ISSN 1413-3555
Rev Bras Fisioter, São Carlos, v. 13, n. 6, p. 506-13, Nov./Dec. 2009
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Family health program: proposal for identification of risk factors for neuropsychomotor development

Programa de saúde da família: proposta para identificação de fatores de risco para o desenvolvimento neuropsicomotor

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Abstract

Objectives: To investigate the occurrence of delayed neuropsychological and motor development in a community assisted through the Family Health Program and to evaluate its association with possible biological, environmental and socioeconomic risk factors. **Methods:** The sample consisted of 31 five-year-old children who were evaluated using the Neurological Development Test, following guidelines proposed by Coelho (1999)*. The study was carried out at the Family Health Program (FHP) center in the Brasilit area of Recife, PE, Brazil. Data were collected using a questionnaire that sought information on the child, its mother/guardian, the family's socioeconomic status and residence. Fisher's exact test was used for the statistical analysis of the results, with a significance level of 5%. **Results:** Appendicular coordination was the parameter with the highest frequency of deficits (90%) and static balance was the item least compromised (12.9%). The frequency of static balance deficits was higher among children who did not attend day care centers (p=0.0163) and among those who spent less time with their mother (p=0.0278). Motor persistence deficits were statistically associated with age of entry into day care (p=0.0415) and father-child time (p=0.0436). **Conclusions:** The FHP was not only a valuable setting for developing studies of this nature but also an appropriate setting for child development follow-up.

Key words: child development; risk factors; Family Health Program; motor activity.

* Coelho MS. Avaliação infantil nas ações primárias de saúde. São Paulo: Atheneu; 1999.

Resumo

Objetivos: Este estudo teve por objetivos investigar a ocorrência de atraso no desenvolvimento neuropsicomotor em uma comunidade assistida pelo Programa de Saúde da Família (PSF) e verificar a sua associação com possíveis fatores de risco biológicos, ambientais e socioeconômicos. **Métodos:** A amostra constou de 31 crianças, com 5 anos de idade, que foram avaliadas por meio do exame neurológico evolutivo (ENE) segundo roteiro proposto por Coelho (1999)*. O local do estudo foi o PSF do bairro de Brasilit, na Cidade de Recife, PE, Brasil, e os dados foram coletados mediante questionário contendo informações sobre a criança, sua mãe ou responsável, a situação socioeconômica da família e o domicílio. Para análise estatística dos resultados, utilizou-se o Qui-quadrado de associação de Fisher, com nível de significância de 5%. **Resultados:** A coordenação apendicular foi o parâmetro que apresentou a maior frequência de déficit (90%), e o equilíbrio estático foi o item menos comprometido (12,9%). A frequência de déficit no equilíbrio estático foi mais elevada nas crianças que não participaram de creche (p=0,0163) e naquelas que passavam menor tempo com a mãe (p=0,0278). O déficit na persistência motora esteve estatisticamente associado à idade de início na creche (p=0,0415) e ao tempo pai-filho (p=0,0436). **Conclusões:** O PSF, além de se constituir num espaço valioso para o desenvolvimento de trabalhos desta natureza, demonstrou ser local adequado para o acompanhamento do desenvolvimento infantil.

Palavras-chave: desenvolvimento infantil; fatores de risco; Programa de Saúde da Família; atividade motora.

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Received: 11/09/2008 – **Revised:** 16/03/2009 – **Accepted:** 16/05/2009

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Introduction

In recent decades, there has been increasing interest in monitoring overall child development because of the sustained reduction in child mortality and the recognition that problem prevention in childhood brings lifelong benefits[1]. Child development is related to neurological integrity combined with the child's behavior, learning skills, acquired skills and abilities to face the challenges of adulthood. This development transforms dependent newborns into productive adults capable of functioning in society[1].

Among the factors that influence child development are nutritional and environmental conditions, stimulation which can be aided by the family's routine, and the family's cultural, educational and socioeconomic standards[2-7]. The factors that have a negative influence on child development are more frequent in the low-income population due to the effects of low socioeconomic status, poor nutrition and inadequate environmental stimulation[3,4,6]. There is evidence that biologically healthy children raised in low socioeconomic conditions and those with chronic malnutrition or neuropsychological learning and behavior difficulties show changes in the Neurological Development Test (NDT)[3,5,8]. Therefore, monitoring all stages of child development with a multidisciplinary team allows early detection and prevention of possible changes that could affect overall development[1,9-11].

The Family Health Program (FHP) is the main strategy of the Brazilian Health Ministry (HM) for restructuring primary care, and it is responsible for strengthening campaigns for disease prevention, health and recovery. The FHP provides real surveillance of suspected delays in child development because it sees the individual as unique, integral part of a broader context, i.e. family and community[12,13]. According to the HM, health professionals should be capable of recognizing the most important aspects of child development and to identify children who should be referred to a specialist[1]. Among these professionals, the qualified physical therapist can make an early assessment of child development and play an important role in the primary care actions within the community. There is a consensus that the earlier the diagnosis of developmental delay and the sooner the intervention, the lower the impact of future damage[4]. Thus, given the above and the importance of studies on child development and its possible disorders, the present study aimed to investigate the occurrence of developmental delays in a community assisted by the FHP and verify its association with possible biological, environmental and socioeconomic risk factors.

Methods

The present cross-sectional study was carried out in the Brasilit area of Recife, PE, Brazil, targeting five-year-old children assisted by the FHP. According to data obtained from the Primary Care Information System (PCIS), 354 children between the age of five and six years were assisted by the Brasilit FHP. In order to make the sample as homogeneous as possible, the study included only those children who turned five years old on the month of the assessment or within three months before or after the month of assessment. This age group was chosen because medical check-ups are no longer routine and are limited to age-related complications, thus reducing the changes for motor development evaluation[14]. At this stage, children should already have reached all of the motor development milestones and also had a period to refine their later motor skills[15].

Based on the medical charts supplied by the Brasilit FHP, 77 children of this age group were identified. Of these, six had the incorrect age on the medical chart, 20 had moved away and 20 had to be excluded (two due to neurological disease, three due to premature birth and 15 who were not cooperative during the NDT). Therefore, the final sample was composed of 31 children.

To evaluate neuropsychomotor development, we used the NDT, which has been described as an important semiological resource to assess the performance and maturity of a child's nervous system[3,5,16-20]. The test was applied according to Lefèvre[20] and Coelho[17], and it was chosen because it is a simple, easy-to-use and low-cost method that does not require resources, facilities and specialized materials. In Brazil, Coelho[17] proposed items of the NDT that should be tested to quantify the assessed elements[17,21,22]. These tests are not only indicated for primary care services but they also warn about the risk of child development delays and the need for confirmatory diagnostic tests[17,21,22].

The evaluations were carried out at the child's home or at the local FHP clinic and lasted no more than 20 minutes. All of the tests were applied in a playful and interactive manner. Before the evaluation, the children went through an adjustment period so they could familiarize themselves with the researcher and the instruments to be used during the test. The researcher had previous training and experience in applying tests and using the instrument.

The NDT evaluates static balance, dynamic balance, appendicular coordination, motor coordination, motor persistence and sensitivity as follows[15].

I) Static Balance: the child must stand for 10 seconds with one foot in front of the other;
II) Dynamic Balance (composed of six tests):
   1st The child must walk heel to toe over a straight, two-meter line;
   2nd The child must run and jump 30 cm high with both feet simultaneously, using a rope placed 30 cm off the ground as reference;

3rd The child must jump over the rope with both feet from a static position;
4th The child must jump and spin at least 180 degrees before landing on the same spot;
5th The child must move over a five-meter line while jumping with feet together;
6th The child must move forward while jumping on one foot over a five-meter line.

III) Appendicular Coordination and Fine Motor Skills (composed of five tests):
1st The child is shown a 10x10 cm card with a circle that he/she must copy. A closed figure is acceptable;
2nd The child is shown another 10x10 cm card with a square and encouraged to copy it. A general square shape and near right angles is acceptable, and it does not need to be equilateral;
3rd The child must throw a tennis ball and hit a 30x30 cm target drawn on the wall at shoulder height and at a distance of 2 m;
4th The child must touch all four fingertips successively with the tip of the thumb, one hand at a time, with two attempts for each hand;
5th The child must open one hand and close the other, alternately, as fast as possible for 10 seconds, with arms stretched forward horizontally and palms facing down.

IV) Motor Persistence: While seated with eyes closed, the child must protrude the tongue for 40 seconds. The persistence of three movements was observed, i.e. opening the mouth, tongue protrusion and keeping eyes closed.

V) Sensitivity: The child must know and name the colors white, yellow, green, red, blue and black.

If the child failed a test in the NDT item, he/she was considered to have a delay in that item. The variables analyzed as possible risk factors were: gender and birth weight, day care center attendance, age of entry into day care center, mother's age and educational level, maternal work outside the home, father-child and mother-child time, and per capita income. The researcher conducted home interviews to collect data about the child, the mother or guardian, the socioeconomic status of the family, and the residence.

The child's birth weight, obtained either from medical charts or from the mother's or guardian's memory, was classified according to the World Health Organization[23]. The mother's age was evaluated in years, and the educational level in years of study. For analysis of the *per capita* income, we considered the mean of the total household income in the last two months. The household income was the sum of revenues of all family members, including wages and other earnings. For the purposes of analysis, this income in local currency (real) was converted into minimum wage (MW) units. Thus, the per capita income was calculated by dividing the total household income (wages + other earnings) by the number of people in the household.

To take part in the study, the children had to be enrolled in the FHP and a parent or guardian had to sign the informed consent form. All mothers or guardians received information about the study, procedures and objectives. They were also informed that they could withdraw from the study at any stage. The present study was approved by the Human Research Ethics Committee of the Health Sciences Center of Universidade Federal de Pernambuco under protocol number 156/06 according to Resolution 196/96-CNS.

All data were double-entered to ensure the consistency and validation of the variables. For processing, the SPSS (version 10.0) for Windows and EPI-INFO (version 6.02) software were used. For statistical analyses, Fisher's chi-square (χ^2) was used to test the association between motor development and possible risk factors. A confidence level of 95% was adopted for all analyses. Statistical tests could not be performed in some cases, therefore descriptive analysis of the differences between proportions was used.

Results

Among the evaluated children, 16 (51.6%) were male, more than half had normal birth weight (21; 77.8%), six (22.2%) had insufficient birth weight, and none of them had low birth weight.

Figure 1 demonstrates the frequency of children with some form of neuropsychomotor developmental delay according to the analyzed parameters. Appendicular coordination had the highest deficit frequency (27; 90%), followed by dynamic balance (24; 80%). The least compromised parameter was static balance (4; 12.9%). Of the children who failed in the appendicular coordination item, six (22.22%) failed one test, eleven (40.74%) failed two tests, five (18.51%) failed three tests and five (18.51%) failed four tests. For the dynamic balance item, six (25%) failed one test; nine (37.5%) failed two tests; six (25%) failed three tests; two (8.33%) failed four tests and one child failed all tests.

The results of the association analyses between static balance and the selected risk factors showed statistically significant differences for the variables day care center and mother-child time (Table 1). Of the children who did not attend a day care center, three (50%) had a static balance delay (p=0.0163) according to the NDT. Mother-child time of less than eight hours was a risk factor for static balance delay (p=0.0278).

Table 2 shows the results of the bivariate analysis between motor persistence and the selected variables. Age of entry

into day care and father-child time were statistically associated with the highest percentile of motor persistence deficit. For those children who started attending day care at an early age, delayed motor persistence occurred in seven (70%), and for the children who started later, delayed motor persistence dropped to four (26.7%; p=0.0415). Children who spent most of the day with the father showed a higher deficit frequency (p=0.0436). There was no significant association between dynamic balance, appendicular coordination and sensitivity and the variables studied.

Discussion

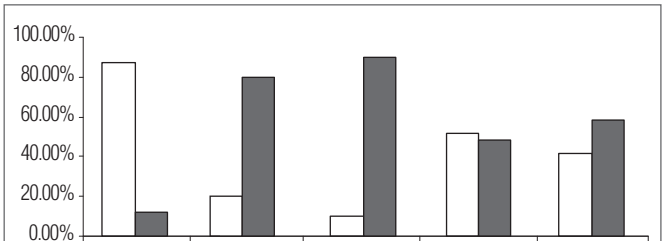
There is evidence in the literature that child development is a process conditioned and determined by several factors, such as biological, environmental and socioeconomic factors[4,6,9]. According to Guardiola, Egewarth and Rotta[5], appendicular coordination constitutes one of the most important functions of the NDT to evaluate the cortical functions. In the present study, appendicular coordination and dynamic balance were the most compromised parameters among those evaluated, a fact also observed by Barros et al.[3] in children who attended public day care centers.

It is generally accepted that mother-child interaction is important for the cognitive[24] and motor[25] development because the mother is usually able to interpret the subtle signs of the child and respond to them[26]. The present results showed that children who spent less time with their mother on a daily basis demonstrated a higher frequency of static balance deficit compared to those who spent more time with the mother, which suggests that the maternal presence can act as a protection factor for the acquisition of this motor skill. Assuming that static balance is an important neurological function for the maintenance of proper postures that are essential to child development[16], the delay observed in the present study may indicate difficulties in the acquisition of future skills.

Consistent with the results observed by Pacheco and Dupret[27] and corroborating other studies[28,29] that reported that children who attended day care centers had better development, the results of the association between static balance and day care center attendance showed greater impairment for the children who did not attend day care. Admittedly, environmental stimulation is one of the most important factors for child development, especially in the early months and years of life[24,30-32]. de Barros et al.[3], comparing the motor development of children who attended public and private day care centers, verified that the high percentage of motor development delay in the children of the public day care centers was mainly related to later entry and low stimulation in terms of recreational activities offered at the public centers compared to the private ones. The present study did not aim to investigate the type of day care center (public or private), however it was observed that the age of entry was a determinant for the higher incidence of motor persistence deficit. Based on the fact that the sample of children come from poor families with a per capita income of less than half a MW, it can be assumed that most of the children attend public day care centers that do not offer the proper stimulation for child development in a period in which the child is most vulnerable to environmental factors[3,33].

An intriguing result was the observation that longer father-child time was statistically associated with a higher percentage of motor persistence delay, unlike the results of previous studies that show paternal presence as a positive effect on child development[6,7,24]. Bustamante[34] reported that paternal presence is usually related with unemployment and that, by the father's own conception of fatherhood, being a provider is a necessary condition to having an affectionate relationship with his children and excludes physical care, which is attributed to women[34]. This interpretation can be used to justify the fact that, in this studied sample, the longer father-child time was not a protection factor for the child's motor development.

One of the most investigated factors among socioeconomic risks to motor development is per capita income[4,6,31,35]. The income level influences the purchase of goods and services, such as food, housing, sanitation and others[36]. Thus, a low socioeconomic level is a risk factor for child development[4,6,31,35]. However, in the present investigation, the per capita income was not a risk factor for developmental delay in any of the evaluated parameters. This result can be explained by the relatively homogeneous nature of the sample in terms of income level, therefore no significant differences in relation to buying power.



	Static balance	Dynamic balance*	Appendicular coordination**	Motor persistence	Sensitivity
□Normal	87.10%	20.00%	10.00%	51.60%	41.90%
■Delay	12.09%	80.00%	90.00%	48.40%	58.10%

*No information=1; **No information=1.

Figure 1. Frequency of neuropsychological and motor development delay in five-year-old children assisted by the Family Health Program/ Brasilit, according to static balance, dynamic balance, appendicular coordination, motor persistence and sensitivity.

Table 1. Neuropsychological and motor development in five-year-old children assisted by the Family Health Program/Brasilit, according to static balance and some variables of interest.

Variables*	Total	Normal Static Balance		Delay in Static Balance		Statistics
	N	N	%	N	%	
Sex						
Male	16	13	81.3%	3	18.8%	Fisher p=0.3248
Female	15	14	93.3%	1	6.7%	
Birth Weight						
2500-2999g	6	5	83.3%	1	16.7%	Fisher p=0.6589
≥3000g	21	18	85.7%	3	14.3%	
Day care center						
Yes	25	24	96.0%	1	4.0%	Fisher p=0.0163
No	6	3	50.0%	3	50.0%	
Age of Entry into Day Care						
24-35 months	10	10	100.0%	0	0.0%	Fisher p=0.6000
36-59 months	15	14	93.3%	1	6.7%	
Mother's Age						
20-29 years	15	12	80.0%	3	20.0%	Fisher p=0.2747
30-72 years	16	15	93.8%	1	6.3%	
Mother's educational level						
0-8 years	22	18	81.8%	4	18.2%	Fisher p=0.2669
9-11 years	8	8	100.0%	0	0.0%	
Maternal work outside the home						
No	3	3	100.0%	0	0.0%	Fisher p=0.6507
Yes	28	24	85.7%	4	14.3%	
Mother-Child Time						
0-6 hours	7	4	57.1%	3	42.9%	Fisher p=0.0278
8-24 hours	24	23	95.8%	1	4.2%	
Father-Child Time						
0-6 hours	22	19	86.4%	3	12.6%	Fisher p=0.6729
8-24 hours	9	8	88.9%	1	11.1%	
Per Capita Income (Minimum Wage)						
≤½ the minimum wage	24	20	83.3%	4	16.7%	Fisher p=0.3377
> ½ the minimum wage	7	7	100.0%	0	0.0%	

*Final numbers may vary due to occasional missing data for some variables.

The results of the present study differed from other studies with regard to the predictive aspect of some variables as risk factors for child development, such as the mother's educational level and birth weight. The mother's educational level is important to child development because it has a direct influence on the quality of domestic stimulation[24]. Although the literature shows that this variable is an important determinant for motor development[9], the same was not observed in the present study. A preliminary interpretation would suggest that the sample size may have influenced the obtained result. However, other authors have used representative samples and did not find such an association, e.g. De Andraca et al.[6] in a prospective study with 788 infants and Handal et al.[2] who evaluated 283 children between three and 60 months of age. Regarding birth weight, the most probable explanation for its lack of association with deficits would be the relative homogeneity of sample, as there was no report of low birth weight.

Although there was no uniformity among the numerous studies on the best method for motor development assessment, there is a consensus on the importance of early detection of developmental problems. Early diagnosis and intervention becomes a determinant to minimizing the effects of the problem

Table 2. Neuropsychological and motor development in five-year-old children assisted by the Family Health Program/Brasilit, according to motor persistence and some variables of interest.

Variables*	Total		Normal Motor Persistence		Delay in Motor Persistence		Statistics
	N	%	N	%	N	%	
Sex							
Male	16	51.6%	7	43.8%	9	56.3%	x^2= 0.30 p=0.5856
Female	15	48.4%	9	60.0%	6	40.0%	
Birth weight							
2500-2999g	5	20.0%	2	33.3%	4	66.7%	Fisher p=0.3618
≥3000g	20	80.0%	11	52.4%	10	47.6%	
Day care center							
Yes	25	80.6%	14	56.0%	11	44.0%	Fisher p=0.2945
No	6	19.4%	2	33.3%	4	66.7%	
Age of entry into day care							
24-35 months	10	40.0%	3	30.0%	7	70.0%	Fisher p=0.0415
36-59 months	15	60.0%	11	73.3%	4	26.7%	
Mother's age							
20-29 years	15	48.4%	8	53.3%	7	46.7%	x^2=0.03 p=0.8618
30-72 years	16	51.6%	8	50.0%	8	50.0%	
Mother's educational level							
0-8 years	22	73.3%	12	54.5%	10	45.5%	Fisher p=0.3408
9-11 years	8	26.7%	3	37.5%	5	62.5%	
Maternal work outside the home							
No	3	9.7%	2	66.7%	1	33.3%	Fisher p=0.5250
Yes	28	90.3%	14	50.0%	14	50.0%	
Mother-child time							
0-6 hours	7	22.6%	4	57.1%	3	42.9%	Fisher p=0.5393
8-24 hours	24	77.4%	12	50.0%	12	50.0%	
Father-child time							
0-6 hours	22	71.0%	14	63.6%	8	36.4%	Fisher p=0.0436
8-24 hours	9	29.0%	2	22.2%	7	77.8%	
Per capita income (Minimum wage)							
≤ ½ the minimum wage	24	77.4%	12	50.0%	12	50.0%	Fisher p=0.5393
> ½ the minimum wage	7	22.6%	4	57.1%	3	42.9%	

*Final numbers may vary due to occasional missing data for some variables.

in the future. The systematic monitoring of child development through a simple, easy-to-use and low-cost methodology, such as the one used in the present study, can be an important form of early detection and viable to be set up in public programs.

It should be noted that there were difficulties during the present study related to the data contained in the FHP medical charts and lack of cooperation by some children and families. These difficulties reduced the sample and limited the analyses and the interpretation of results. This does not mean, however, that programs such as the FHP are not appropriate for investigations of this nature. Given its knowledge of the geographical area and the local population, the FHPs seem to be appropriate for the evaluation and monitoring of child development[1,13], as demonstrated by Eickmann et al.[35]. Furthermore, the sample losses during the course of the present study were not an isolated fact. In the current literature, there are reports of sample losses of 40% due to reasons similar to the ones observed here[37].

Despite the difficulties during the present investigation and its limitations, the association results suggest that, in the studied sample, less mother-child time, non-attendance of day care centers and more father-child time were factors related to motor

development delay. However, it is important to emphasize that the results of the analysis found only an indication of association between the variables, being therefore inconclusive, and its extrapolation should be viewed with caution.

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