1987).

MSPSS: this 12-item scale measures perceived satisfaction about of support received from family, friends and significant others. The total score ranges from 12 to 84, with higher scores indicating greater perceived social support. The subscale scores range from 4 to 28 (Zimet et al., 1998).

MPAS: this series of self-report items, each scored on a five-point scale, evaluates how the mother feels towards her infant and how this is reflected in her behaviour. MPAS provides a global mother-to-infant bonding score ranging from 19 to 95, where higher scores indicate higher levels of attachment (Condon and Corkindale, 1997; Scopesi and Viterbori, 2004; Provenzi et al., 2016).

PSS:NICU: this is a self-report scale that evaluates parental perceptions of sources of stress in the NICU. It consists of three subscales covering the following aspects: sights and sounds of the NICU (SS – 6 items), the infant's behaviour and appearance (IBA – 13 items), and perceptions of parental role alteration (PRA – 7 items). Parents rate their stress level for each item on a 5-point Likert scale ranging from 1 (not stressful) to 5 (extremely stressful). The Italian version of PSS: NICU has been found to have adequate psychometric properties in a large sample of Italian mothers. A cut-off score of ≥3 is used to identify high parental stress (Miles et al., 1993; Montirosso et al., 2012).

PSI-SF: this is a self-administered instrument in which, for each item, the level of parenting stress is rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items are divided into three subscales: Parental Distress, which measures distress that a parent is experiencing for personal reasons; Parent-Child Dysfunctional Interaction, which measures parents' perceptions of their interaction with their child; and Difficult Child, which measures parental perceptions of the child's temperament and disposition. The subscale scores, which range from 12 to 60, are added to provide a total score ranging from 36 to 180. High subscale scores and total scores indicate greater levels of stress. The 85th percentile has been established as the cut-off point for the subscale and total scale scores. Scores equal to or above this cut-off point are considered clinically significant (Abidin, 1995).

Data Reduction

28 mother of preterm infant pairs were consecutively enrolled according to the inclusion/exclusion criteria and invited to participate in the study; 6 mothers refused for organizational reasons (they did not guarantee

participation in the follow-up), 2 mothers did not reported any specific motivation. Thus, we evaluated 20 mother-preterm infant dyads matched to 20 mothers-term infant dyads, as a control group.

Data Analyses

Quantitative variables were described as mean and standard deviation (sd) if normally distributed (Shapiro–Wilk test), as median and interquartile range (iqr) if not normally distributed; qualitative ones as counts and percentages. Univariate comparisons between two groups were performed with Student t test (or similar non-parametric tests) for quantitative variables. Chi-squared test or Fisher's exact test were used to evaluate statistical associations between qualitative variables at the same time; Mc Nemar test was used to evaluate statistical associations between assessments of the same categorical variable at two time points: birth or 38-40 weeks of post-conceptional age (t0) and 3 months of infant age, corrected for the preterm infants (t1).

The association between two continuous variables was performed by means of Pearson correlation, expressed by r coefficient. A value of $p < 0.05$ was considered statistically significant. All tests were two-sided. Data analysis was performed using the STATA statistical package (release 14.1, 2015, Stata Corporation, College Station, Texas).

Results

Table 1 shows the maternal and infant characteristics, including neurological examination, in the two groups. No differences in gender of the newborn neither in maternal socio-demographic data are reported between the control group and the preterm group. The two groups show significant differences regarding type of delivery, gestational age, birthweight, and perinatal risk; since these variables are strictly linked to preterm birth, these results were expected.

Table 2 reports the results of the administered questionnaires in the two groups, reported respectively at t0 and t1. Regarding depression, we find at t0 a statistically significant difference in EPDS scores between preterm and term mothers ($p=0.010$) (Fig. 1). In particular, postnatal depression at t0 is reported in 17 preterm mothers (85%) in comparison to 5 term mothers (25%) ($p<0.001$); at t1 depression symptoms decrease in the preterm mothers ($p<0.001$), but remain stable in mothers with at term infant with no more statistically significant difference between the two groups.

Regarding stress in the postnatal period, valued with PSS:NICU only in the preterm mothers group, we find that alterations in infant behaviour and appearance (IBA) and in parenting role (PRA) are the largest source of parental stress (correlation between PSS:NICU total score and IBA, r = 0.91 [p <0.0001]; correlation between PSS:NICU total score and PRA score, r = 0.88 [p <0.0001]), while sights and sounds (SS) of the NICU ranked lowest as a source of stress (r = 0.84; p < 0.0001). Overall, stress levels during hospitalization in NICU (PSS:NICU total score ≥ 3) are relevant for 12 preterm mothers (60%).

At three months of infants' age no mother, neither preterm nor at term, exceed the PSI-SF total score percentile cut off.

Furthermore, we considered preterm infants with low perinatal risk (PERI <10; n=12) comparing with term dyads. These additional analyses confirm higher postnatal depression in preterm mothers during the NICU hospitalization than in term mothers at birth, as reported by the EPDS score (EPDS p=0.042). Instead, comparing the same two groups at t1, we found higher parental stress in term mothers than in preterm mothers with infants at three months of corrected age (PSI-SF Total Score: p= 0.017; PSI-SF PD: p= 0.027; PSI-SF DC: p=0.022) (Fig. 2).

In the preterm group only, we compared indicators/scores for maternal psychological condition and infant variables between different pairs of subgroups, according respectively to: PERI score (considering as cut off PERI=10), and normal/abnormal neurological examination at t1 (see Table 3: descriptive statistics and p values for the comparisons are shown). With regard to PERI score, we observe statistically significant higher values in the subgroup with PERI ≥ 10 for PSI-SF Total Score (p = 0.019), PSI-SF maternal stress related to parental disease (PSI-SF PD, p = 0.007), and PSI-SF difficult child (PSI-SF DC, p = 0.049).

Comparing subgroups of preterm according to the outcome of the neurological examination at t1, we report similar results: statistically significant higher values are observed in the subgroup with abnormal neurological examination for PSI-SF Total score (p = 0.023), PSI-SF dysfunctional parent-child interaction (PSI-SF P-C, p = 0.020) and for PSI-SF difficult child (PSI-SF DC, p = 0.006).

Discussion

This study firstly aimed to explore the psychological distress related to preterm birth compared to term birth, secondly to identify maternal and infant factors associated with stress level during the NICU hospitalization and after 3 months of corrected age.

Consistent with prior prevalence estimates (Miles et al., 2007; Rogers et al., 2013), approximately three quarter of the NICU mothers in our sample reported elevated postnatal depressive symptoms, significantly higher in mothers of preterm infants than in mothers of full term infants. As already confirmed by literature, having a premature infant may be defined as a stressful experience leading to depressive symptoms, due to fear that the infant may not survive and to the loss of the expected maternal role (Holditch-Davis et al., 2015). These symptoms among mothers of preterm infants may resolve with time, as literature suggests. Miles et al. (2007) reported that depressive symptoms are especially high during the first six months after discharge. In this longitudinal study, more than half of preterm mothers reached high EPDS scores during NICU hospitalization, and about one third at two months after discharge. Comparable studies reported in a systematic review, revealed a decreasing prevalence of mean depression scores over time (Vigod et al., 2010). Data from our study are in agreement with literature: post-natal depression decreases significantly in preterm mothers group, but it remains stable in term mothers. At three months of infant age (corrected age for preterm infant), there is no significant difference between postnatal depression levels in the two mothers groups. Also if we considered mothers of preterm infants with low perinatal risk during NICU evaluation, we found higher postnatal depression in preterm mothers than in term mothers. It seems that the experience of preterm birth is disruptive for mothers, even if their child presents no clinical complication during hospitalization. The full-term duration of pregnancy permits time for emotional adaptation to the dynamic changes that are detecting during pregnancy and towards parenting. On the contrary, preterm delivery is characterized by psychosocial implications associated with premature parenting, in which a woman's expectations of a physiological pregnancy and birth with a healthy infant are not realized (Stern and Karraker, 1988; Stern et al., 2006).

Premature birth and consequent NICU hospitalization are also commonly considered an experience associated with stress. Miles and colleagues studied stress of parents with children in NICU settings and identified several sources of stress (Miles et al., 1993). Specifically, aspects of the physical environment such as lights, monitors, and life support attached to the baby contribute to the stressful experience. Instead, one of the most powerful variables associated with maternal stress is the perception of infant's fragility and premature condition severity.

Nevertheless, researchers found that the loss of the maternal role is reported as the greatest source of stress for NICU mothers, which may have consequences on the development of the mother-infant relationship in the very early post-partum period (Muller-Nix et al., 2004). Our results are consistent with literature: NICU mothers, evaluated during infants' hospitalization, show high stress levels, especially in the parental role alteration items (Pisoni et al., 2018, Montirosso et al., 2012). There is evidence that maternal stress may influence the maternal-infant relationship, moreover literature confirm that child's first relationship is an early protective experience essential to his/her future development, and this is particularly true in children with high perinatal risk (Provenzi et al., 2017; Holditch-Davis et al., 2007). A recent review has investigated this topic and findings suggest that a number of prenatal adverse events (e.g., maternal stress and depression) and post-natal events (e.g., NICU-related pain-related stress) affect the developmental trajectories of preterm infants and children via epigenetic alterations (Provenzi et al., 2018).

A result hypothetically conflicting is the fact that did not appear a statistically significant correlation between maternal stress and/or depression during NICU hospitalization and objective measurements of infant health (PERI and neurological assessment at t0). These data suggest that parental stress is relatively independent of infant illness. It seems that in our sample, mother's own internal psychological status and experience, not the infant's clinical condition, determine the expression and degree of manifested stress. Similar results emerged from other studies (Spear et al., 2002), but literature is still inconsistent (DeMier et al., 2000). For example, in our previous research mothers with higher-risk infants reported higher levels of parenting stress, which we supposed was probably linked to the trauma of seeing their child struggle with neonatal medical complications and in addition to the difficulty of caring for a fragile infant (Pisoni et al., 2018).

Regarding maternal stress at three months of infant age (corrected age for preterm sample), we do not found a statistical difference between the two mothers' groups and no mother exceeds the cut-off of stress level. In preterm mothers, parental stress is strictly related to perinatal risk and impaired neurological examination at t1. Comparing preterm infant with low perinatal risk, with the full-term born children, we found higher parental stress in term mothers than in preterm mothers. Literature about preterm-term maternal stress differences beyond the first year of life is conflicting (Taylor et al., 2001; Tommiska et al., 2002; Pisoni et al., 2018). A meta-analysis by Shapping et al. (2013) provides a comprehensive account of parental stress in preterm infants, from their birth to adolescence. Authors proposed different explanations about the lack of difference in stress

levels between parents of preterm and term during the first year of life. One suggestion is that mothers of preterm infants tend to deny the child's clinical condition and to perceive their infant healthier than his/her really are. Secondly, it is possible that mothers, rationalizing the emotional impact of preterm birth, are able to maintain control over the situation and diminish parental stress. Finally, it is also possible that due to adequate social, medical and psychological support during the postnatal period, stress is not negated, but really reduced in mothers of preterm infants. Several studies have investigated the role of early intervention on parental mental health: evidence from two systematic reviews indicates that early intervention programs after preterm birth that include parental psychosocial support (and often developmental support for the infant) are associated with lower symptoms of maternal depression and anxiety (Benzies et al., 2013; Brett et al., 2011). Regarding our preterm dyads, we hypothesize that if the perinatal period has not been too burdened by clinical complications, and the development of the infants is good, mothers soon experienced a decrease in stress levels. A beneficial effect on the maternal stress reduction can also be attributable to interventions regarding psychosocial care and communication during NICU hospitalization, even if not clustered in a structured program. These mothers also demonstrated significant reduction of depression during the three months of infant's life, which suggest adaptation to their initial difficulty in parenting. It will be important to follow up our preterm dyads over time to establish if resilience and adaptive parenting strategies are stable over time. On the other hand, it will be also important to investigate stressors in term mothers. According to Abidin (1995), stress typically occurs when there is a mismatch between parents' perception of available psychological and family resources and the demands of parenthood. Consequently, it could be necessary to identify precursors of parenting stress, in order to support mothers and their partners in the potentially difficult transition period around childbirth.

This study has several strengths: the 3-months follow-up enables us to monitor mother distress over an extremely sensible period, during which attachment starts and develops. Secondly, we used a panel of validated scales to evaluate both mothers and infants over time; then the control group of dyads with full-term birth strengthens the value of our results. Some limits of the study might be acknowledged, in particular regarding the small size of the sample. It would be useful to explore this topic further, possibly in larger samples followed up as long as possible. Another limitation is the lack of data about factors such as pre-gestational maternal psychopathological condition, marital union, paternal psychopathology and infant temperament, which are

associated with maternal stress (Moura, 2017). Furthermore, we did not systematically investigate the family income, a variable that has been suggested to impact greatly on parental distress, the ability to adapt to stressful events and medium- to long-term family outcome (Singer, 2010). Another limitation, which also represent a future research direction, is represented by the lack of a specific support program for preterm mother-infant dyads, such as early intervention and developmental care. Few studies demonstrate how an early child-centered and family-focused intervention may reduce parenting stress across childhood (Benzies et al., 2013; Brett et al., 2011; Landsem et al., 2014). This is an issue, not only concerning families taking care of prematurely born children but possibly also for other children and families at risk.

Conclusion

Our findings confirm that becoming a mother of a preterm infant is an event associated with emotional distress, sometimes independent of the infant's clinical condition severity. Assessing parental sources of stress through NICU hospitalization and subsequent follow-up is essential to promoting parental support, and to increasing parents' awareness of the key role they can play in their child's development. Study results emphasize the importance of understanding the multifactorial antecedents of parenting stress in term mothers too, and consequently planning intervention efforts aimed at supporting mothers during the transition to parenthood. This study also highlights the need to plan follow-up both for infant and for mothers. Help parents to cope with stress, and consider the factors that may be negatively/positively associated with parental stress is necessary to assess how it may affect family functioning and wellbeing.

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Table 1

Demographic, obstetric and neonatal data in the two groups of dyads parents-children

		PRETERM GROUP (20 dyads)	TERM GROUP (20 dyads)	*p value*
Male N (%)		9 (45)	10 (50)	*0.752*
Female N (%)		11 (55)	10 (50)	*0.752*
CS N (%)		18 (90)	4 (20)	***<0.001***
SGA N (%)		3 (15)	2 (10)	*1.000*
IUGR N (%)		3 (15)	-	*0.231*
GA (weeks) Mean (SD)		30.3 (2.75)	39.35(0.81)	***<0.001***
BW (g) Mean (SD)		1282.55 (271.04)	3262.25 (412.69)	***<0.001***
PERI Mean (SD)		9.3 (3.74)	0.3 (0.65)	***<0.001***
NE – abnormal N (%)				
T0		7 (35)	0	***0.008***
T1		3 (15)	0	*0.231*
Maternal Age Mean (SD)		33.7 (4.50)	34.7 (4.61)	*0.4923*
Maternal Education N (%)	**<13 years**	9 (45)	10 (50)	*1.000*
	>=13 years	11 (55)	10 (50)	*1.000*

CS: caesarean section; **SGA**: small for gestational age; **IUGR**: intrauterine growth restriction; **GA**: gestational age at birth; **BW**: birth weight; **PERI**: Perinatal Risk Inventory score; **NE**: neurological examination, t0: birth or (for the preterm infants) 40 weeks of corrected gestational age; t1: 3 months of age (corrected age for the preterm infants)

Table 2

Mothers' psychological variables measured at t0 (in the NICU for preterm group, at birth for at term group) and at t1 (when the child has 3 months of age, corrected age for preterm group)

	t0			t1		
	PRETERM Mothers	TERM Mothers	*p value*	PRETERM Mothers	TERM Mothers	*p value*
EPDS, mean (SD)	11.5 (5.95)	6.95 (4.60)	***0.010***	5.05 (5.02) *	5.95 (3.87)	*0.529*
PND, n (%)	17 (85)	5 (25)	***<0.001***	3 (15)	5 (25)	*0.429*
MSPSS (Total Score), mean (SD)	72,89 (10,79)	73 (8.47)	*0,772*	74,2 (8.55)	71,65 (10.03)	*0,393*
MPAS (Total Score), mean (SD)				84,08 (7.93)	73 (8.47)	*0,621*
PSS:NICU (Total Score), mean (SD)	3.11 (0.98)					
PSS:NICU ≥ 3, n (%)	12 (60)					
SS	2.46 (1.01)					
IBA	3.17 (1.05)					
PRA	3.42 (1.04)					
PSI-SF (Total Score), mean (SD)				41 (9.01)	45,15 (8,49)	*0.184*
PD				21.7 (6.19)	25.2 (8.73)	*0.152*
P-C				15.35 (3.04)	16.55 (3,59)	*0.262*
DC				17.05 (5.31)	18.4 (3.39)	*0.344*

Note: EPDS: Edinburgh Postnatal Depression Scale; **PND**: postnatal depression; **MSPSS**: Multidimensional Scale of Perceived Social Support; **MPAS**: Maternal Postnatal Attachment Scales; **PSS:NICU**: Parental Stressor Scale: Neonatal Intensive Care Unit; **SS**: Sight and Sounds in the NICU; **IBA:** Infant Behaviour and Appearance; **PRA**: Parental Role Alteration; **PSI-SF**: Parenting Stress Index – Short Form; **PD**: Parental Distress; **P-C**: Dysfunctional parent-child interaction; **DC**: Difficult Child

* EPDS in preterm mothers: t0>t1 (***p value< 0.001***)

Significant p-values (<.05) are in bold.

Table 3

Mother-preterm infant dyads (n=20): comparison for maternal psychological characteristics and infant variables between different subgroups according respectively to: PERI values (cut off PERI =10), and normal/abnormal neurological examination at t1.

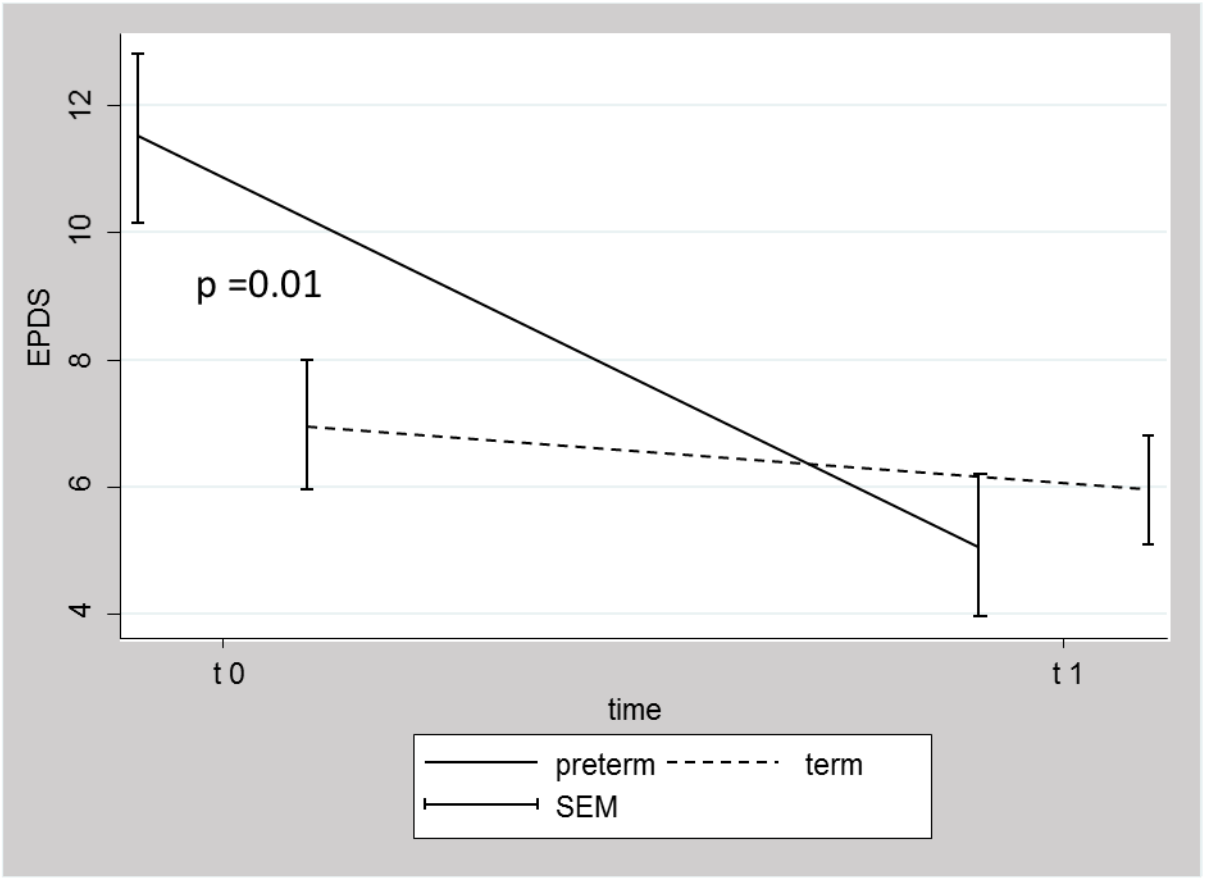
p values for statistically significant differences of the comparisons are reported.

scores	time	PERI score at t0			Neurological examination at t1		
		PERI <10	**PERI ≥ 10**	**p value**	**Normal**	**Abnormal**	**p value**
EPDS	t0	10.75 (5.38)	12.63 (6.95)	0.505	-	-	-
EPDS	t1	3.92 (2.64)	6.75 (7.21)	0.226	5.41 (5.28)	3 (3)	0.458
MSPSS	t0	76.18 (6.62)	68.38 (14.03)	0.122	-	-	-
MSPSS	t1	77 (7.39)	70 (3.15)	0.072	73.82 (8.97)	76.33 (6.66)	0.652
MPAS	t0	84.38 (7.82)	83.64 (3.05)	0.843	83.37 (7.60)	88.13 (10.39)	0.352
PSS:NICU Total Score	t0	2.96 (0.78)	3.34 (0.44)	0.422	3.24 (0.87)	2.38 (1.46)	0.164
PSS:NICU SS	t0	2.19 (0.69)	2.87 (1.32)	0.150	2.55 (0.96)	1.98 (1.42)	0.382
PSS:NICU IBA	t0	2.85 (1.01)	3.66 (0.98)	0.090	3.23 (1.07)	2.87 (1.06)	0.596
PSS:NICU PRA	t0	3.50 (0.91)	3.30 (1.26)	0.696	3.56 (0.89)	2.62 (1.64)	0.149
PSI-SF Total Score	t1	37.67 (7.51)	47 (8.50)	**0.019**	39.53 (7.43)	52 (11.53)	**0.023**
PSI-SF PD	t1	18.83 (4.80)	26 (5.73)	**0.007**	21.06 (6.24)	25.33 (5.51)	0.283
PSI-SF P-C	t1	14.67 (3.26)	16.38 (2.56)	0.229	14.71 (2.76)	19 (2)	**0.020**
PSI-SF DC	t1	15.17 (4.09)	19.88 (5.94)	**0.049**	15.76 (3.82)	24.33 (7.64)	**0.006**

Data are reported as mean and standard deviation.
p values for statistical significance of the comparison between the subgroups ($p < 0.05$) are highlighted in bold

Fig. 1

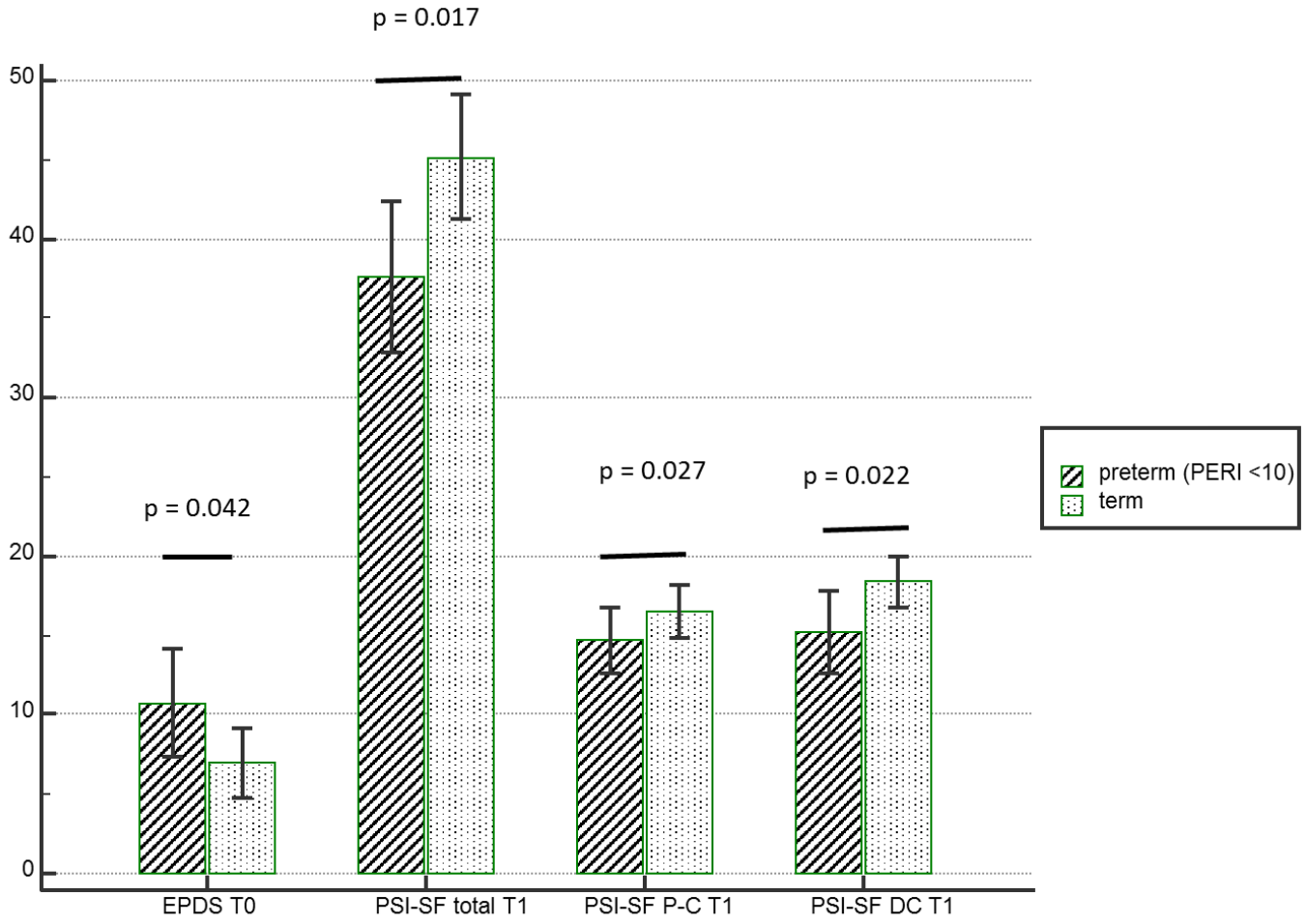
Time series plot: Depression scores reported by the two groups (preterm and term mothers) at the two time points (t0 and t1).



p values for the statistical significance of the comparisons (p<0.05) between groups are reported

Fig. 2

Bar plot: Clustered multiple comparison graph of the following scores: EPDS at t0, PSI-SF at t1 (Total Score, P-C, DC) reported by preterm mothers of infant with PERI score <10 (low perinatal risk) and by the term mothers.



p values for the statistical significance of the comparisons (p<0.05) between groups are reported