Journal of Paediatrics and Child Health

doi:10.1111/jpc.13167

ORIGINAL ARTICLE

Late preterm birth is a strong predictor of maternal stress later in life: Retrospective cohort study in school-aged children

Branka Polic,[1] Andreja Bubic,[2] Julije Mestrovic,[1] Josko Markic,[1] Tanja Kovacevic,[1] Milan Juric,[1] Roberta Andrea Tesija,[3] Helena Susnjar[4] and Ivana Kolcic[5]

[1]Department of Paediatrics, PICU and [4]Emergency Medicine, University Hospital Centre Split, [2]Faculty of Humanities and Social Sciences, University of Split, [3]The Health Centre of Split-Dalmatia County and [5]Department of Public Health, Medical School University of Split, Split, Croatia

Aim: The aim of this study was to compare the level of stress in mothers of school-aged children born late preterm and admitted to the intensive care unit (ICU) with the level of maternal stress if a child was born late preterm and not admitted to the ICU as well as if a full-term child was admitted to the ICU.

Methods: In this retrospective cohort study the data were gathered via telephone interview with mothers. The Parenting Stress Index/Short Form was used to determine the level of stress in mothers. Background demographic characteristics, medically relevant variables, and the level of stress were tested using the chi-square test and Kruskal-Wallis test. Logistic regression was used in order to identify predictors of significant level of stress.

Results: Mothers of late preterm born children who were admitted to the ICU, as well as mothers of late preterm children who were not admitted had higher level of stress compared to mothers of full-term children. Namely, mothers of late preterm born children admitted to the ICU had 18-fold increase in risk for significant level of total stress (OR = 18.09; 95% CI 8.55 to 38.26) while 24-fold greater risk was observed in mothers of late preterm children who were not admitted to the ICU (OR = 24.05; 95% CI 10.66 to 54.26) in comparison to mothers of full-term born children.

Conclusion: Results indicate that preterm birth and its complications are associated with a higher level of stress in mothers, that persists to school age.

Key words: intensive care unit; maternal stress; prematurely born infant; term birth.

What is already known on this topic

1 Premature birth results in parental stress, especially among parents of infants who were subsequently admitted to the ICU.
2 Disturbances in the relationship between mother and prematurely born child may persist for several years upon birth, and it may cause high level of stress in mother.
3 Most of the previous studies investigated parental stress in infants and younger preschool-aged children who were born very prematurely or with low birth weight.

What this paper adds

1 Mothers of school-aged children who were born late preterm, no matter whether the child was treated in the ICU or not, had higher level of stress than mothers of full-term born children.
2 The majority of the mothers of late preterm infants showed a significant level of stress in the domain of difficult child.

Preterm birth is a stressful event for parents,[1] especially for parents of children born preterm and subsequently admitted to the intensive care unit (ICU).[2,3] Parents with an infant admitted to the ICU experience anxiety, depression and loss of control over management of their infant.[4] Mother's distress, as a result of vulnerability of an immature newborn may cause parental role alteration[5] and those negative feelings may be extremely powerful and have long-term effects on parenthood.[4] Although it is known that disturbances in the relationship between parents and children born preterm may persist for several years after a medical problem upon birth, and this can cause a high level of parental stress,[6] it is unclear whether parents of school-aged children born late preterm (LP) experience more stress than parents of children born full-term (FT). Also, most of the previous studies included infants and younger preschool-aged children who were born very prematurely or with low birth weight. Some studies reported higher level of stress in mothers of children born preterm in preschool,[7] and school period.[8,9]

Correspondence: Dr Branka Polic, Department of Paediatrics, PICU, University Hospital Centre Split, Spinciceva 1, 21 000 Split, Croatia. Fax: +385 2155 6590; email: branka.polic1@gmail.com

Conflict of interest: None declared.

Accepted for publication 27 January 2016.

The aim of this study was to compare the level of stress in mothers of school-aged children born LP who had health problems upon birth that required admission to the ICU and mothers of children born LP who were not admitted to the ICU, as well as of children born FT with the same health problems as the LP children that required treatment in the ICU. Our hypothesis is that mothers of LP children, regardless the child's treatment in the ICU, experience higher level of stress, compared to mothers of FT children treated in the ICU. Such a finding would be important in order to raise awareness towards the necessity of early support to mothers of LP children which would potentially result in the reduction of the intensity of mother's stress. Also, we investigated the risk factors that were associated with higher levels of stress in mothers.

Methods

Participants

In this retrospective cohort study, the study population comprised of 384 mothers of school-attending children aged between 6 and 12 and born at the Department of Obstetrics and Gynaecology of the University Hospital Centre Split in Croatia, from January 2002 to March 2008. Three study groups were defined: children born late preterm and admitted to the ICU after birth (LP-ICU), children born late preterm who did not require ICU admission (LP-nonICU) and full-term born children who were admitted to the ICU after birth (FT-ICU).

Late preterm birth was defined as birth between $34^{0/7}$ and $36^{6/7}$ weeks of gestational age (GA), while term birth was defined as birth between $37^{0/7}$ and 42 weeks of gestation. GA was determined by the time of the last menstrual period and the ultrasound confirmation for all of the children.

During selected time period there were 968 infants born late preterm and 176 of them (18.2%) were admitted to the ICU. Additionally, in the same period 25,086 full-term infants were born and 1630 of them (6.5%) required ICU admission. Indications for the ICU treatment were set on the basis of the definition of British Association of Perinatal Medicine.[10] LP infants who did not require the ICU treatment (LP-nonICU) were those infants who were either with their mothers until discharge from the hospital or they temporarily needed special medical care and were separated from mothers, but not longer than three days. This medical care included photo-therapy, temperature control, infusion support or observation. They were located in a separate room which was a part of the Department of neonatology, but was close to the Department of gynaecology where the mothers stayed and daily took care of their infants.

Exclusion criteria for all three groups of children were: congenital malformations, severe congenital heart disease, metabolic and other genetic disorders, or any of the syndromes, and infants from multiple pregnancies or drug-addicted mothers. After applying these criteria a total of 136 children (77.3%) were eligible for enrolment in the LP-ICU group. Given that there was greater number of infants who fulfilled the criteria for enrolment in LP-nonICU and FT-ICU groups, we randomly selected 136 examinees to both of these groups using the random number generator option in the Excel.

Since the maternal response was 92.6 % in the LP-ICU group, 93.4 % in the LP-nonICU, and 96.3 % in the FT-ICU, the study groups included 126, 127, and 131 children, respectively.

Measures

All the information about the mothers' health during pregnancy, gestational age of infant, mode of delivery and complications during delivery, Apgar scores, birth weight, diagnosis requiring ICU admission, mechanical ventilation and the number of days treated in the ICU were collected retrospectively from the medical records. Other information was collected during 2014 via the telephone interview with mothers only, when the children were 6 to 12 years old (telephone numbers were also retrieved from medical records) and reflects the state in 2014.

The Parenting Stress Index/Short Form (PSI/SF) was used to determine the level of stress in the mothers.[11] It is a derivative of the Parenting Stress Index full-length test and consists of 36 questions. Questions are arranged in three subscales: Parental Distress (PD), Parent-Child Dysfunctional Interaction (P-CDI), Difficult Child (DC) and the sum provides the total stress (TS).[11] PD subscale correlates with dysfunctional parenting; P-CDI subscale focuses on the parent's perception that a child does not meet the parent's expectations and the interaction between the parent and the child is disturbed; DC subscale reveals basic behavioural characteristics of children that make them either easy or difficult to manage. Mothers can rate each of the items from 1 to 5. Higher score means a higher level of stress and a clinically significant level of stress is in accordance with values which are above the 90^{th} percentile, according to the manual.[11] This questionnaire had been previously translated into Croatian, its psychometric properties had been validated and it is applied by psychologists in their daily clinical practice. Three interviewers, well-trained by an experienced clinician, gathered the data. The interviewers were blinded to the study group, in a way that telephone numbers were given randomly to all three interviewers without revealing any other data. Each interviewer was instructed to ask the questions from the PSI/SF questionnaire first, and after this they asked the mothers about their education and the socioeconomic status of the family (poor, average or good on the basis of the parents' education, occupation and income).

Informed maternal written consent was obtained and participation was voluntary. The study was approved by the Medical Ethical Committee of the University Hospital Centre Split (registration number 2181-147-01/06/J.B.-13-1).

Data management

Differences between LP-ICU children, LP-nonICU children, FT-ICU children and their mothers with respect to several background demographic characteristics, as well as medically relevant variables, were tested using the chi-square test and Kruskal-Wallis test. Also, the extent of maternal stress expressed as the raw scores on the TS scale and on the three subscales was compared using the Kruskal-Wallis test. Finally, logistic regression was used in order to identify the factors which may be used for predicting the significant level of stress (raw scores above the 90^{th} percentile), with four models created for four outcome variables (Parental Distress, Parent-Child Dysfunctional Interaction, Difficult Child and Total

Stress). All logistic regression models included the following predictor variables: gender, child's age when the mother completed the questionnaire, mother's age at delivery, complications during pregnancy, mode of delivery, Apgar score in the 5th minute, number of days the child was treated in the ICU, mechanical ventilation, mother's education, socioeconomic status of the family, and the study group. The data were analysed using SPSS 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY, USA). Statistical significance was set at a *P*-value of <0.05.

Results

The background characteristics of the study groups are shown in the Table 1. The mothers of LP-ICU children, as well as the mothers of LP-nonICU children had higher overall scores on all scales of the PSI/SF questionnaire, compared to the mothers of FT-ICU children (see Table 2). Differences in average scores for stress depending on the child's gender were observed only in the group of LP-ICU children for the DC scale (median 31.0; interquartile range 14.0 for boys vs. 28.0; 12.0 for girls, $P=0.015$) and in the TS (median 93.0; interquartile range 27.0 vs. 81.0; 32.0, respectively) (data not shown).

The highest incidence of the clinically significant level of total stress was found in the mothers of LP-nonICU children (69.3%), as well as in the mothers of LP-ICU children (65.9%) (see Table 3). A similar result was obtained on the DC scale, then on the P-CDI scale and the lowest incidence was found on the PS scale (see Table 3). A statistically significant difference among boys and girls, with respect to the levels of maternal stress, was observed in the group of LP-ICU children in the TS scores (74.6% mothers of boys and 54.5% mothers of girls; $P=0.018$) and in the P-CDI scale (60.6% mothers of boys and 38.2% mothers of girls; $P=0.018$) (data not shown).

Logistic regression analysis indicated that the most important risk factor for all the domains of stress in mothers was preterm birth (see Table 4). In addition to belonging to the group of LP children risk factors for higher level of stress in mothers were: child's age when testing was performed (increased total stress with children aged 9–12 years), number of days of ICU treatment (increased parental distress for each day longer spent in ICU), application of mechanical ventilation in their children after birth and mother's education (increased total stress for mothers with education less than university degree) (see Table 4).

Table 1 Background characteristics of the three studied groups

		LP-ICU ($n=126$)	LP-nonICU ($n=127$)	FT-ICU ($n=131$)	*P*-value
Gender, *n* (%)	Male	71 (56.3)	73 (57.5)	78 (59.5)	0.871
	Female	55 (43.7)	54 (42.5)	53 (40.5)	
Child's age when tested (years), *n* (%)	≤9	46 (36.5)	47 (37.0)	47 (35.9)	0.982
	>9–12	80 (63.5)	80 (63.0)	84 (64.1)	
Gestational age (weeks), *n* (%)	$34^{0/7}$–$34^{6/7}$	36 (28.6)	18 (14.2)	0	<0.001
	$35^{0/7}$–$36^{6/7}$	90 (71.4)	109 (85.8)	0	
	≥37	0	0	131 (100)	
Complicated pregnancy, *n* (%)	No	45 (35.7)	61 (48.0)	83 (63.4)	<0.001
	Yes	81 (64.3)	66 (52.0)	48 (36.6)	
Mode of delivery, *n* (%)	Vaginal	78 (61.9)	103 (81.1)	98 (75.4)	0.002
	Caesarean section	48 (38.1)	24 (18.9)	32 (24.6)	
Apgar score in 5th minute, median (IQR)		8 (2)	9 (2)	9 (3)	<0.001
Admission diagnosis at birth, *n* (%)	Healthy	0	112 (88.2)	0	0.509
	Hypoxia	45 (35.7)	0	36 (27.5)	
	Infection	34 (27.0)	0	36 (27.5)	
	RDS	24 (19.0)	0	30 (22.9)	
	Other	23 (18.3)	15 (11.8)	29 (22.1)	
Respirator use, *n* (%)	No	89 (70.6)	127 (100)	114 (87.0)	<0.001
	Yes	37 (29.4)	0	17 (13.0)	
Number of days in ICU, median (IQR)		8.0 (4.0)	NA	5.0 (3.0)	<0.001
Family socio-economic status, *n* (%)	Poor	9 (7.2)	14 (11.1)	11 (8.4)	0.424
	Average	88 (69.8)	85 (67.5)	81 (61.8)	
	Good	29 (23.0)	27 (21.4)	39 (29.8)	
Mother's age at delivery (years), *n* (%)	<25	27 (21.4)	31 (24.4)	22 (16.8)	0.315
	25-29	40 (31.8)	40 (31.5)	55 (42.0)	
	30-34	35 (27.8)	40 (31.5)	37 (28.2)	
	≥35	24 (19.0)	16 (12.6)	17 (13.0)	
Mother's education, *n* (%)	Primary or high school	86 (68.3)	86 (67.7)	94 (71.8)	0.746
	University degree	40 (31.7)	41 (32.3)	37 (28.2)	

IQR, interquartile range; FT-ICU, full-term born children who were admitted to the ICU after birth; LP-ICU, children born late preterm and admitted to the ICU after birth; LP-nonICU, children born late preterm who did not require ICU admission; NA, not applicable.

Table 2 Maternal stress expressed as raw scores according to the Parenting Stress Index/Short Form questionnaire

	LP-ICU ($n = 126$)	LP-nonICU ($n = 127$)	FT-ICU ($n = 131$)	*P*-value
Parental Distress, median (IQR)	31.0 (10.5)	32.0 (8.0)	21.0 (10.0)	<0.001
Parent-Child Dysfunctional Interaction, median (IQR)	27.0 (11.0)	27.0 (7.0)	19.0 (8.0)	<0.001
Difficult Child, median (IQR)	29.5 (13.3)	29.0 (9.0)	19.0 (8.0)	<0.001
Total Stress, median (IQR)	88.0 (30.3)	87.0 (23.0)	58.0 (25.0)	<0.001

FT-ICU, full-term born children who were admitted to the ICU after birth; IQR, interquartile range; LP-ICU, children born late preterm and admitted to the ICU after birth; LP-nonICU, children born late preterm who did not require ICU admission.

Table 3 The incidence of the clinically significant level of overall stress (defined as raw scores >90th percentile in the group of FT children)

	LP-ICU ($n = 126$)	LP-nonICU ($n = 127$)	FT-ICU ($n = 131$)	*P*-value
Parental Distress, *n* (%)	53 (42.1)	56 (44.1)	13 (9.9)	<0.001
Parent-Child Dysfunctional Interaction, *n* (%)	64 (50.8)	67 (52.8)	11 (8.4)	<0.001
Difficult Child, *n* (%)	75 (59.5)	71 (55.9)	11 (8.4)	<0.001
Total Stress, *n* (%)	83 (65.9)	88 (69.3)	13 (9.9)	<0.001

FT-ICU, full-term born children who were admitted to the ICU after birth; IQR, interquartile range; LP-ICU, children born late preterm and admitted to the ICU after birth; LP-nonICU, children born late preterm who did not require ICU admission.

Table 4 Odds ratios (OR) with a 95% confidence interval (95% CI) were obtained by means of the logistic regression analysis to establish the risk for significant level of stress in mothers

	Parental Distress	Parent-Child Dysfunctional Interaction	Difficult Child	Total Stress
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender (girls are referent group)	1.15 (0.71 1.85)	1.44 (0.88 2.36)	1.10 (0.67 1.79)	1.63 (0.98 2.72)
Child's age when tested (years)	1.14 (0.99 1.31)	1.16 (1.00 1.34)	1.16 (1.00 1.34)	1.20 (1.03 1.40)
Mother's age at delivery	0.99 (0.94 1.03)	1.0 (0.95 1.04)	1.02 (0.97 1.07)	0.96 (0.91 1.01]
Complicated pregnancy	1.27 (0.76 2.13)	1.61 (0.95 2.72)	1.33 (0.79 2.25)	1.37 (0.79 2.39)
Mode of delivery (vaginal delivery is referent group)	0.80 (0.44 1.44)	0.90 (0.50 1.64)	0.87 (0.48 1.59)	0.81 (0.43 1.50)
Apgar score in 5th minute	1.15 (0.95 1.38)	1.06 (0.89 1.28)	1.11 (0.92 1.33)	1.15 (0.95 1.40)
Number of days treated in the ICU	0.94 (0.89 0.99)	0.99 (0.94 1.04)	1.00 (0.95 1.05)	0.99 (0.94 1.04)
Mechanical ventilation	4.39 (1.88 10.26)	6.12 (2.59 14.50)	3.86 (1.61 9.26)	5.46 (2.12 14.11)
Mother's education (higher education is referent group)	0.79 (0.44 1.43)	1.00 (0.55 1.81)	0.65 (0.35 1.19)	2.20 (1.15 4.23)
Family socio economic status				
Good	Referent	Referent	Referent	Referent
Medium	1.15 (0.60 2.20)	1.02 (0.53 1.95)	1.88 (0.97 3.66)	1.70 (0.86 3.38)
Poor	1.57 (0.58 4.24]	1.36 (0.49 3.76)	2.75 (0.97 7.74)	1.69 (0.58 4.96)
Study group				
FT ICU	Referent	Referent	Referent	Referent
LP ICU	7.05 (3.42 14.55)	10.44 (4.82 22.61)	14.09 (6.59 30.11)	18.09 (8.55 38.26)
LP nonICU	5.29 (2.44 11.45)	15.09 (6.57 34.66)	15.93 (7.04 36.04)	24.05(10.66 54.26)

FT ICU, full term born children who were admitted to the ICU after birth; LP ICU, children born late preterm and admitted to the ICU after birth; LP nonICU, children born late preterm who did not require ICU admission.

Discussion

The results of this study showed that the mothers of school-aged children who were born as LP infants manifested higher levels of stress than the mothers of FT children. The majority of the mothers of the LP infants showed a significant level of stress in the domain of the difficult child (59.5% of the mothers of LP infants treated in the ICU and 55.9% of the mothers of LP infants untreated in the ICU), somewhat lower stress was in the domain of dysfunctional interaction between parent and child (50.8% and 52.8%, respectively), and the lowest percentage of mothers showed a significant level of stress in the domain of parental distress (42.1% and 44.1%, respectively). Other authors found 39.7% mothers of low birth-weight children with significant level of stress in the child domain compared to 20.8% mothers of normal birth-weight children, all at the age of four.[7] Also, some authors showed that the scores in the parent domain of children born LP were comparable with normative samples, while scores in the child domain were above the 50th percentile for all child scales.[12] Our results are comparable to previous studies, revealing that the characteristics of a child primarily affected the level of maternal stress rather than parental perceptions of their role and competence.[7,12] Also, the highest incidence of total stress (74.6%) was found in mothers of boys born LP and treated in the ICU. It is known that boys generally cause higher intensity of stress in mothers than girls.[7] Boys are more vulnerable than girls[13] and mothers are more protective of them, which leads to additional burdens and increases the level of stress in mothers.[14] Mothers, in general, express higher attunement and lower levels of negative emotionality when interacting with their daughters than with their sons.[15]

Furthermore, the older age of the child was associated with a higher risk for significant level of stress in mother. The relationship between the child's age and stress in parents is not entirely clear and uniform. In some studies it has been shown that a child's age had little impact on the parental stress, while in other studies the parents' stress grew over time, but only in certain domains.[16] The level of parental stress may increase particularly when the child enters school-age years, especially when the child does not meet parental expectations in the physical, intellectual, emotional abilities as well as in behaviour.[16]

The need for mechanical ventilation after birth was related to the significant level of stress in mothers in all three domains and total stress. Although a few researches have examined the impact of respiratory illnesses of the premature infant on the intensity of parental stress, it is known that longer mechanical ventilation in premature infant led to increased stress in their parents.[5,16] The infants who experienced longer mechanical ventilation showed a double risk for neurodevelopmental problems at school age.[17,18] In addition, mechanically ventilated preterm infants are prone to many complications such as pneumonia, sepsis, intracranial haemorrhage, necrotizing enterocolitis,[19] which can cause additional stress to the parents.

As LP infants require a longer stay in the ICU[20] than FT infants, the stressful environment, including noise,[21] light and painful interventions can lead to early neurological damage and changes in psychokinetic of premature infant development, and it can additionally leave long-term neurological effects and consequences on the child's behaviour.[17,18] Consequently parents, especially mothers, have difficulties with all the stressful events associated with the treatment of premature infant in the ICU as well as the separation from the child. It is known that a longer duration of the treatment of a premature infant has a negative impact on the family functioning many years after, even more so for mothers. As that high intensity of parental stress can linger long after the child's discharge from the ICU,[22] this, in turn, may adversely affect the parental mental health, especially for mothers of premature infants who are already prone to anxiety and depression.[23–25] Therefore, parents of premature infants need to have psychological support from the ICU staff and daily share in the child's care.[22] It would be useful to involve an intra-intensive care unit clinical psychologist[26] who may help parents of premature infants to recover from stressful experience. Unfortunately, such psychological support was not applied in our ICU during the investigated time period.

Furthermore, the mothers with lower education level showed a higher risk for significant level of total stress related to a child born LP, and this finding is similar to the findings of other authors.[5,27] These mothers showed a higher level of stress because they often may be unemployed[5] and are burdened by the lack of money and the limitations related to work and social life, which may increase the level of stress related to preterm birth. A higher-educated mother can better face difficulties and is able to develop more adaptive mechanisms to deal with them.[7,9,28]

Our results showed significantly higher intensity of stress in mothers of LP children who were not treated in the ICU than in mothers of FT children who were admitted to the ICU. This is in collision with the finding of other authors who showed smaller differences between families with very preterm and term born children in parenting stress, with parental mental health problems and child neurodevelopmental disability further burdening the parenting and affecting the level of stress.[29] Various risk factors related to the child or parental characteristics may affect the level of stress in parents of premature infants, so it would be necessary to explore additional risk factors in order to increase knowledge on this important topic. Our results are consistent with some previous studies, indicating that parental stress, is affected primarily with the prematurity as well as behavioural characteristics of the child.[7,12,27] Also, a higher risk for significant level of stress in mothers was associated with the mechanical ventilation in the LP children,[22] as well as with some mother's characteristics, such as lower level of maternal education.[7,27] Therefore, in order to reduce the negative impact of child's problems and parental stress on the functioning of the family, health service providers have to apply behaviour management strategies within the intervention programmes.[30] Such programmes, if implemented in early childhood, may lead to reduction of the behavioural problems in young children, strengthen the quality of the relationship between the parents and the child, and reduce the level of parental stress.[31,32]

The main weakness of this study is a relatively small number of eligible participants with wider age range of children and potential bias due to this cannot be excluded, even though there was no difference in age distribution across the study groups. Since our study showed increased maternal stress even 6–12 years after the birth of a premature child it would be important to examine the effects of other risk factors not included in this study. Further studies would significantly contribute to the clarification of this extremely important and inadequately explored area. The

strength of the study is the inclusion of the FT children with the same health problems as LP children, which allowed us an insight into how the immaturity in itself and diseases that require ICU treatment may affect the intensity of maternal stress of LP children. Our results contribute to the understanding of a long-term impact of late prematurity, as well as late prematurity health burden upon birth and the treatment in the ICU on the level of maternal stress.

Conclusion

The results of the study showed that immaturity and consequences of immaturity are associated with higher level of stress in mothers, which can last long after birth. Furthermore, the disease and treatment in the ICU may have a stronger long-term impact on the level of stress in mothers of LP children than in mothers of FT children. The results also emphasise that further studies are needed to assess whether early intervention may reduce the behavioural problems of a child and the intensity of maternal stress. Intervention, as early as possible, may lead to the improvement of the quality of family life as well as, in turn, the wellbeing of the entire community.

Acknowledgement

We are grateful to all the mothers who responded to the survey for their time and patience answering a long series of questions.

References

1 Forcada-Guex M, Borghini A, Pierrehumbert B, Ansermet F, Muller-Nix C. Prematurity, maternal posttraumatic stress and consequences on the mother-infant relationship. *Early Hum. Dev.* 2011; **87**: 21–6.
2 Turan T, Başbakkal Z, Özbek S. Effect of nursing interventions on stressors of parents of premature infants in neonatal intensive care unit. *J. Clin. Nurs.* 2008; **17**: 2856–66.
3 Trombini E, Surcinelli P, Piccioni A, Alessandroni R, Faldella G. Environmental factors associated with stress in mothers of preterm newborns. *Acta Paediatr.* 2008; **97**: 894–8.
4 Obeidat HM, Bond EA, Callister LC. The parental experience of having an infant in the newborn intensive care unit. *J. Perinat. Educ.* 2009; **18**: 23–9.
5 Wormald F, Tapia JL, Torres G *et al.* Stress in parents of very low birth weight preterm infants hospitalized in neonatal intensive care units. A multicenter study. *Arch. Argent. Pediatr.* 2015; **113**: 303–9.
6 Rautava P, Lehtonen L, Helenius H, Sillanpaa M. Effect of newborn hospitalization on family and child behavior: A 12-year follow-up study. *Pediatrics* 2003; **111**: 277–83.
7 Ong LC, Chandran V, Boo NY. Comparison of parenting stress between Malaysian mothers of four-year-old very low birth weight and normal birth weight children. *Acta Paediatr.* 2001; **90**: 1464–9.
8 Taylor HG, Klein N, Minich NM, Hack M. Long-term family outcomes for children with very low birth weight. *Arch. Pediatr. Adolesc. Med.* 2001; **155**: 155–61.
9 Singer LT, Fulton S, Kirchner HL *et al.* Parenting very low birth weight children at school age: Maternal stress and coping. *J. Pediatr.* 2007; **151**: 463–9.
10 British Association of Perinatal Medicine. *Standard for Hospitals Providing Neonatal Intensive and High Dependency Care*, 2nd edn. London,: The Association, 2001.
11 Abidin RR. *Parenting Stress Index (PSI) Manual*, 3rd edn. Charlottesville, VA: Pediatric Psychology Press, 1995.
12 Thomas KA, Renaud MT, Depaul D. Use of the parenting stress index in mothers of preterm infants. *Adv. Neonatal Care* 2004; **4**: 33–41.
13 Elsmén E, Hansen Pupp I, Hellström-Westas L. Preterm male infants need more initial respiratory and circulatory support than female infants. *Acta Paediatr.* 2004; **93**: 529–33.
14 Scher A, Scharabani R. Parenting anxiety and stress: does gender play a part at 3 months of age? *J. Genet. Psychol.* 2005; **166**: 203–13.
15 Feldman R. Infant–mother and infant–father synchrony: The coregulation of positive arousal. *Infant Ment. Health J.* 2003; **24**: 1–23.
16 Schappin R, Wijnroks L, Uniken Venema MMAT, Jongmans MJ. Rethinking stress in parents of preterm infants: A meta-analysis. *PLoS One* 2013; **8**: e54992.
17 Perlman JM. The genesis of cognitive and behavioral deficits in premature graduates of intensive care. *Minerva Pediatr.* 2003; **55**: 89–101.
18 Bouza H. The impact of pain in the immature brain. *J. Matern. Fetal Neonatal Med.* 2009; **22**: 722–32.
19 Teune MJ, Bakhuizen S, Gyamfi Bannerman C *et al.* A systematic review of severe morbidity in infants born late preterm. *Am. J. Obstet. Gynecol.* 2011; **205**: 374.e1.
20 Marshall G, Luque MJ, Gonzalez A *et al.* Center variability in risk of adjusted length of stay for very low birth weight infants in the Neocosur South American Network. *J. Pediatr.* 2012; **88**: 524–30.
21 Alkozei A, McMahon E, Lahav A. Stress levels and depressive symptoms in NICU mothers in the early postpartum period. *J. Matern. Fetal Neonatal Med.* 2014; **27**: 1–17.
22 Busse M, Sromgren K, Thorngate L, Thomas KA. Parents' responses to stress in the neonatal intensive care unit. *Crit. Care Nurse* 2013; **33**: 52–9.
23 Treyvaud K, Anderson VA, Lee KJ *et al.* Parental mental health and early social-emotional development of children born very preterm. *J. Pediatr. Psychol.* 2010; **35**: 768–77.
24 Singer LT, Fulton S, Kirchnrl HL *et al.* Longitudinal predictors of maternal stress and coping after very low-birth-weight birth. *Arch. Pediatr. Adolesc. Med.* 2010; **164**: 518–24.
25 Paulson JF, Dauber S, Leiferman JA. Individual and combined effects of postpartum depression in mothers and fathers on parenting behavior. *Pediatrics* 2006; **118**: 659–68.
26 Peris A, Bonizzoli M, Iozzelli D *et al.* Early intra-intensive care unit psychological intervention promotes recovery from post traumatic stress disorders, anxiety and depression symptoms in critically ill patients. *Crit. Care* 2011; **15**: R41.
27 Woodward LJ, Bora S, Clark CAC *et al.* Very preterm birth: Maternal experiences of the neonatal intensive care environment. *J. Perinatol.* 2014; **34**: 555–61.
28 Holditch-Davis D, Miles MS, Weaver MA *et al.* Patterns of distress in African-American mothers of preterm infants. *J. Dev. Behav. Pediatr.* 2009; **30**: 193–205.
29 Treyvaud K, Doyle LW, Lee KJ *et al.* Family functioning, burden and parenting stress 2 years after very preterm birth. *Early Hum. Dev.* 2011; **87**: 427–31.
30 Bourke-Taylor H, Pallant JF, Law M, Howie L. Relationships between sleep disruptions, health and care responsibilities among mothers of school-aged children with disabilities. *J. Paediatr. Child Health* 2013; **49**: 775–82.
31 Vaughan EL, Feinn R, Bernard S, Brereton M, Kaufman JS. Relationships between child emotional and behavioral symptoms and caregiver strain and parenting stress. *J. Fam. Issues* 2013; **34**: 534–56.
32 Borghini A, Habersaat S, Forcada-Guex M *et al.* Effects of an early intervention on maternal post-traumatic stress symptoms and the quality of mother-infant interaction: The case of preterm birth. *Infant Behav. Dev.* 2014; **37**: 624–31.