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Severity of preterm birth and perinatal depressive symptoms in mothers and fathers: trajectories over the first postpartum year

Introduction[1]

The transition to parenthood ~~marks a major milestone in family development and it~~ involves complex, often stressful, intrapsychic and interpersonal adjustments that can result in increased vulnerability to mental health problems for mothers and fathers (Pinquart and Teubert, 2010). In this context, perinatal depression (PND), the one that emerges during pregnancy and/or within a year after childbirth, is one of the most common, debilitating mental health disease (Patel et al., 2012)~~. Indeed, PND is a serious clinical condition characterized by mood lability, agitation, loss of control, feelings of inadequacy, guilt, fatigue, insomnia, and poor appetite (Monzon et al., 2014)~~, which may significantly impair parental functioning and child development (Letourneau et al., 2012).

According to recent systematic reviews and meta-analyses, approximately 17% of mothers and 10% of fathers meet criteria for PND after childbirth with an increasing prevalence during the first 3 -6 months (Shorey et al., 2017; Cameron et al., 2016).

From a longitudinal perspective, maternal depressive symptoms more frequently peak at around 3 months postpartum for then gradually declining toward the end of the first year (e.g., Paulson et al., 2016; Grekin et al., 2017). The few existing studies on fathers have revealed a similar course (Perren et al., 2005; Vismara et al., 2016; Paulson et al., 2016).

A more recent body of studies have suggested that mothers does not represent a single, homogenous population that follow the same trajectory in symptomatology over time; instead, it is possible to identify at least 3 different PND trajectories across the first year postpartum: one characterized by low symptoms which gradually go into remission, one by moderate symptoms which partially improve, ~~reaching a mild intensity~~, and a last one ~~represented~~ by a worsening of symptoms with a severe and chronic decourse (e.g., Santos et

[1] PND = perinatal depression; FT = full-term; PT = preterm; ELBW = Extremely Low Birth Weight; VLBW = Very Low Birth Weight; LBW = Low Birth Weight; VPT = Very Preterm; EPDS = Edinbugh Postnatal Depression Scale; GCM = Growth Curve Model; MLM = Multilevel Linear Models

al., 2017). Early studies on fathers seem to be in line with these findings (Kiviruusu et al., 2020; Pietikainen et al., 2020).

Also, another line of research has focused on consequences of PND, showing both on a reciprocal influence between mothers and fathers on the levels of depressive symptoms and on their parenting functioning as well, with a more detrimental effect when PND is severe and chronic (e.g., Parfitt et al., 2013; Fredriksen et al., 2019).

The complex interplay of psychological processes, in mothers and fathers, ~~regarding both self-regulation and hetero regulation of mood during the transition to parenthood~~ suggests the importance of monitoring the evolution of parents' depressive symptoms across the postpartum period; this is indeed empirically and clinically relevant to detect the conditions at risk for chronicity, most in need of intervention and support. This consideration becomes further central in case of atypical and vulnerable populations, such those represented by preterm babies and their parents.

The birth of a premature baby (that is occurring before 37 gestational weeks; World Health Organization, 2012) may be a traumatic experience for parents, who have to cope with violated expectations for a healthy infant, early assumption of parental roles, feelings of guilt, and persistent worries about the infant's survival and health (Pisoni et al., 2019). This challenging life event might increase the risk of PND for mothers and fathers; indeed, reported prevalence rates range of 14%–27% for preterm (PT) mothers and of 6%–13% for PT fathers (e.g., Vigod et al., 2010; Helle et al., 2015; Cheng et al., 2016). These symptoms have been recognized as higher than those observed in full-term (FT) mothers and fathers (e.g., Candelori et al., 2015; Ionio et al., 2016; Trumello et al., 2018).

The impact of prematurity on parents could be further enhanced when preterm birth is more severe, i.e., in case of complications during hospitalization (Miceli et al., 2000), low gestational age (Sansavini et al., 2015) and birth weight (Agostini et al., 2014; Morales et al.,

2013; Neri et al., 2015, 2020). In line with previous studies (Agostini et al., 2014; Neri et al., 2015, 2020), the latter criterion seemed to be especially critical for the onset of PND: indeed, the occurrence of PND in mothers of infants with most severe preterm condition, represented by Extremely Low Birth Weight (ELBW; <1000g) infants, was significantly higher compared to mothers of preterm infants with less severe prematurity, represented by Very Low Birth Weight (VLBW; <1500g). Conversely, it did not emerge a similar effect when depressive symptoms in fathers of ELBW and VLBW infants were investigated. To our knowledge, no other studies investigated the effect of birth weight on PND of preterm parents, and especially on fathers~~: giving the worthy and clinical implications, further investigations should be given.~~

Furthermore, the research about the longitudinal course of PND after a preterm birth is still represented by poor empirical literature. At present, two studies (Miles et al., 2007; Poehlmann et al., 2009) have reported that PND in mothers of Low Birth Weight (LBW; <2500g) infants tended to be higher during the first trimester, for gradually declining across the postpartum period. A third study (Pace et al., 2016), focused on the first six months after birth, observed a similar decreasing trend in a sample of mothers and fathers of Very Preterm infants (VPT; <30 gestational weeks) and higher levels of depression, when compared to parents of FT infants. Lastly, the study by Barkmann et al. (2018) detected 5 different trajectories of PND over the postpartum period in a group composed by both parents of VLBW and FT infants, highlighting how a VLBW-birth resulted a significant predictor for parents with constantly elevated depression levels compared to parents with FT infants. The empirical literature on the longitudinal course of PND after a preterm birth needs to be further enhanced, to provide sufficient information about the impact of the severity of prematurity on depressive symptoms in both mothers and fathers over time.

~~Altogether these cross-sectional and longitudinal studies show that a premature birth may increase the risk for PND and that this risk tends to be greater with a higher severity of prematurity, they also highlight the need to especially support high-risk preterm infants' parents, to reduce maternal and paternal depressive risk and the possible negative consequences on parenting. Since the risk for PND may be intensified in case of high-risk preterm condition (e.g., Neri et al., 2020) and the impact of PND on parenting tend to be worse in case of severe, persistent symptomatology (e.g., Fredriksen et al., 2019), it is clinically relevant filling this gap in the literature.~~

Based on these premises, this study aimed at: a) describing the trajectory of depressive symptoms across the first year postpartum; b) investigating how this trajectory changes as function of the severity of prematurity as well as of its interaction with parental role. Coherently with the previous empirical findings in the context of full-term birth (e.g., Pace et al., 2016), we hypothesized that, independently from birth weight and parental role, depressive symptoms trajectory would show a declining trend characterized by higher depressive symptoms levels in the first trimester followed by a reduction in the following months. Regarding the second aim, since no previous studies have explored the trajectories of postpartum depressive symptoms according to the severity of prematurity together with parental role, our investigation intended to be exploratory.

Methods

Participants and procedure

This research project was part of a wider longitudinal study aimed at assessing the characteristics of parenting in mothers and fathers and infants' development from 3-12 months postpartum.

The study participants were 177 families (each composed by 177 mothers, 177 fathers and 177 newborns) recruited according to the following exclusion criteria: presence of parental previous or present psychiatric illness, lack of fluency in Italian, and presence of infant's chromosomal abnormalities, cerebral palsy, malformations and fetopathy.

Of the total sample, 94 couples were parents of preterm infants recruited at Neonatal Intensive Care Unit (NICU) of Bufalini hospital (Cesena, Italy). These parental couples, according to infant birth weight, were differentiated in 38 couples of parents of ELBW infants (with a birth weight < 1000 g) (ELBW families) and in 56 couples with VLBW infants (with a birth weight between 1000 and 1500 g) (VLBW families).

Birth weight was chosen as criterion of severity for categorizing preterm population as it is widely used, in line with Vermont Oxford Network criteria (https://public.vtoxford.org), for premature babies' inclusion in clinical follow up assessments.

The remaining 83 couples (FT families) were parents of FT infants (with a birth weight > 2500 g and gestational age ≥ 37 weeks), recruited at the antenatal classes held in Cesena (Italy) during the third trimester of pregnancy.

Once providing written informed consent, parents were asked to complete an ad hoc questionnaire regarding sociodemographic variables and infant information as well as a self-report questionnaire to assess their mood. The assessments took place at "Anna Martini" University Lab of the Department of Psychology (Bologna) at 3 months (T1), at 9 months (T2), and at 12 months (T3) postpartum (corrected age for preterm infants). Following the Declaration of Helsinki, the Ethical Committee of the Department of Psychology (University of Bologna) accepted the study before its start.

Measures

The Edinburg Postnatal Depression Scale (EPDS).

The EPDS (Cox et al., 1987) is probably the most used self-report questionnaire to screen for depressive symptomatology in both women and men in the perinatal period (e.g., Escriba-Aguir and Artazcoz, 2011).

It is composed by 10 items detecting the presence and severity of perinatal depressive symptoms (i.e., sleeping difficulties, feeling sad, tearfulness, sense of guilty, negativity) during the previous 7 days. Each item is scored from 0–3, providing a total score ranging from 0–30, where higher total scores indicate increasing symptomatology.

An Italian version of EPDS was validated for the assessment of PND on mothers (Benvenuti et al., 1999) and on fathers (Loscalzo et al., (da 3 a 5) 2015). Both maternal and paternal EPDS versions showed good internal consistency (Chronbach's alpha .78; Chronbach's alpha .83, respectively) and the validation studies suggested an optimal cutoff (≥10 for mothers, ≥ 13 for fathers) to screen for postpartum depression.

The EPDS has been already used in previous research to investigate postpartum depressive symptoms trajectories, referring to the continuous scores (e.g., Park et al., 2018). Therefore, according to the aims of the present study, we used the EPDS continuous scores.

Statistical analyses

All statistical analyses were carried out using the IBM SPSS statistical package version 25.0.

Pearson's Chi Square Test and Univariate ANOVA were run to verify the homogeneity regarding of sociodemographic and clinical variables among ELBW, VLBW and FT families.

To determine relevant confounder variables to include in the subsequent analyses, we performed a series of Repeated Measures Analysis of Variance for exploring the impact on EPDS scores of time of assessment (T1, T2 and T3), as within-subjects factor, birth weight (ELBW, VLBW and FT families), parental role (mothers and fathers) and specific parents'

confounder variables (educational level, marital status, age and parity), as between-subjects factors.

Growth Curve Model (GCM) was used to examine trajectories of EPDS as a function of time, birth weight and parental role, controlling for covariates. GCM is a particular application of Multilevel Linear Models (MLM) which is used to analyze longitudinal data (Field, 2004). A strength of MLM is that it does not require a complete data sets because parameters can be estimated successfully with the available data, offering a relatively easy solution to deal with missing data.

Modeling took place in two steps: a within participants (unconditional) phase (Model 1) and a between participants (conditional) phase (Model 2) (Francis et al., 2000).

Model 1 was fit as an unconditional growth model as a function of time for estimating a trajectory of change in depressive symptoms described by two parameters: intercept (depressive symptoms at a specified point time) and slope (the direction and the rate of the change in depressive symptoms over time). In the present study, time was measured in months and the model was centered at the month during which the first data were collected (i.e., at T1) and, therefore, represented parents initial EPDS scores. Moreover, because we considered three repeated measures (i.e., T1, T2, and T3) of outcome variables, analyses were limited to two alternative sets of growth curve models for depressive symptoms (Field, 2014): (1) a linear model with a random intercept and random slopes, which reflects linear change over time; (2) a quadratic model with a random intercept and random slopes, which reflects change that takes on a “U” or inverted “U” shape. To determine the model that best balanced goodness-of-fit and parsimony we used the −2 log likelihood difference test (−2LL) (Singer and Willett, 2003). Model 1 (unconditional growth model) provided a test of whether, on average, intercepts and slopes differed significantly from zero and whether there was variability in parameter estimates across parents. Model 2 was fit as a conditional growth

model for exploring the effect of time-invariant predictors (that is, birth weight and its interaction with parental role), irrespective of covariates, on (a) levels of depressive symptoms at T1 (intercept) and (b) rates of change in depressive symptoms over time (slope). All the predictors in model 2 were dichotomous, therefore separate GCM were conducted for each pair of birth weight groups: first, we compared ELBW families with FT ones, second, we confronted ELBW families with VLBW ones, and then ELBW families with VLBW ones. Significant results were considered when *p* values were lower than 0.05.

Results

Sociodemographic and clinical variables

Preliminary analyses showed that the three birth weight families were homogenous with relation to all sociodemographic and clinical variables, except for maternal education and parity (see Table 1): ELBW mothers, compared to VLBW and FT ones, had lowest level of education, while FT mothers, compared to VLBW and ELBW ones, were nulliparous in a higher percentage. Moreover, as expected, our data showed significant lower scores on birth weight, gestational age for ELBW and VLBW compared to FT groups, higher frequencies of twinning and caesarean section in preterm families (see Table 1).

The analysis of the impact of all sociodemographic and clinical variables on EPDS scores showed only a significant effect for marital status ($F(4,622) = 2.55$, $p < .05$), therefore, this variable was included as confounder variable in the subsequent analyses.

Put Table 1 here

Trajectory of depressive symptoms over time

Coherently with the first aim of the study, we explored the trajectory of EPDS scores as a function of time (model 1), independently from birth weight and parental role.

The −2 log likelihood difference test ($\chi^2(1) = 1.65$, $p < .001$) indicated that, on average, depressive symptoms were best described by a significant, negative linear change over time, indicating a linear pattern ($F(1,168.957) = 14.10$, $p < .001$). There was significant between-subject variability in the intercept parameter (symptom levels at T1) (12.53), but not in the slope ones (.26), indicating the presence of significant individual differences in parents' EPDS scores at the baseline, but not in the rates of change of depressive symptoms over time.

Trajectories of depressive symptoms as a function of birth weight and parental role

In line with the second aim, we explored the trajectories of EPDS scores as a function of birth weight (ELBW vs. FT; ELBW vs. VLBW; VLBW vs. FT) and its interaction with parental role (mothers vs. fathers), controlling for the confounder variable "marital status".

ELBW versus FT families.

As a function of birth weight, results showed that at T1 ELBW parents had higher levels of depressive symptoms than FT ones. Moreover, ELBW parents' EPDS scores showed a significant decrease over time; this pattern of reduction, when confronted with the one observed in FT parents, was consistently higher (about .54 points more) (see Table 2) (see Figure 1a).

As a function of birth weight and parental role, results showed that at T1 ELBW mothers had significantly higher depressive symptoms than FT mothers and FT fathers. Moreover, ELBW mothers reported a significant reduction of depressive symptoms across time, showing a trend of decrease significantly higher than that emerged in FT mothers and FT fathers (about -.52 and -.63 points more, respectively) (see Table 2) (see Figure 1b).

Conversely, at T1 ELBW fathers' EPDS mean score was like that of FT mothers and FT fathers. Also, ELBW fathers showed a significant decrease in depressive symptoms over time, but the rate of change did not differ significantly from FT mothers and FT fathers (see Table 2) (see Figure 1b).

Put Figure 1a/b here

ELBW versus VLBW families.

As a function of birth weight, results highlighted significant higher levels of depressive symptoms at T1 for ELBW parents compared to VLBW ones. In addition, ELBW parents reported a considerable decrease of depressive symptoms over time; this pattern, when compared with that observed in VLBW parents, appeared significantly higher (about .55 points more) (see Table 2) (Figure 2a).

As a function of birth weight and parental role (see Table 2) (see Figure 2b), at T1 ELBW mothers reported higher levels of depressive symptoms compared to VLBW mothers and VLBW fathers. Furthermore, ELBW mothers reported a significant reduction of depressive symptoms over time, with a rate of decrease significantly higher than that observed in VLBW mothers and VLBW fathers (about .71 and .67 points more, respectively).

Comparing ELBW fathers with VLBW mothers and VLBW fathers, results showed no significant differences on the levels of depressive symptoms at T1. Across time, ELBW fathers reported a significant trend of decrease of symptoms, which was like the one observed in VLBW mothers and VLBW fathers (see Table 2) (see Figure 2b).

Put Figure 2a/b here

VLBW versus FT families.

As a function of birth weight, results showed that VLBW and FT parents reported similar levels of depressive symptoms at T1 (the first time point) as well as a similar rate of symptomatology decrease across time (see Table 2) (see Figure 3a).

As a function of birth weight and parental role, VLBW mothers' levels of depressive symptoms at T1 were like those observed in FT mothers and FT fathers. Moreover, across time, results showed a significant trend of decrease in symptoms for VLBW mothers, comparable with that emerged in FT mothers and FT fathers (see Table 2) (see Figure 3b).

Similarly, VLBW fathers, when compared with FT mothers and FT fathers, did not show significant differences in EPDS scores at T1 nor in the significant decreasing pattern of symptoms over time (see Table 2) (see Figure 3b).

Put Figure 3a/b here

Put Table 2 here

Discussion

The aim of this study was to investigate the trajectories of PND across the first postpartum year, by exploring possible differences according to severity of prematurity (ELBW, VLBW and FT families) and parental role (mothers and fathers).

First, as a function of time, GCM analyses showed that the trajectory of depressive symptoms was best described by a significant, negative linear pattern over time, characterized by a peak at 3 months followed by a decrease in the following months. This result, coherently with previous studies on FT (e.g., Paulson et al., 2016; Grekin et al., 2017) and PT mothers and fathers (e.g., Pace et al., 2016; McMahon et al., 2020), suggests that in the first trimester parents may have greater difficulties in emotionally handling the changes connected to the

transition to parenthood for then, in the following months, gradually adapting to the demands of the situation and to their parental role.

As a function of the severity of birth weight, GCM analyses showed that at 3 months ELBW parents had higher levels of depressive symptoms than VLBW and FT parents, while VLBW and FT reported the same scores. These results are partially coherent with a previous cross-sectional study (Pace et al., 2016) whereby in the first trimester VPT parents had higher levels of depressive symptoms than FT ones and could suggest that the risk of PND is related mainly to ELBW birth than to VLBW condition.

Also, the results emerged in term of slope confirmed that ELBW, VLBW and FT parents showed trajectories characterized by a symptoms reduction over time. The decreasing trend of symptomatology shared by our three birth weight groups of parents is coherent with previous findings (Vismara et al., 2016; Pace et al., 2016; Neri et al., 2020). Interestingly, the rate of change was different among the groups: the decrease shown by ELBW parents across the first postpartum year became progressively greater and evident than those observed in VLBW and FT parents, while VLBW and FT parents reported a similar course. These observations are coherent with a recent study's results (Neri et al., 2020).

These findings add further support to the relevance of considering the high-risk group of ELBW parents as a specific clinical population, different from the lower-risk ones (i.e., VLBW), characterized by higher levels of PND in the first trimester and a peculiar trend of depressive symptoms across time. Clinically, these results suggest that in the first months after birth, given the more stressful scenario in which the transition to parenthood happens, parents of severely preterm babies may be particularly at risk for developing PND; that special clinical attention should be paid to them by planning early assessment for detecting the most severe cases to include in early interventions programs; besides, systematic longitudinal assessments should be programmed for detecting cases at risk for chronicity.

As a function of the interaction between birth weight and parental role, GCM analyses suggested a detailed clinical picture.

First and foremost, in line with previous findings (e.g., Perren et al., 2005; Paulson et al., 2016), mothers and fathers, independently from birth weight, shared a decreasing trend in PND, strengthening the observation whereby parents, even in case of stressful situation, tend to be equipped with the emotional and psychological resources for handling, and adapting, to the changes required by the transition to parenthood.

In addition, our results showed that ELBW mothers had significant higher levels of depressive symptoms at 3 months along with a higher rate of reduction in their severity across time compared to VLBW and FT groups, both mothers and fathers. Differently, VLBW mothers reported comparable levels of PND at 3 months to FT mothers and fathers and a similar decreasing pattern across time.

Regarding to the comparison among mothers, most of the studies have compared PT mothers or one specific category of PT mothers (e.g., VPT) with FT ones through cross-sectional design, showing higher levels of depressive symptoms for preterm condition (e.g., Candelori et al., 2015; Helle et al., 2015). Differently, not many studies (Agostini et al., 2014; Trumello et al., 2018; Neri et al., 2015, 2020) have included mothers of babies with different degrees of prematurity, often focusing on early assessment of PND and finding results are in line with our observation. Only one study (Neri et al., 2020) have explored the PND longitudinal course, detecting no considerable differences among ELBW, VLBW and FT mothers. This study's results are in line with our observation whereby the course of PND in VLBW and FT mothers is comparable, but they are in contrast with the higher rate of PND decreasing showed by ELBW mothers, when compared to VLBW and FT ones. The partial inconsistency of these results may be explained by the heterogeneity of the methodology used to compare groups: repeated measures ANOVA, able to detect differences on PND'

symptoms across different time points, were performed by Neri et al. (2020), while GCM, able to detect differences in the direction and in the rate of the change over time of PND, were used in this study.

These findings put in evidence that ELBW mothers represent the condition at highest risk for PND at 3 months postpartum. This period is already well recognized by the literature as the one in which PND usually more frequently occurs (Poehlmann et al., 2009). Anyway, when we considered the postpartum course of symptomatology, it is relevant to notice that this group showed the most significant reduction of symptoms, compared to VLBW and FT groups, reaching almost the same level of these two groups. Clinically, this suggests that, after the first months where coping with the birth of a severely preterm baby may impact on the emotional adjustment, in the following months mothers are more able to emotionally cope and regulate themselves, showing resilient behaviours and adapting to the demands of the situation (Provenzi et al., 2016). Also, these findings put in evidence that a VLBW-birth seems to expose less to the risk of developing PND in mothers which, when compared to FT groups, showed comparable levels of PND at 3 months and a similar decreasing trajectory through the year. Again, we suppose that, differently from a higher risk preterm condition, a VLBW-birth might be a less stressful event for mothers that seem to be able to emotionally handle the parenting since the first months after birth.

It is worth specifying that our PT mothers were recruited at the NICU of Bufalini hospital (Cesena, Italy), where treatment encompasses modern care principles, encouraging kangaroo care, early breastfeeding, parental participation in baby care and unrestricting visiting. Care interventions were provided also after discharge, through follow-up meetings for monitoring and, in case of need, supporting maternal emotional and psychological well-being. Therefore, as suggested by empirical literature (Bergström et al., 2012), the resilience process shown by our preterm mothers could have been enhanced by the specific NICU care intervention.

Giving the lack of studies on this field, these hypotheses should be verified by further investigations.

Furthermore, the higher levels of PND shown by ELBW mothers at 3 months in comparison with VLBW and FT fathers are in line with previous results whereby mothers were more depressed than fathers in the postpartum period (e.g., Vismara et al., 2016; Chhabra and McDermott, 2020). Nevertheless, we found this difference only in case of ELBW mothers, confirming the high risk of these condition.

Lastly, our results showed that ELBW fathers reported comparable levels of PND at 3 months to VLBW and FT groups and a similar decreasing trend across time. The same similarity emerged between VLBW fathers and FT group.

Regarding to the comparison among fathers, the few existing cross-sectional studies have compared PT fathers or one specific category of PT fathers (e.g., VPT) with FT ones, showing higher levels of PND for preterm population (Helle et al., 2015; Cheng et al., 2016). Differently, only one longitudinal study (Neri et al., 2020) has compared fathers of preterm infants with different condition of severity showing, in line with our findings, no differences in postpartum PND levels among ELBW, VLBW and FT fathers. The inconsistency of the results about the risk for paternal PND in case of prematurity, and according to its severity, does not allow to draw specific conclusion and does highlight the need of further investigation on the field.

Globally, the results of this study highlight that birth weight, as an indicator of severity of prematurity, might be considered an important signal in the complex set of bio-psycho-social factors leading to the development of depressive profiles as well as a prognostic factor for mental health of parents. Also, they suggest that, according to severity, a premature birth may have a different impact on the emotional and psychological well-being of mothers which, in case of more serious condition, may be more exposed to the risk of PND. Clinically, these

findings might help to plan intervention programs for mothers differentiated in relation to the severity of their babies' prematurity; particularly, mothers at higher risk, besides the NICU's care interventions, could benefit from tailored treatments for reducing symptomatology and for sustaining parenting, and from follow-up assessments for monitoring the course of symptoms. Also, mothers at lower risk, given their higher resources, might be sufficiently sustained by the NICU's care interventions, and from follow-up assessments for detecting the most severe cases, at risk for chronicity (Barkmann et al., 2018), for which furthers treatments are required.

In addition, this study's findings highlight a general reduction of depressive symptoms over time, particularly for mothers at highest risk, suggesting that, even if they gave birth to severely preterm babies, they showed resilience over time. In this context, promptly interventions for treating symptoms and for supporting parenting may foster and enhance these resilience' capacities, also preventing the risk for chronicity (Santos et al., 2017).

To sum up, these findings strengthen the relevance of considering the severity of prematurity when the impact of a preterm birth on parents' psychological variables is investigated as well as the centrality of differentiating the interventions, and consequently social policies and resource allocation, according to the risk connected to the severity of preterm condition.

Limitations

This is one of the first research focused on the longitudinal monitoring of PND in mothers and fathers of high-and-low risk preterm condition in the first year after birth. So, this study's findings will contribute to fulfill the gap in literature on the impact of the severity of prematurity on the postpartum course of PND, given it is recognized as a risk factor for parental functioning and child development (Letourneau et al., 2012).

This study clearly has some limitations that need to be considered. First, the results need to be confirmed on wider sample, also reaching a similar size among groups. Second, we assessed PND by a self-report tool (EPDS): given the well-known limitations of this kind of measures, it may be useful for further studies to use also a structured clinical interview. Also, the EPDS for fathers seems more appropriate in detecting a general level of distress, rather than perinatal depression (Matthey and Agostini, 2017); these characteristics could possibly explain why we found low levels of depressive symptoms in fathers, even in case of severely preterm ones. Third, we did not explore the potential contribution of prenatal factors (e.g., prenatal visit frequency, clinic visit interval, length of hospital stay before delivery etc..) in affecting PND intensity and course. Fourth, we did not investigate the presence of anxious symptoms, which often occur in comorbidity with depressive symptoms (O'Hara and Wisner, 2014). Besides, we did not explore the potential role played by the NICU support on parental PND (Bergström et al., 2012). All these variables need to be considered for their possible influences on the outcomes of the study.

Nevertheless, given the paucity of the studies on maternal and paternal course of PND in prematurity, results of this study shed new light on this field of the research and would benefit of a confirmation by further investigations.

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References

Agostini, F., Neri, E., Dellabartola, S., Biasini, A., Monti, F., 2014. Early interactive behaviours in preterm infants and their mothers: Influences of maternal depressive symptomatology and neonatal birth weight. Infant Behav. Dev. 37, 86–93. https://doi.org/10.1016/j.infbeh.2013.12.003

Barkmann, C., Helle, N., Bindt, C., 2018. Is very low infant birth weight a predictor for a five-year course of depression in parents? A latent growth curve model. J. Affect. Disord. 229, 415–420. https://doi.org/https://doi.org/10.1016/j.jad.2017.12.020

Baron, E., Bass, J., Murray, S.M., Schneider, M., Lund, C., 2017. A systematic review of growth curve mixture modelling literature investigating trajectories of perinatal depressive symptoms and associated risk factors. J. Affect. Disord. 223, 194–208. https://doi.org/10.1016/j.jad.2017.07.046

Benvenuti, P., Ferrara, M., Niccolai, C., Valoriani, V., Cox, J.L., 1999. The Edinburgh Postnatal Depression Scale: Validation for an Italian sample. J. Affect. Disord. 53, 137–141. https://doi.org/10.1016/S0165-0327(98)00102-5

Bergström, E.B., Wallin, L., Thomson, G., Flacking, R., 2012. Postpartum depression in mothers of infants cared for in a Neonatal Intensive Care Unit - Incidence and associated factors. J. Neonatal Nurs. 18, 143–151. https://doi.org/10.1016/j.jnn.2011.11.001

Bowen, A., Bowen, R., Butt, P., Rahman, K., Muhajarine, N., 2012. Patterns of depression and treatment in pregnant and postpartum women. Can. J. Psychiatry 57, 161–167. https://doi.org/10.1177/070674371205700305

Brandon, D.H., Tully, K.P., Silva, S.G., Malcolm, W.F., Murtha, A.P., Turner, B.S., Holditch-Davis, D., 2011. Emotional Responses of Mothers of Late-Preterm and Term Infants. JOGNN - J. Obstet. Gynecol. Neonatal Nurs. 40, 719–731. https://doi.org/10.1111/j.1552-6909.2011.01290.x

Cameron, E.E., Sedov, I.D., Tomfohr-Madsen, L.M., 2016. Prevalence of paternal depression in pregnancy and the postpartum: An updated meta-analysis. J. Affect. Disord. 206, 189–203. https://doi.org/10.1016/j.jad.2016.07.044

Canário, C., Figueiredo, B., 2017. Anxiety and depressive symptoms in women and men from early pregnancy to 30 months postpartum. J. Reprod. Infant Psychol. 35, 431–449. https://doi.org/10.1080/02646838.2017.1368464

Candelori, C., Trumello, C., Babore, A., Keren, M., Romanelli, R., 2015. The experienceof premature birth for fathers: The application of the Clinical Interview for Parents of High-Risk Infants (CLIP) to an Italian sample. Front. Psychol. 6, 1–9. https://doi.org/10.3389/fpsyg.2015.01444

Carter, J.D., Mulder, R.T., Bartram, A.F., Darlow, B.A., 2005. Infants in a neonatal intensive care unit: Parental response. Arch. Dis. Child. Fetal Neonatal Ed. 90, 109–113. https://doi.org/10.1136/adc.2003.031641

Cheng, E.R., Kotelchuck, M., Gerstein, E.D., Taveras, E.M., Poehlmann-tynan, J., 2016. Postnatal Depressive Symptoms Among Mothers and Fathers of Early Cognitive Function 37, 33–42.

Chhabra, J., McDermott, B., Li, W., 2020. Risk Factors for Paternal Perinatal Depression and Anxiety: A Systematic Review and Meta-Analysis. Psychol. Men Masculinity 21, 593–611. https://doi.org/10.1037/men0000259

Cox, J.L., Holden, J.M., Sagovsky, R., 1987. Detection of Postnatal Depression: Development of the 10-item Edinburgh Postnatal Depression scale. Br. J. Psychiatry 150, 782–786. https://doi.org/10.1192/bjp.150.6.782

Cox, J., 2019. Thirty years with the Edinburgh Postnatal Depression Scale: Voices from the past and recommendations for the future. Br. J. Psychiatry 214, 127–129. https://doi.org/10.1192/bjp.2018.245

Davis, L., Edwards, H., Mohay, H., Wollin, J., 2003. The impact of very premature birth on the psychological health of mothers. Early Hum. Dev. 73, 61–70. https://doi.org/10.1016/S0378-3782(03)00073-2

Deave, T., Johnson, D., Ingram, J., 2008. Transition to parenthood: The needs of parents in pregnancy and early parenthood. BMC Pregnancy Childbirth 8, 1–11. https://doi.org/10.1186/1471-2393-8-30

Drozd, F., Haga, S.M., Valla, L., Slinning, K., 2018. Latent trajectory classes of postpartum depressive symptoms: A regional population-based longitudinal study. J. Affect. Disord. 241, 29–36. https://doi.org/10.1016/j.jad.2018.07.081

Escribà-Agüir, V., Artazcoz, L., 2011. Gender differences in postpartum depression: A longitudinal cohort study. J. Epidemiol. Community Health 65, 320–326. https://doi.org/10.1136/jech.2008.085894

Field, A., 2014. Discovering Statistic Using IBM SPSS Statistics, fourth ed. SAGE Publication, London.

Fisher, S.D., Sit, D.K., Yang, A., Ciolino, J.D., Gollan, J.K., Wisner, K.L., 2019. Four maternal characteristics determine the 12-month course of chronic severe postpartum depressive symptoms. Depress. Anxiety 36, 375–383. https://doi.org/10.1002/da.22879

Flykt, M., Kanninen, K., Sinkkonen, J., Punamäki, R.-L., 2010. Maternal depression and dyadic interaction: the role of maternal attachment style. Infant Child Dev. 19, 530–550. https://doi.org/https://doi.org/10.1002/icd.679

Francis, D.J., Schatschneider, C., Carlson, C.D., 2000. Introduction to Individual Growth Curve Analysis, in: In D. Drotar (Ed.), Issues in clinical child psychology. Handbook of research in pediatric and clinical child psychology: Practical strategies and methods. Kluwer Academic Publishers, pp. 51-57. https://doi.org/10.1007/978-1-4615-4165-3_3

Fredriksen, E., von Soest, T., Smith, L., Moe, V., 2019. Depressive symptom contagion in the transition to parenthood: Interparental processes and the role of partner-related attachment. J. Abnorm. Psychol. 128, 397–403. https://doi.org/10.1037/abn0000429

Garfield, C.F., Duncan, G., Rutsohn, J., McDade, T.W., Adam, E.K., Coley, R.L., Chase-Lansdale, P.L., 2014. A longitudinal study of paternal mental health during transition to fatherhood as young adults. Pediatrics 133, 836–843. https://doi.org/10.1542/peds.2013-3262

Gavin, N.I., Gaynes, B.N., Lohr, K.N., Meltzer-Brody, S., Gartlehner, G., Swinson, T., 2005. Perinatal depression: a systematic review of prevalence and incidence. Obstet. Gynecol. 106, 1071—1083. https://doi.org/10.1097/01.aog.0000183597.31630.db

Grekin, R., Brock, R.L., O'Hara, M.W., 2017. The effects of trauma on perinatal depression: Examining trajectories of depression from pregnancy through 24 months postpartum in an at-risk population. J. Affect. Disord. 218, 269–276. https://doi.org/10.1016/j.jad.2017.04.051

Helle, N., Barkmann, C., Bartz-Seel, J., Diehl, T., Ehrhardt, S., Hendel, A., Nestoriuc, Y., Schulte-Markwort, M., Von Der Wense, A., Bindt, C., 2015. Very low birth-weight as a risk factor for postpartum depression four to six weeks postbirth in mothers and fathers:

Cross-sectional results from a controlled multicentre cohort study. J. Affect. Disord. 180, 154–161. https://doi.org/10.1016/j.jad.2015.04.001

Ierardi, E., Ferro, V., Trovato, A., Tambelli, R., Riva Crugnola, C., 2019. Maternal and paternal depression and anxiety: their relationship with mother-infant interactions at 3 months. Arch. Womens. Ment. Health 22, 527–533. https://doi.org/10.1007/s00737-018-0919-x

Ionio, C., Colombo, C., Brazzoduro, V., Mascheroni, E., Confalonieri, E., Castoldi, F., Lista, G., 2016. Mothers and fathers in nicu: The impact of preterm birth on parental distress. Eur. J. Psychol. 12, 604–621. https://doi.org/10.5964/ejop.v12i4.1093

Kiviruusu, O., Pietikäinen, J.T., Kylliäinen, A., Pölkki, P., Saarenpää-Heikkilä, O., Marttunen, M., Paunio, T., Paavonen, E.J., 2020. Trajectories of mothers' and fathers' depressive symptoms from pregnancy to 24 months postpartum. J. Affect. Disord. 260, 629–637. https://doi.org/https://doi.org/10.1016/j.jad.2019.09.038

Letourneau, N.L., Dennis, C.-L., Benzies, K., Duffett-Leger, L., Stewart, M., Tryphonopoulos, P.D., Este, D., Watson, W., 2012. Postpartum Depression is a Family Affair: Addressing the Impact on Mothers, Fathers, and Children. Issues Ment. Health Nurs. 33, 445–457. https://doi.org/10.3109/01612840.2012.673054

Loscalzo, Y., Giannini, M., Contena, B., Gori, A., Benvenuti, P., 2015. The Edinburgh Postnatal Depression Scale for Fathers: A contribution to the validation for an Italian sample. Gen. Hosp. Psychiatry 37, 251–256. https://doi.org/10.1016/j.genhosppsych.2015.02.002

Massoudi, P., Hwang, C.P., Wickberg, B., 2013. How well does the Edinburgh Postnatal Depression Scale identify depression and anxiety in fathers? A validation study in a population based Swedish sample. J. Affect. Disord. 149, 67–74. https://doi.org/https://doi.org/10.1016/j.jad.2013.01.005

Matthey, S., 2008. Using the Edinburgh Postnatal Depression Scale to screen for anxiety disorders. Depress. Anxiety 25, 926–931. https://doi.org/https://doi.org/10.1002/da.20415

Matthey, S., Agostini, F., 2017. Using the Edinburgh Postnatal Depression Scale for women and men—some cautionary thoughts. Arch. Womens. Ment. Health 20, 345–354. https://doi.org/10.1007/s00737-016-0710-9

Matthey, S., Barnett, B., Ungerer, J., Waters, B., 2000. Paternal and maternal depressed mood during the transition to parenthood. J. Affect. Disord. 60, 75–85. https://doi.org/https://doi.org/10.1016/S0165-0327(99)00159-7

McMahon, G.E., Anderson, P.J., Giallo, R., Pace, C.C., Cheong, J.L., Doyle, L.W., Spittle, A.J., Spencer-Smith, M.M., Treyvaud, K., 2020. Mental Health Trajectories of Fathers Following Very Preterm Birth: Associations With Parenting. J. Pediatr. Psychol. 45, 725–735. https://doi.org/10.1093/jpepsy/jsaa041

Miceli, P.J., Goeke-Morey, M.C., Whitman, T.L., Kolberg, K.S., Miller-Loncar, C., White, R.D., 2000. Brief Report : Birth Status, Medical Complications, and Social Environment : Individual Differences in Development of Preterm, Very Low Birth Weight Infants. J. Pediatr. Psychol. 25, 353–358. https://doi.org/10.1093/jpepsy/25.5.353

Miles, M.S., Holditch-Davis, D., Schwartz, T.A., Scher, M., 2007. Depressive Symptoms in Mothers of Prematurely Born Infants. J. Dev. Behav. Pediatr. 28, 36-44. https://doi.org/10.1097/01.DBP.0000257517.52459.7a

Molgora, S., Fenaroli, V., Malgaroli, M., Saita, E., 2016. Trajectories of Postpartum Depression in Italian First-Time Fathers. Am. J. Mens. Health 11, 880–887. https://doi.org/10.1177/1557988316677692

Monzon, C., di Scalea, T.L., Pearlstein, T., 2014. Postpartum psychosis: updates and clinical issues. Psych. Times 31, 26-26

Morales, M.R., Polizzi, C., Sulliotti, G., Mascolino, C., Perricone, G., 2013. Early precursors of low attention and hyperactivity in moderately and very preterm children at preschool age. Pediatr. Rep. 5, 76–80. https://doi.org/10.4081/pr.2013.e18

Morey, J.A., Gregory, K., 2012. Nurse-Led Education Mitigates Maternal Stress and Enhances Knowledge in the NICU. MCN Am. J. Matern. Nurs. 37, 182–191. https://doi.org/10.1097/NMC.0b013e31824b4549

Moss, K.M., Skouteris, H., Wertheim, E.H., Paxton, S.J., Milgrom, J., 2009. Depressive and anxiety symptoms through late pregnancy and the first year post birth: an examination of prospective relationships. Arch. Womens. Ment. Health 12, 345-359. https://doi.org/10.1007/s00737-009- 0086-1

Neri, E., Agostini, F., Baldoni, F., Facondini, E., Biasini, A., Monti, F., 2017. Preterm infant development, maternal distress and sensitivity: The influence of severity of birth weight. Early Hum. Dev. 106–107, 19–24. https://doi.org/https://doi.org/10.1016/j.earlhumdev.2017.01.011

Neri, E., Agostini, F., Salvatori, P., Biasini, A., Monti, F., 2015. Mother-preterm infant interactions at 3 months of corrected age: influence of maternal depression, anxiety and neonatal birth weight. Front. Psychol. 6, 1234. https://doi.org/10.3389/fpsyg.2015.01234

Neri, E., Giovagnoli, S., Genova, F., Benassi, M., Stella, M., Agostini, F., 2020. Reciprocal Influence of Depressive Symptoms Between Mothers and Fathers During the First Postpartum Year: A Comparison Among Full-Term, Very Low, and Extremely Low Birth Weight Infants. Front. Psychiatry. 11, 578264. https://doi.org/10.3389/fpsyt.2020.578264

O'Hara, M.W., Wisner, K.L., 2014. Perinatal mental illness: Definition, description and aetiology. Best Pract. Res. Clin. Obstet. Gynaecol. 28, 3–12. https://doi.org/https://doi.org/10.1016/j.bpobgyn.2013.09.002

Pace, C.C., Spittle, A.J., Molesworth, C.M.L., Lee, K.J., Northam, E.A., Cheong, J.L.Y., Davis, P.G., Doyle, L.W., Treyvaud, K., Anderson, P.J., 2016. Evolution of depression and anxiety symptoms in parents of very preterm infants during the newborn period. JAMA Pediatr. 170, 863–870. https://doi.org/10.1001/jamapediatrics.2016.0810

Parfitt, Y., Pike, A., Ayers, S., 2013. The impact of parents' mental health on parent–baby interaction: A prospective study. Infant Behav. Dev. 36, 599–608. https://doi.org/https://doi.org/10.1016/j.infbeh.2013.06.003

Park, M., Brain, U., Grunau, R.E., Diamond, A., Oberlander, T.F., 2018. Maternal depression trajectories from pregnancy to 3 years postpartum are associated with children's behavior and executive functions at 3 and 6 years. Arch. Womens. Ment. Health 21, 353–363. https://doi.org/10.1007/s00737-017-0803-0

Patel, M., Bailey, R.K., Jabeen, S., Ali, S., Barker, N.C., Osiezagha, K., 2012. Postpartum depression: A review. J. Health Care Poor Underserved 23, 534–542. https://doi.org/10.1353/hpu.2012.0037

Paulson, J.F., Bazemore, S.D., Goodman, J.H., Leiferman, J.A., 2016. The course and interrelationship of maternal and paternal perinatal depression. Arch. Womens. Ment. Health 19, 655–663. https://doi.org/10.1007/s00737-016-0598-4

Paulson, J.F., Dauber, S., Leiferman, J.A., 2006. Individual and Combined Effects of Postpartum Depression in Mothers and Fathers on Parenting Behavior. Pediatrics 118, 659-668. https://doi.org/10.1542/peds.2005-2948

Perren, S., von Wyl, A., Bürgin, D., Simoni, H., von Klitzing, K., 2005. Intergenerational Transmission of Marital Quality Across the Transition to Parenthood. Fam. Process 44, 441–459. https://doi.org/https://doi.org/10.1111/j.1545-5300.2005.00071.x

Pietikäinen, J.T., Kiviruusu, O., Kylliäinen, A., Pölkki, P., Saarenpää-Heikkilä, O., Paunio, T., Paavonen, E.J., 2020. Maternal and paternal depressive symptoms and children's emotional problems at the age of 2 and 5 years: a longitudinal study. J. Child Psychol. Psychiatry 61, 195–204. https://doi.org/https://doi.org/10.1111/jcpp.13126

Pinquart, M., Teubert, D., 2010. Effects of parenting education with expectant and new parents: a meta-analysis. J. Fam. Psychol. JFP J. Div. Fam. Psychol. Am. Psychol. Assoc. (Division 43) 24, 316–327. https://doi.org/10.1037/a0019691

Pisoni, C., Spairani, S., Manzoni, F., Ariaudo, G., Naboni, C., Moncecchi, M., Balottin, U., Tinelli, C., Gardella, B., Tzialla, C., Stronati, M., Bollani, L., Orcesi, S., 2019. Depressive symptoms and maternal psychological distress during early infancy: A pilot study in preterm as compared with term mother–infant dyads. J. Affect. Disord. 257, 470–476. https://doi.org/https://doi.org/10.1016/j.jad.2019.07.039

Poehlmann, J., Schwichtenberg, A.J.M., Bolt, D., Dilworth-Bart, J., 2009. Predictors of depressive symptom trajectories in mothers of preterm or low birth weight infants. J. Fam. Psychol. JFP J. Div. Fam. Psychol. Am. Psychol. Assoc. (Division 43) 23, 690–704. https://doi.org/10.1037/a0016117

Provenzi, L., Olson, K.L., Montirosso, R., Tronick, E., 2016. Infants, mothers, and dyadic contributions to stability and prediction of social stress response at 6 months. Dev. Psychol. 52, 1–8. https://doi.org/10.1037/dev0000072

Quist, M., Kaciroti, N., Poehlmann-Tynan, J., Weeks, H.M., Asta, K., Singh, P., Shah, P.E., 2019. Interactive Effects of Infant Gestational Age and Infant Fussiness on the Risk

of Maternal Depressive Symptoms in a Nationally Representative Sample. Acad. Pediatr. 19, 917–924. https://doi.org/10.1016/j.acap.2019.02.015

Ramchandani, P., Stein, A., Evans, J., O'Connor, T.G., 2005. Paternal depression in the postnatal period and child development: a prospective population study. Lancet (London, England) 365, 2201–2205. https://doi.org/10.1016/S0140-6736(05)66778-5

Sansavini, A., Zavagli, V., Guarini, A., Savini, S., Alessandroni, R., Faldella, G., 2015. Dyadic co-regulation, affective intensity and infant's development at 12 months: A comparison among extremely preterm and full-term dyads. Infant Behav. Dev. 40, 29–40. https://doi.org/https://doi.org/10.1016/j.infbeh.2015.03.005

Santos, H., Tan, X., Salomon, R., 2017. Heterogeneity in perinatal depression: how far have we come? A systematic review. Arch. Womens. Ment. Health 20, 11–23. https://doi.org/10.1007/s00737-016-0691-8

Sethna, V., Murray, L., Edmondson, O., Iles, J., Ramchandani, P.G., 2018. Depression and playfulness in fathers and young infants: A matched design comparison study. J. Affect. Disord. 229, 364–370. https://doi.org/https://doi.org/10.1016/j.jad.2017.12.107

Sethna, V., Murray, L., Netsi, E., Psychogiou, L., Ramchandani, P.G., 2015. Paternal Depression in the Postnatal Period and Early Father–Infant Interactions. Parenting 15, 1–8. https://doi.org/10.1080/15295192.2015.992732

Shorey, S., Chee, C.Y.I., Ng, E.D., Chan, Y.H., Tam, W.W.S., Chong, Y.S., 2018. Prevalence and incidence of postpartum depression among healthy mothers: A systematic review and meta-analysis. J. Psychiatr. Res. 104, 235–248. https://doi.org/https://doi.org/10.1016/j.jpsychires.2018.08.001

Silverstein, M., Feinberg, E., Cabral, H., Sauder, S., Egbert, L., Schainker, E., Kamholz, K., Hegel, M., Beardslee, W., 2011. Problem-solving education to prevent depression

among low-income mothers of preterm infants: a randomized controlled pilot trial. Arch. Womens. Ment. Health 14, 317–324. https://doi.org/10.1007/s00737-011-0222-6

Singer, J.D., Willett, J.B., 2003. Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence. Oxford University Press, New York. https://doi.org/10.1093/acprof:oso/9780195152968.001.0001

Stein, A., Pearson, R.M., Goodman, S.H., Rapa, E., Rahman, A., McCallum, M., Howard, L.M., Pariante, C.M., 2014. Effects of perinatal mental disorders on the fetus and child. Lancet (London, England) 384, 1800–1819. https://doi.org/10.1016/S0140-6736(14)61277-0

Trumello, C., Candelori, C., Cofini, M., Cimino, S., Cerniglia, L., Paciello, M., Babore, A., 2018. Mothers' depression, anxiety, and mental representations after preterm birth: A study during the infant's hospitalization in a neonatal intensive care unit. Front. Public Heal. 6, 1–9. https://doi.org/10.3389/fpubh.2018.00359

Vesga-López, O., Blanco, C., Keyes, K., Olfson, M., Grant, B.F., Hasin, D.S., 2008. Psychiatric Disorders in Pregnant and Postpartum Women in the United States. Arch. Gen. Psychiatry 65, 805–815. https://doi.org/10.1001/archpsyc.65.7.805

Vigod, S.N., Villegas, L., Dennis, C.-L., Ross, L.E., 2010. Prevalence and risk factors for postpartum depression among women with preterm and low-birth-weight infants: a systematic review. BJOG An Int. J. Obstet. Gynaecol. 117, 540–550. https://doi.org/https://doi.org/10.1111/j.1471-0528.2009.02493.x

Vismara, L., Rollè, L., Agostini, F., Sechi, C., Fenaroli, V., Molgora, S., Neri, E., Prino, L.E., Odorisio, F., Trovato, A., Polizzi, C., Brustia, P., Lucarelli, L., Monti, F., Saita, E., Tambelli, R., 2016. Perinatal parenting stress, anxiety, and depression outcomes in first-time mothers and fathers: A 3-to 6-months postpartum follow-up study. Front. Psychol. 7, 1–10. https://doi.org/10.3389/fpsyg.2016.00938

World Health Organization, 2012. Born Too Soon: The Global Action Report on Preterm Birth. World Health Organization, Geneva.

Wu, Y.P., Selig, J.P., Roberts, M.C., Steele, R.G., 2011. Trajectories of Postpartum Maternal Depressive Symptoms and Children's Social Skills. J. Child Fam. Stud. 20, 414–423. https://doi.org/10.1007/s10826-010-9407-2

Yang, S., Yang, R., Liang, S., Wang, J., Weaver, N.L., Hu, K., Hu, R., Trevathan, E., Huang, Z., Zhang, Y., Yin, T., Chang, J.J., zhao, J., Shen, L., Dong, G., Zheng, T., Xu, S., Qian, Z., Zhang, B., 2017. Symptoms of anxiety and depression during pregnancy and their association with low birth weight in Chinese women: a nested case control study. Arch. Womens. Ment. Health 20, 283–290. https://doi.org/10.1007/s00737-016-0697-2

Table 1

Descriptive Statistics for Families according to birth weight

	ELBW families (n = 38)	VLBW families (n = 56)	FT families (n = 83)	F/X^2
Parental variables				
Maternal age in years [a]	34.5 (5.1) [a]	35.1 (5.5) [a]	33.1 (4.9) [a]	2.95
Paternal age in years [a]	36.9 (5.1) [a]	37.5 (5.7) [a]	35.7 (5.2) [a]	2.00
Maternal education [b]				7.32***
Primary/Secondary school	9 (25) [b]	4 (7) [b]	8 (10) [b]	
High school/University	29 (75) [b]	52 (93) [b]	75 (90) [b]	
Paternal education [b]				5.93
Primary/Secondary school	14 (39) [b]	9 (16) [b]	20 (24) [b]	
High school/University	24 (61) [b]	47 (84) [b]	63 (76) [b]	
Marital status [b]				0.69
Married	20 (54) [b]	32 (57) [b]	50 (62) [b]	
Other	18 (46) [b]	24 (43) [b]	33 (38) [b]	
Parity [b]				16.53***
Nulliparous	27 (71) [b]	33 (59) [b]	72 (89) [b]	
Multiparous	11 (29) [b]	23 (41) [b]	11 (11) [b]	
Infant variables				
Gender [b]				3.74
Male	19 (50) [b]	36 (64) [b]	40 (48) [b]	
Female	19 (50) [b]	20 (36) [b]	43 (52) [b]	
Birth weight in grams [a]	818.9 (122.6) [a]	1305.66 (145.3) [a]	3489.25 (457.7) [a]	1173.68***
Gestational age in weeks [a]	27.3 (1.9) [a]	30.20 (2.1) [a]	40.07 (1.1) [a]	1000.56***
Type of delivery [b]				42.50***
Spontaneous	10 (29) [b]	14 (26) [b]	64 (77) [b]	
Caesarean section	28 (71) [b]	42 (74) [b]	19 (23) [b]	
Twinning [b]				21.19***
Yes	4 (10) [b]	16 (29) [b]	2 (3) [b]	
Not	34 (90) [b]	40 (71) [b]	81 (98) [b]	

Note. ELBW = Extremely Low Birth Weight; VLBW = Very Low Birth Weight; FT = Full-Term.

[a] Means (and standard deviations in parentheses) for interval data. [b] Number (and % in parentheses) for categorical data.

*p < .05. **p < .01. ***p < .001.

Table 2

Model 2 (centered at 3 months) for EPDS scores in ELBW, VLBW and FT families

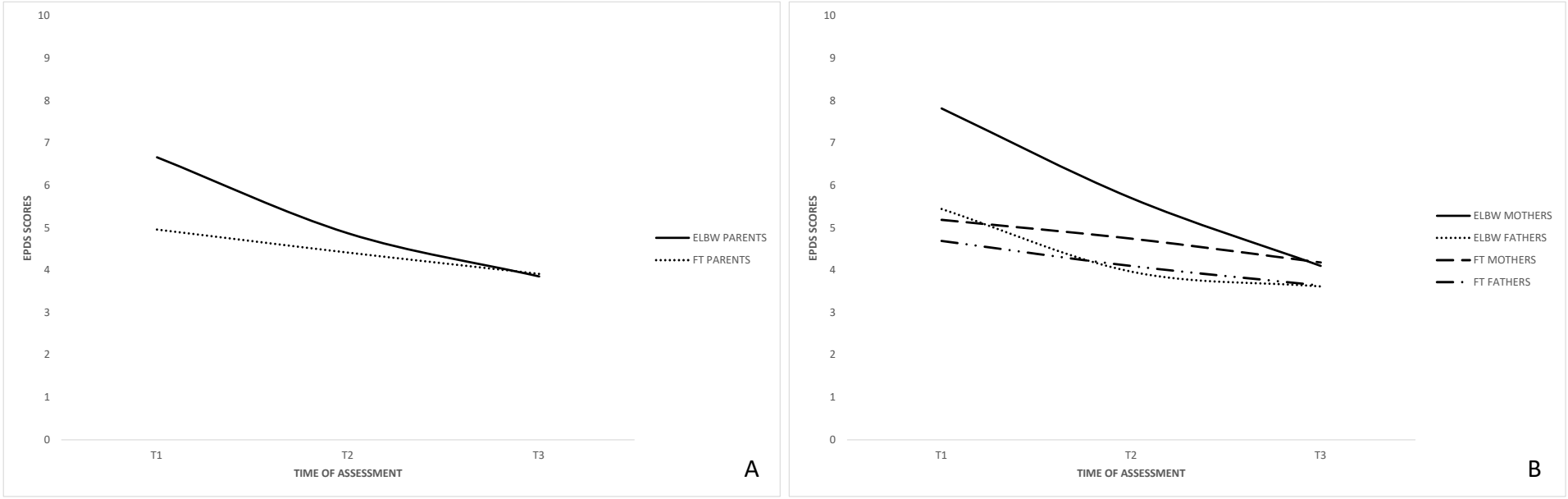
	[ELBW = 0; FT = 1]		[ELBW = 0; FT = 1] [MOTHERS = 0; FATHERS = 1]		[ELBW = 0; FT = 1] [FATHERS = 0; MOTHERS = 1]		[ELBW = 0; VLBW = 1]		[ELBW = 0; VLBW = 1] [MOTHERS = 0; FATHERS = 1]		[ELBW = 0; VLBW = 1] [FATHERS = 0; MOTHERS = 1]		[VLBW = 0; FT = 1]		[VLBW = 0; FT = 1] [MOTHERS = 0; FATHERS = 1]		[VLBW = 0; FT = 1] [FATHERS = 0; MOTHERS = 1]	
	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept	6.87	0.74	7.96	0.90	6.28	0.90	6.64	0.52	7.94	0.86	5.19	0.66	5.85	0.54	6.67	0.68	5.04	0.68
BW	-1.92***	0.26	-2.87***	1.09	-1.02	1.09	-1.59*	0.68	-1.99*	0.91	-0.84	0.85	-0.34	0.70	-0.90	0.88	0.20	0.88
BW × PR			-2.86***	0.89	-0.58	0.91			-3.36***	1.18	0.35	1.12			-1.49	0.83	0.72	0.76
Slope	-1.42***	0.26	-1.90***	0.35	-0.96***	0.35	-1.41***	0.26	-1.97***	0.32	-1.22*	0.32	-0.65***	0.19	-0.77**	0.27	-0.54*	0.27
BW	0.88***	0.31	1.38***	0.43	0.40	0.43	0.86*	0.34	1.26*	0.48	0.44	0.49	0.11	0.25	0.25	0.35	-0.01	0.35
BW × PR			1.27***	0.48	0.49	0.46			1.30**	0.43	0.24	0.40			0.23	0.28	0.03	0.30

Note. EPDS = Edinburgh Postanatal Depression Scale. ELBW = Extremely Low Birth Weight; VLBW = Very Low Birth Weight; FT = Full-Term; BW = Birth Weight; PR = Parental Role.

*$p < .05$. ** $p < .01$. ***$p < .001$.

Figure 1

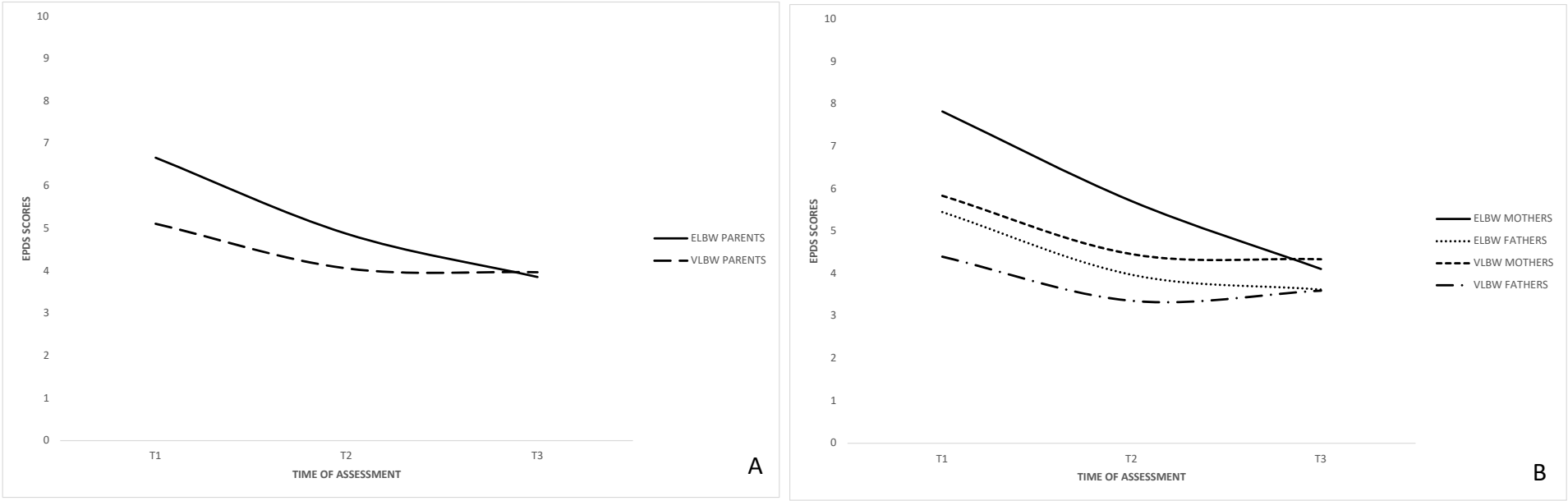
Trajectories of depressive symptoms in ELBW and FT parents (mothers and fathers)



Note. Figure A represents trajectories of PND considering as function as time and birth weight. Figure B represents trajectories of PND as function as time, birth weight and parental role.

Figure 2

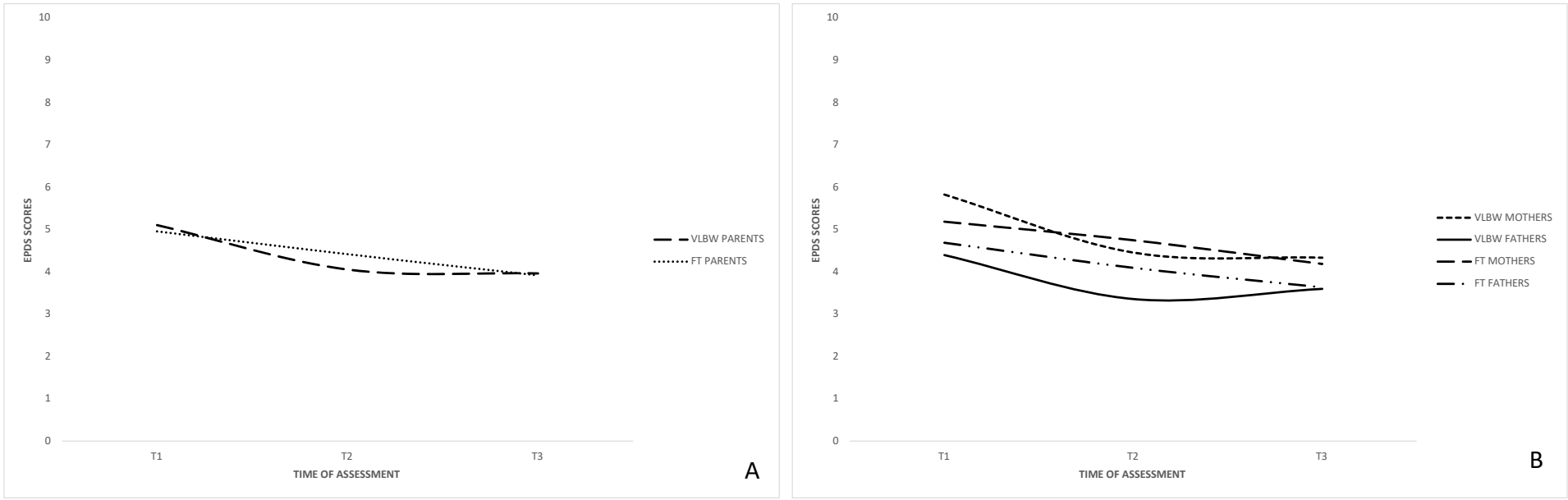
Trajectories of depressive symptoms in ELBW and VLBW parents (mothers and fathers)



Note. Figure A represents trajectories of PND considering as function as time and birth weight. Figure B represents trajectories of PND as function as time, birth weight and parental role.

Figure 3

Trajectories of depressive symptoms in VLBW and FT parents (mothers and fathers)



Note. Figure A represents trajectories of PND considering as function as time and birth weight. Figure B represents trajectories of PND as function as time, birth weight and parental role.