

Biopsychosocial Risks to Development in Preterm and Low Birth Weight¹

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Abstract: Prematurity (PT) and low birth weight (LBW) are risk factors for development, as well as psychosocial variables. These relationships were studied with 40 children PTBW between 12-36 months old, assessed by the Bayley-III Screening Test (BSID-III), and their parents who answered the Child Behavior Checklist (CBCL 1½-5 years old) and the interview for identification of biopsychosocial risks; medical records were consulted. It was found more frequently at risk for developmental problems from cognitive and expressive language scales. It is noted the correlations between perinatal conditions and developmental problems; severe psychosocial risk and the receptive language and behavioral problems, and between these risks and expressive language and cognition. The results confirmed the need for monitoring the development of these children, with assessment activities, early intervention and family care.

Keywords: risk factors, premature birth, development measures

Riscos Biopsicossociais para o Desenvolvimento de Crianças Prematuras e com Baixo Peso

Resumo: A prematuridade (PT) e o baixo peso ao nascimento (BP) são fatores de risco para o desenvolvimento, assim como as variáveis psicossociais. Este estudo teve por objetivo descrever e analisar as relações entre variáveis psicossociais e de nascimento e o desempenho cognitivo, linguístico, motor e comportamental em crianças nascidas PTBP, com idade de 12 a 36 meses. Essas relações foram estudadas em 40 crianças PTBP, com 12-36 meses de idade, avaliadas pela Bayley-III Screening Test (BSID-III), e também em seus pais, que responderam ao Child Behavior Checklist (CBCL 1½-5 anos) e à entrevista para identificação de riscos biopsicossociais. Prontuários médicos também foram consultados. Identificou-se maior frequência de risco para problemas de desenvolvimento na área cognitiva e de linguagem expressiva. Destacam-se as correlações entre condições de nascimento e problemas de desenvolvimento, risco psicossocial severo e riscos à linguagem receptiva e a problemas comportamentais, bem como entre os últimos e riscos à linguagem expressiva e à cognição. Aponta-se a necessidade de monitoramento do desenvolvimento dessas crianças, com atividades de avaliação, estimulação precoce e atendimento familiar.

Palavras-chave: fatores de risco, nascimento prematuro, medidas de desenvolvimento

Riesgos Biopsicosociales para el Desarrollo de Niños Prematuros y de Bajo Peso al Nacer

Resumen: La prematuridad (PT) y el bajo peso al nacer (BP) son factores de riesgo para el desarrollo, así como las variables psicossociales. La finalidad de este estudio fue describir y analizar las relaciones entre variables psicossociales y de nacimiento y el desempeño cognitivo, lingüístico, motor y comportamental en niños nacidos PTBP, de 12-36 meses. Esas relaciones fueron estudiadas con 40 niños PTBP, de 12-36 meses, evaluados por la Bayley-III Screening Test (BSID-III), y también con sus padres, que respondieron al Child Behavior Checklist (CBCL 1½-5 años) y a una entrevista para identificación de riesgos biopsicosociales; registros médicos también fueron consultados. Se encontró mayor frecuencia de riesgo de problemas de desarrollo en el área cognitivo y de lenguaje expresivo. Se destacan las correlaciones entre las afecciones perinatales y problemas de desarrollo; riesgo psicossocial severo y riesgos para el lenguaje receptivo y problemas de conducta; y entre estos y riesgos para el lenguaje expresivo y la cognición. Se confirma la necesidad de monitorear el desarrollo de estos niños, con evaluación, intervención temprana y atención a la familia.

Palabras clave: factores de riesgo, nacimiento prematuro, medidas de desarrollo

Prematurity (PT) and low birth weight (LBW), characterized by a gestational age of less than 37 weeks and a birth weight of less than 2,500g (Bazergo, 2000), respectively, can be associated with gestational factors like smoking and prenatal care quality (Niclasen, 2007). The most frequently related morbidity factors are the respiratory adaptation syndrome, respiratory distress syndrome and hyperbilirubinemia (Castro & Leite, 2007). Bronchodysplasia, cardiopathies, gastroesophageal reflux and inguinal hernia can also occur, besides neurological problems like convulsion and hydrocephalus (Cabral & Silva, 2008).

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Despite the considerable influences of PT and LBW on newborns, technological advances have increased their survival, through better equipment, medication and techniques at neonatal intensive care units (NICU) (Lorenzi, Tanaka, Bozzetti, Ribas, & Weissheimer, 2001). Therefore, the main developmental aspects need to be investigated in the long term and, in addition, the factors need to be discovered that can influence development processes.

In the literature, significant delays have been appointed in the linguistic development of preterm and low-weight children between the approximate ages of 12 months (Oliveira, Lima, & Gonçalves, 2003) and 24 months (Chermont, Cunha, Sales, Moraes, & Malveira, 2005), besides the association between language, cognition and psychomotor delays at the age of 36 months (Schirmer, Portuguese, & Nunes, 2006).

Also, reduced motor performance is verified in these children in the third month of life (Santos et al., 2004), which can continue until they reach school age, including greater slowness to gain motor accuracy, which can affect their school performance (Magalhães, Catarina, Barbosa, Mancini, & Paixão, 2003).

In cognition, lower levels of cognitive skills and daily memory have been identified in preterm children (Briscoe, Gathercole, & Marlow, 2001). Attention focus problems, detected early, at the age of seven months, are one of the predictors of hyperactivity/impulsiveness at the age of 4-5 years and cognitive problems at the ages of 2, 3 and 4-5 years (Lawson & Ruff, 2004).

In the school-age period, these children may experience deficits in other cognitive skills, including planning, visual motor coordination, ability to synthesize and perceptual organization and spatial orientation (Mêio et al., 2004), besides academic difficulties (Rodrigues, Mello, & Fonseca, 2006), a below-average intellectual level and behavioral problems (Linhares, Chimello, Bordin, Carvalho, & Martinez, 2005). Significant correlations may also exist between intellectual and behavioral indicators and PT and LBW (Espírito Santo, Portuguese, & Nunes, 2009). Impairments are identified in this population's cognitive development, mainly in the presence of psychosocial mediating variables (Eickmann, Lira, & Lima, 2002).

Difficulties in the personal-social behavior of PTLBW children can also be observed (Chermont et al., 2005). Higher frequency levels can be found for respiratory problems, nocturnal enuresis, school refusal, agitation, impatience, inquietude and attachment to the mother when compared to term children (Carvalho, Linhares, & Martinez, 2001), besides further affective-motivational behaviors that do not facilitate their performance during cognitive evaluations in the pre-school period (Turrini, Enumo, Ferrão, & Monteiro, 2010). The trend towards behavioral problems can be stable over time (Gray, Indurkha, & McCormick, 2004). In a literature review, Vieira and Linhares (2011) found relations between the risk for behavioral problems at the age of five years and low neonatal cardiac vagal tone, reduced emotional regulation at the age of 12 months, reduced attention at the

age of two years and delayed motor development at the age of five years.

General developmental risk assessments are scarce in Brazil but, when assessing the development and resources of 120 PTLBW children between six and 44 months of age, Santa Maria-Mengel and Linhares (2007) identified that 33% of them were at risk, besides relations between the father's lower education level and greater risks for developmental problems, and between family psychosocial risk familiar and increased chances of expressive language problems.

Nobre, Carvalho, Martinez and Linhares (2009) found that 20% of a sample of 30 PTLBW children were at risk of developmental problems in the age range between 5-7 months, and 27% in the range between 10 and 14 months (corrected age), with a significant difference between the age ranges and higher levels of language risks at the age of 10-14 months. They also found that cases of lower weight and gestational age, longer hospitalization time and adverse family situations revealed more developmental problems.

Hence, it is appointed in the literature that social risks may be associated (Alves, 2006) and exert a cumulative and distinguished effect, with family risk factors affecting different developmental areas and perinatal risk factors affecting motor and cognitive areas (Laucht, Schmidt, & Esser, 2004).

In this context, parental overprotection can prevent children from administering the stimuli characteristic of life and from gaining independence, favoring the development of behavioral problems (Morsch & Abreu, 2008). Thus, family conditions can be more predictive variables of cognitive development at the age of four than premature birth itself and LBW (Dezoete, MacArthur, & Tuck, 2003). In addition, the birth of children at high risk can affect family dynamics and produce interactions that can deregulate the development process (Feldman, 2007). PT children with a history of active, intrusive and distant interaction tend to present more behavioral problems than term children and children with a history of responsive and collaborative interaction (Forcada-Guex, Pierrehumbert, Borghini, Moessinger, & Muller-Nix, 2006).

Maternal depression, in turn, can contribute to these problems as it impairs responsiveness to children's behavior, affecting the quality of the interaction that is established (Schmidt, Piccoloto, & Muller, 2005) and reducing reciprocity and family cohesion, while anxiety leads to more frequent and intrusive interaction behaviors (Feldman, 2007).

In this context, it is important for families to participate in care programs like the Newborn Individualized Developmental Care and Assessment Program (NIDCAP), according to a review by Gaspardo, Martinez and Linhares (2010). These programs can act as developmental protection factors. The same is true for the following variables: more advanced gestational age, higher weight at birth, greater brain circumference, better sleep quality in the neonatal period, maternal breastfeeding and higher family income, according to the literature review by Vieira and Linhares (2011).

Therefore, based on Developmental Psychopathology, it is important to return to the idea that any disorders in individual adaptation should be considered in a process and context perspective, without linear, deterministic or isomorphic predictions (Rutter & Sroufe, 2000). In that sense, early evaluation is extremely important, keeping in mind that the neurological system is still fully maturing during the first years of life (Ferrari, Toyoda, Faleiros, & Cerutti, 2001).

Hence, the aim in this study was to describe and analyze relations between psychosocial and birth variables and cognitive, linguistic, motor and behavioral performance in PTLBW children between the ages of 12 and 36 months. More specifically, the intent was to describe the cognitive, motor, linguistic and behavioral performance of these PTLBW children and the indicators related to birth and family context, including weight at birth, gestational age, time of stay at the NICU, family income and their possible associations with cognitive, linguistic and motor development indicators.

Method

To reach the first objective, a descriptive study with a cross-sectional design was undertaken to assess biopsychosocial and developmental indicators. For the second objective, a quasi-experimental correlational study was developed, using the same sample (Meltzoff, 2001).

Participants

A convenience sample was obtained based on a survey of 357 patient charts of children between 12 and 36 months of age, registered at the Follow-Up Sector of the Neurology Outpatient Clinic at a high-complexity public hospital affiliated with the Unified Health System (SUS) in the Metropolitan Region of Greater Vitória, in the State of Espírito Santo (ES), Brazil. At this sector the development of children discharged from the NICU is monitored until the age of seven years. Due to a lack of precise birth weight and gestational age information, and due to outdated addresses, 130 families living in the Metropolitan Region (seven cities) were eligible, but telephone contact was only possible with 29 of them, 23 of which agreed to participate. In addition, 17 mothers who attended a consult at the hospital were contacted directly, among 35 mothers who had an appointment between November 2007 and April 2008. Thus, the mothers of 40 children agreed to participate (mean age = 23.6 months, $SD = 7.6$, with 24 girls - 60%). This sample represents 31% of the 130 PTLBW children between 12 and 36 months of age, enrolled at the Follow-Up service during the data collection period. Data were collected in clinical care rooms at *Universidade Federal do Espírito Santo*, located in Vitória-ES, and at the hospital, so that the families could choose the most accessible place, thus guaranteeing their adherence to the research. The gestational age was not corrected, in accordance with Pedromônico's (2006) suggestion that, at more advanced ages, this correction can retard the identification of any delays.

Instruments

The instruments used are described next.

Hospital discharge form of the child: present in the medical charts of each child enrolled at the follow-up Sector. Contains information about pregnancy, delivery and birth-related problems like prematurity, hospitalization time at the NICU, respiratory, cardiovascular and neurological problems;

Interview to identify biopsychosocial risk factors in the child's life history (Santa Maria-Mengel & Linhares, 2007): contains demographic characteristics of the family and the family environment, prenatal and perinatal risk items and morbid antecedents, besides questions about the family routine and a list of ten items that permits the use of three psychosocial risk classifications: Low Psychosocial Risk (when no risk factor is appointed); Moderate Psychosocial Risk (1 or 2 factors); Severe Psychosocial Risk (3 or more factors);

Child Behavior Checklist (CBCL) (1½ to 5 years) (Achenbach & Rescorla, 2000): assesses aspects related to internalizing (like introversion, anxiety, depression) and externalizing (like aggressiveness and attention problems) behavioral problems in children between the ages of 18 months and five years. In addition, behavioral performance is evaluated based on scales oriented by the Diagnostic and Statistical Manual of Mental Disorders - DSM-IV: affective disorders, anxiety disorders, invasive developmental problems, attention deficit and hyperactivity disorder, and oppositional defiant disorder. Parents are asked to answer the items by classifying behaviors as *true*, *more or less true* or *not true*;

Bayley Scales for Infant and Toddler Development[®] - *Third Edition* (Bayley-III[®]) *Screening Test* (BSID-III) (Bayley, 2006): evaluates risks for developmental problems. Includes five independent scales for the application and evaluation of child behavior in the following areas: (a) Cognition (COG): 33 items related to attention, exploration and handling of objects, problem solving and concept formation; (b) Receptive Language (REL): 24 items on hearing accuracy, responsiveness to voices, discrimination and location of sounds, identification of objects and morphological development); (c) Expressive Language (EXL): 24 items on preverbal communication, like babbling and gesticulation, use of connectors, vocabulary development, naming of objects and figures and morphosyntactic development, including the use of two-word sentences or more, plurals and verbal tenses); (d) Fine Motor Skills (FMS): 27 items that assess comprehension, perceptual-motor integration, planning and motor speed, reach and manipulation of objects; and (e) Gross Motor Skills (GMS): 28 items on limb and trunk movements and static positioning; dynamic movements like locomotion, coordination, balance and motor planning.

The screening version used in this research provides three risk indicators: (a) *Competent*: regular functional performance; (b) *Emergent*: average or below-average functional performance, indicating the need for further longitudinal attention; and (c) *At Risk*: results significantly below average

and below the cut-off points established in normative studies, indicating the need for more specific evaluations and early stimulation follow-up – based on cut-off points for each of the scale, without a total score for the instrument. The application takes between 10 and 20 minutes for each scale.

Procedure

Data collection. The medical charts of the Follow-up Sector were analyzed and the families of the children who complied with the inclusion criteria were informed about the research by telephone. The 40 families who accepted to participate in data collection were interviewed at a care room of the hospital or the Applied Psychology Center of *Universidade Federal do Espírito Santo*, at the participants' convenience, who received transportation aid.

The application of the instruments happened individually and was audio and video-recorded, with the participant's authorization. The mothers answered the Interview for the identification of biopsychosocial risks, which took an average two hours. A psychologist and Ph.D. candidate evaluated each child using the BSDI-III, in the mother's presence, which took an average 45 min., with the help of two Psychology students, who had received preliminary training to administer the items, in line with children's behavior and the correction of the scales.

Data analysis. In this study, significance was set at 0.05. For data processing and analysis, Statistical Package for Social Sciences (SPSS)[®] software was used - version 15.0. To correct the instrument data, the standards published in the manuals were followed.

For the risk classifications for developmental delay obtained based on the BSID-III to be considered minimally reliable, a preliminary study was undertaken for the sake of comparison between the gross scores obtained in the American standardization sample and the gross data for part of the present study sample. Both groups were in the same age range. As observed, there were no significant differences between the two groups' mean scores, except for a slight increase on the Cognitive Scale for the American sample and on the Gross Motor Skills Scale for the Brazilian sample.

Ethical Considerations

The research received authorization from the Scientific Committee at the hospital where data were collected as, at the time of study, the Research Ethics Committee of the university was not functioning for all areas. The hospital also considered the approval of ethical care by the Thesis and Dissertation Examination Board of the Graduate Psychology Program at the institution. The caregivers responsible for the children signed the Informed Consent Form for Participation in Research, in compliance with Decree 196/96 by the National Research Ethics Committee - CONEP (National Health Council/Ministry of Health, issued in 1996).

The place of data collection, prepared for clinical care, did not cause any discomfort for the patients. Whenever a pause was needed in the evaluation because the child was somehow indisposed, time was given to relax, eat and play with the available playthings. At the end of the evaluation, the relatives of children with some risk of developmental delay were advised about stimulating activities in accordance with the child's profile. The importance of participating in the consults at the Follow-Up Sector.

Results

Characteristics of the Children's Birth and Psychosocial Conditions

The characteristics of the children's birth and associated conditions were obtained based on the medical charts and interviews with the mothers. The Hospital Discharge Forms of the NICU were used to verify exposure to gestational risk factors, including high blood pressure, infection and diabetes, in 60% of the mothers.

Also based on the Hospital Discharge Forms, the children's mean gestational age (GA) was 32.6 weeks, equivalent to moderate prematurity (31 to 34 weeks of gestational age), ranging between 26 and 36.4 weeks in the sample. The mean weight at birth was 1,646 g, bordering on the Very Low Birth Weight (VLBW) classification, which refers to weight < 1,500 g (Basegio, 2000). The mean hospitalization time at the NICU was 25.9 days. Upon discharge from the NICU, the mean GA was 38.4 weeks, and the mean birth weight 2,134 g (Table 1).

Most children (90%) presented respiratory problems at birth, with Hyaline Membrane Disease (HMD) as the most frequent respiratory dysfunction (50% of cases). Half of the children went through reanimation process. Other frequent risk factors at birth were: hyperbilirubinemia (62.5%), infection (47.5%), hematological problems (47.5%), asphyxia (42.5%) and neurological problems (8%) (Table 1).

Through the Biopsychosocial Risk Identification Interview, the presence of 47.5% of Low Risk, 40% of Moderate Psychosocial Risk and 12.5% of Severe Psychosocial Risk indicators was observed. In total, 13 mothers (32% of the sample) went out to work and five children (12%) were in kindergarten. The parents' mean age during the evaluation was 30.3 years for the mothers and 33.6 years for the fathers, ranging from adolescent to adult parents. The mean education for both parents was five years and family income per person corresponded to 244.50 reais (Table 1).

In the interviews, the mothers appointed psychosocial risk factors, most frequently related to marital problems (11 mentions), early motherhood/fatherhood and overcrowded housing (7 mentions each). Most mothers (30) mentioned that the pregnancy had not been planned. Twenty-two mothers referred recurrent negative feelings during pregnancy, related to marital or family problems (14 mothers) and apprehension due to the risk pregnancy (7 mothers).

Table 1
Biopsychosocial Characteristics of Preterm Children with Low Birth Weight in the Age Range between 1 and 3 Years (n = 40)

Characteristics	Variables	<i>f</i>	%	<i>SD</i>	RV	
Nascimento						
	Gestational age (weeks)	–	–	32.6	3.1	26-36
	Weight at birth (g)	–	–	1.646.6	456.6	785-2.480
	Days at NICU	–	–	25.9	19	3-96
	Gestational age upon discharge (weeks)	–	–	38.4	2.3	35-43
	Weight upon discharge from NICU (g)	–	–	2.134.9	236.3	1.805-2.765
	Respiratory problems	36	90	–	–	–
	Hyperbilirubinemia	25	63	–	–	–
	Infection	19	48	–	–	–
	Hematological problems	19	48	–	–	–
	Asphyxia	17	43	–	–	–
	Neurological problems	3	8	–	–	–
Psychosocial						
	Low psychosocial risk	19	47	–	–	–
	Moderate psychosocial risk	16	40	–	–	–
	Severe psychosocial risk	5	12	–	–	–
	Mother who goes out to work	13	32	–	–	–
	Child attends kindergarten	5	12	–	–	–
	Mother's age (years)	–	–	30.3	8.1	16-46
	Father's age (years)	–	–	33.6	9.3	18-58
	Income per person (<i>Real</i>)	–	–	244.5	140.8	23.0-583.0
	Number of rooms in house	–	–	4.9	1.8	1-10
	Mother's education (years)	–	–	5.3	1.7	2-9
	Father's education (years)	–	–	5.4	1.9	1-8

Note. *f* = frequency; = mean; *SD* = standard deviation; % = percentage; RV = range of variation.

The mothers reported that the activities they most performed with the children were games, walks and family visits. They also assessed that the fathers played a secondary role in care for the children. In total, 14 mothers (40%) affirmed in the interviews that they used to deal with the children's behavioral problems and tried to distract them in case of tantrums. They used to give into their children's requests because they thought that they were too fragile to support frustrations.

Cognitive, Motor, Linguistic and Behavioral Development Characteristics

The children's cognitive, motor, linguistic and behavioral development characteristics were evaluated with the help of the CBCL (1½ to 5 years) and BSID-III (Table 2).

Considering all BSID-III scales, lower performance levels were observed on the Cognitive scale, responsible for the higher frequency of the classifications *At Risk* and *Emergent*, followed by the Expressive Language scale (Table 2).

On the Cognitive Scale of the BSID-III, two children were *At Risk* and 18 were classified as *Emergent*, so that

half of the sample should be followed in this area. In addition, two children were at risk in the Expressive Language area of the BSID-III and 10 (25%) were classified as *Emergent*, corresponding to 30% of the sample in situations of care and/or attention. The third BDSI-III scale on which a child at risk was identified was the Gross Motor Skills Scale, while seven children (17.5%) were classified as *Emergent*, totaling 20% of the sample that needed attention (Table 2).

No children at risk were identified in the Fine Motor Skills and Receptive Language areas of the BSID-III; nevertheless, 22.5% were classified as *Emergent* on the first and 12.5% on the second scale mentioned (Table 2).

On the CBCL (1½ to 5 years), three children were classified as *Clinical* for all internalizing and externalizing problems and for the general result (Table 2). The scale based on the DSM-IV on which most *Clinical* classifications were obtained was the Attention Deficit/Hyperactivity Disorder (11 children), with a mean T score of 61 points; followed by the Oppositional Defiant Disorder scale (5 children), with a mean T score of 59 points (Table 2).

Table 2

Developmental Characteristics (BSID-III) and Behavioral Problems (CBCL) in Preterm Children with Low Birth Weight, in the Age Range between 1 and 3 Years (n = 40)

Development areas	Risk classifications (f children; n = 40)		
	Competent	Emergent	At Risk
BDSI-III			
Cognition	20	18	2
Expressive language	28	10	2
Gross motor skills	32	7	1
Fine motor skills	31	9	–
Receptive language	35	5	–
Total classifications (n = 200)	146	49	5
Clinical classification			
CBCL (1½-5 years)			
Syndromes			
TS Total		3	
TS Externalizing		3	
TS Internalizing		3	
DSM-IV			
TS ADHD		11	
TS OD Disorder		5	
TS anxiety		4	
TS Developm Disord.		4	
TS Affect. Disord.		2	

Note. TS = T Scores; f = frequency; ADHD = Attention Deficit and Hyperactivity Disorder; DO = Oppositional Defiant.

The application of Pearson’s correlation test showed significant correlations between developmental indicators. Significant mutual correlations were found for all five BSID-III scales. The CBCL (1½ to 5 years) revealed significant correlations between the scales, except between scales with diverging contents: the Internalizing Problems scale (CBCL) was negatively correlated with the Expressive Language ($r -0.41$) scale of the BSID-III, indicating that more intense internalizing behavioral problems are associated with lower linguistic expression performance. Also, a negative correlation was found between the Invasive Developmental Disorders scale (CBCL) and two BSID-III scales, Cognitive ($r -0.36$) and Expressive Language ($r -0.42$), indicating that a higher frequency of complaints related to behavioral (retraction, atypical behavior, fear of what is new) and speech problems is associated with lower performance on cognitive skills and expressive communication.

Due to the small number of participants, only the initial results of the logistic regression test were analyzed (stepwise method), which refers to the isolated degree of correlation between each variable of interest and the response variable. Psychosocial (family income, early motherhood, among others), pregnancy (like gestational risk factors) and birth (presence of asphyxia, infection, hyperbilirubinemia, among others) variables were analyzed for the risk of developmental delay (Table 3).

The variables of interest that showed significant correlations with each predictive variable included severe

psychosocial risk and the fact that the father lives with the child, which were correlated with childhood behavioral problems (Table 3).

The children’s worse performance on Cognitive Scale tasks, in turn, was correlated with biological and psychosocial variables: younger gestational age, lower weight at birth, intracranial hemorrhage, not attending kindergarten and lower paternal education level. This was the area most affected by psychosocial and birth variables (Table 3).

Three psychosocial variables were correlated with linguistic development – the mother’s lower education level, marital problems and severe psychosocial risk; in addition, this area also revealed correlations with biological variables: (a) worse Receptive Language performance was correlated with the mother’s lower education level and severe psychosocial risk, (b) worse Expressive Language performance was correlated with marital problems, and also with lower weight at birth and younger gestational age (Table 3).

These two biological variables (PT and LBW), in turn, were correlated not only with expressive language and cognition, but also with Fine Motor Skills difficulties, an area that also showed influence from a longer time of stay at the NICU and the presence of intracranial hemorrhage. The latter two conditions, which indicate the severity of the case, were also correlated with Gross Motor Skills problems. In addition, this area revealed a correlation with marital problems (Table 3).

Table 3

Correlations between Psychosocial and Birth Variables and Developmental Variables (BSID-III) and Behavioral Problems (CBCL) in Preterm Children with Low Birth Weight, in the Age Range between 1 and 3 Years (n = 40)

Response-variables	Variables of interest	Score	<i>p</i> *
Behavioral problems	(CBCL 1 ½ to 5 years)		
Severe psychosocial risk		7.143	0.007**
Father living with the child		4.802	0.028*
Risk for cognition	(BSID-III/COG)		
Younger gestational age		11.079	0.000**
Lower weight at birth		4.691	0.030*
Not attending kindergarten		6.984	0.008**
Intracranial hemorrhage		4.675	0.031*
Lower education level of father		3.948	0.046*
Risk for receptive language	(BSID-III/LRE)		
Lower education level of mother		3.774	0.052*
Severe psychosocial risk		9.076	0.003**
Risk for expressive language	(BSID-III/LEX)		
Younger gestational age		4.761	0.029*
Lower weight at birth		4.947	0.026*
Marital problems		5.566	0.018*
Risk for fine motor skills	(BSID-III/MFI)		
Younger gestational age		4.338	0.037*
Lower weight at birth		4.214	0.040*
More days at NICU		5.499	0.019*
Intracranial hemorrhage		4.608	0.032*
Risk for gross motor skills	(BSID-III/MAM)		
More days at NICU		4.147	0.042*
Marital problems		3.793	0.051*
Intracranial hemorrhage		5.714	0.017*

Note. **p* - values inferior to 0.05; ***p* - values inferior to 0.01.

In summary, psychosocial variables were related with the children's motor, cognitive and linguistic development: (a) marital problems showed correlations with the motor and linguistic areas, and (b) parents' lower education was related with children's worse cognitive and linguistic performance (Table 3).

Discussion

Among the five areas evaluated in the BSID-III, the cognitive area was the most affected, with the lowest frequency of *Competent* classifications. Half of the sample was at moderate or severe risk for cognitive developmental delay, confirming literature data on the influence of prematurity and low birth weight on childhood development (Briscoe et al., 2001; Bühler, Flabiano, Mendes & Limongi, 2007; Méio et al., 2004; Rodrigues et al., 2006). The fact that this and other BSDI-III areas have presented positively correlated results confirms the possible association between linguistic, cognitive and motor indicators (Schirmer et al., 2006). In addition, behavioral problems were identified in half of the sample, with externalizing problems, besides attention problems, also

confirming data presented in the literature (Carvalho et al., 2001; Lawson & Ruff, 2004; Morsch & Abreu, 2008; Vieira & Linhares, 2011).

Among biological risk factors, the most frequent complication during NICU hospitalization referred to respiratory problems, particularly Hyaline Membrane Disease, in line with the trend appointed in Almeida et al. (2007). Other risk factors were identified, including hyperbilirubinemia, infection, hematological pressure, asphyxia and intracranial hemorrhage, in decreasing frequency order, also in accordance with other authors (Castro & Leite, 2007).

As observed, lower weight at birth and greater prematurity were correlated with worse cognitive development, expressive language and fine motor skills indicators, in line with literature in the area (Briscoe et al., 2001; Bühler et al., 2007; Castro & Leite, 2007; Chermont et al., 2005; Linhares et al., 2005; Rodrigues et al., 2006; Santa Maria-Mengel & Linhares, 2007; Schirmer et al., 2006).

With regard to the psychosocial variables, the most identified risk factors were marital problems, early motherhood/fatherhood and overcrowded housing, which according to the literature can entail further behavioral (Gray et al., 2004),

neuropsychomotor development (Andrade et al., 2005; Pilz & Schermann, 2007), language and motor skills problems (Oliveira et al., 2003), keeping in mind that, in the long term, psychosocial variables can play an even greater role than births that pose risks (Dezoete et al., 2003; Eickmann et al., 2002; Laucht et al., 2004).

Severe psychosocial risk was strongly correlated with behavioral problems, also confirming the literature (Gray et al., 2004; Vieira & Linhares, 2011). The correlation between living with the father and the presence of behavioral problems among children in the sample can be attributed to parents' excessive care or overprotection, possibly due to educational practices that are more tolerant towards behavioral disabilities and less efficient to stimulate the social skills needed to cope with daily requirements, in accordance with Linhares et al. (2000). A parental practice in response to tantrums is highlighted – trying to distract the children, helping them to reach their objectives and not interfering. In view of these results, literature alerts to the importance of setting limits for children to become independent and emotionally stable (Morsch & Abreu, 2008). Hence, the way the family faces the risk conditions associated with birth and daily problems can positively or negatively influence behavioral development.

In the observation of these results, the study limitations should be kept in mind. Although the preliminary analysis of the BSID-III did not appoint significant differences between the American normative sample and the present research sample, research is needed to standardize the scale for the Brazilian context, in view of its functionality for the purpose of evaluation and early stimulation. Besides this limitation, as a non-random sample was used in this study, including children who attended the Follow-Up outpatient clinic of a Neurology clinic, the results found may be related to this specific population, demanding further research to guarantee greater sample representativeness, including children who dropped out of the longitudinal follow-up that is offered. It should also be considered that both psychosocial variables and behavioral assessments were based on the relatives' viewpoint. Possible influences include their perspectives on the family conditions and dynamics, children's behavioral characteristics and even the form and contents expressed when in contact with the researcher.

The overprotective attitude almost half of the mothers report reveals this influence of parental perception on the child's behavioral problems, especially externalizing ones, which obtained a higher mean score in this sample. This compensatory form of coping with the situation may be related to the perception that these children are fragile, because of their birth conditions, and may be a possible reaction to the feelings of guilt and concerns with their development. Hence, this way of dealing with the children's externalizing behaviors can gain different functions – compensation in view of the child's difficulties, also reducing family tension in view of their vulnerability and furthering the establishment of a non-assertive repertoire in the children, harming

long-term adaptation to different contexts, like school, in accordance with different authors (Carvalho et al., 2001; Chermont et al., 2005; Gray et al., 2004; Turrini et al., 2010).

In general, the children were exposed to different risk factors since birth, whether related to delivery and resulting complications or to the psychosocial difficulties inherent in each family context. The risk factors affected the development of cognitive, linguistic, motor and behavioral skills differently. This finding underlines the fact that the actions of each variable the subject receives may exert a cumulative and distinguished effect. Countless organic, psychological, social and economic conditions permeate the maturing processes and the individual's interaction with the environment, whose negative effects add up or, on the opposite, gain the power to protect the child against developmental delays (Rutter, 2000).

The interaction between parents and children is considered fundamental for children's development and parents' coping with the preterm infant's birth, and the expectations constructed about this development can influence interaction patterns. Therefore, early intervention is extremely important, based on the promotion of public policies that involve more adaptive strategies in parents and specialized early stimulation for cases of greater childhood vulnerability.

Conclusion

This study offers a methodological contribution by testing a more updated version of the BSID scales (Bayley, 2006), using the screening version, little used so far in Brazilian research. For the local context, the identification of psychosocial risk factors related to preterm birth and low birth weight in a sample from a population about which little research has been done in the region can support the elaboration of prevention and intervention strategies.

These study results, showing that preterm children with low birth weight experienced cognitive, linguistic and motor performance difficulties, besides behavioral problems, during the first three years of life, confirm Brazilian and international data in the area. Moving beyond a performance assessment proposal, associated biological variables were identified, as well as some psychosocial risk factors, related to status variables, including young maternal age, low socioeconomic level, generally associated with bad housing conditions and lack of opportunities for the child, low education level of the father and not just the mother; besides other family context and parental care variables, like marital conflicts and overprotection, which may be associated with the correlation found between paternal presence at home and the presence of behavioral problems at a young age. In this respect, these data suggest a possible combination, constituting a typical condition of developmental "chaos", which increases the possibility of a negative outcome.

More than evidencing these children's difficulties, however, this risk assessment should highlight the need to

monitor their development, through assessment and early stimulation activities, in view of the observation of the family and social context the child is inserted in and the consideration that the presence of protective variables can support children's development in risk contexts. Thus, professionals are expected to maintain an optimistic posture towards the development history of children in contexts that offer some biological or psychosocial risk.

It is important for professionals to be able to cooperate with the parents in educative processes and post-discharge healthcare, based on techniques suggested in specialized outpatient clinics and which are applicable in the home context. In that sense, it is extremely important for healthcare services to offer family-oriented educative processes, emphasizing parental skills training in cases of prematurity and low birth weight and focusing on the stimulation of children's cognitive, linguistic, motor and behavioral skills, with emphasis on cognitive skills.

Similarly, actions are needed that consider family welcoming and promote the manifestation of coping strategies to facilitate changes in cases of births in more fragile biological conditions. This can lead to more adaptive reactions to this context among parents and, in the long term, to the reinforcement of children's more assertive behaviors, stimulated in line with the developmental profiles presented, which are constructed at the crossing between different biopsychosocial variables present in their life history.

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