DOI: 10.1590/1809-2950/18047027012020

ORIGINAL RESEARCH

Evaluation of child motor development and its association with social vulnerability

Avaliação do desenvolvimento motor infantil e sua associação com a vulnerabilidade social

Evaluación del desarrollo motor infantil y su asociación con la vulnerabilidad social

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ABSTRACT | This study aimed to evaluate the motor development of children aged four to 17 months and investigate its association with sociodemographic risk factors. This is a cross-sectional descriptive study conducted with clinically stable children aged four to 17 months from the pediatric inpatient unit of a public hospital in Porto Alegre, RS, and whose hospital discharge would happen soon. For the evaluation of sociodemographic risk factors, a questionnaire developed by the researchers was used which addressed biological, social and environmental factors. The Alberta Infant Motor Scale (AIMS), in its version translated, adapted and validated to Brazilian Portuguese, was used in the evaluation of motor development. In statistical analysis, Student's t-test and Chi-square test were used with significance level of 5% (p≤0.05) for all tests. From a total of 110 evaluated children, motor performance was lower than expected in more than half of them (63.6%, n=70). Motor development presented statistically significant associations with delayed vaccines (p=0.005), cohabitation with smokers (p=0.047), and receiving socioeconomic benefits (p=0.036). In conclusion, social factors such as delayed vaccines, cohabitation with smokers and receiving socioeconomic benefits may be associated with risk factors related to motor development of children aged four months to 17 months old.

Keywords | Physical Therapy; Child Development; Risk Factors; Social Vulnerability.

RESUMO | O objetivo deste estudo foi avaliar o desenvolvimento motor de crianças de quatro a 17 meses e investigar sua associação com fatores de risco sociodemográficos. Estudo transversal, descritivo, composto por crianças de quatro a 17 meses provenientes da unidade de internação pediátrica de um hospital público de Porto Alegre (RS), clinicamente estáveis e com alta breve prevista. Para a avaliação dos fatores de risco sociodemográficos foi utilizado um questionário elaborado pelas pesquisadoras, que abordou fatores biológicos, sociais e ambientais. Para a avaliação do desenvolvimento motor foi utilizada a Alberta Infant Motor Scale na versão traduzida, adaptada e validada para a população brasileira. Para a análise estatística foi utilizado o teste t de Student e o teste qui-quadrado, com nível de significância de 5% (p≤0,05). De um total de 110 crianças avaliadas, o desempenho motor se mostrou aquém do esperado em mais da metade delas (63,6%, n=70). Houve associação estatisticamente significativa entre o desenvolvimento motor e vacinas atrasadas (p=0,005), convivência com tabagistas em casa (p=0,047) e recebimento de benefício socioeconômico (p=0,036). Conclui-se que esses fatores sociais podem estar associados a fatores de risco ao desenvolvimento motor de crianças de quatro a 17 meses.

Descritores | Fisioterapia; Desenvolvimento Infantil; Fatores de Risco; Vulnerabilidade Social.

RESUMEN | El presente estudio tuvo el objetivo de evaluar el desarrollo motor de niños de 4 a 17 meses de edad e investigar su asociación con factores de riesgo

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Financing source: nothing to declare – Conflict of interests: nothing to declare – Presentation: Sep. 22nd, 2018 – Accepted for publication: Nov 12th, 2019 – Submitted to Comitê de Ética em Pesquisa do Hospital Materno Infantil Presidente Vargas (CEP-HMIPV) for review and approved under No. CAEE 69154217.4.0000.5329.

sociodemográficos. Es un estudio transversal, descriptivo, en el cual participaron niños de 4 a 17 meses de la unidad de hospitalización pediátrica de un hospital público en Porto Alegre (Brasil), clínicamente estables y con la espera de recibir el alta pronto. Para la evaluación de los factores de riesgo sociodemográficos, se utilizó un cuestionario desarrollado por los investigadores, que abordó los factores biológicos, sociales y ambientales. Para la evaluación del desarrollo motor, se utilizó la Alberta Infant Motor Scale en la versión traducida, adaptada y validada para la población brasileña. En el análisis estadístico, se aplicaron la prueba t de Student y la prueba chi-cuadrado, con un nivel de significación del 5% (p≤0,05). De 110 niños evaluados, más de la mitad de ellos (63,6%, n=70) tuvieron rendimiento motor inferior a lo esperado. Hubo una asociación estadísticamente significativa entre el desarrollo motor y las vacunas tardías (p=0,005), la convivencia con fumadores en el hogar (p=0,047) y el recibimiento de beneficios socioeconómicos (p=0,036). Se concluye que estos factores sociales pueden estar asociados con factores de riesgo para el desarrollo motor de niños de 4 a 17 meses.

Palabras clave | Fisioterapia; Desarrollo Infantil; Factores de Riesgo; Vulnerabilidad Social.

INTRODUCTION

Human development is a continuous age-related process, which involves sequential and complex changes[1,2]. In this process, innumerable important psychomotor skills are acquired, which evolve from simple disorganized movements to highly complex abilities[3-5]. In the last decades, an important change has been observed in the profile of child morbidity, as infectious and parasitic diseases and malnutrition, which used to be prevalent disorders, have included with new situations of morbidities, such as exposure to violence, parents using drugs, increasing obesity and sedentary lifestyle, in addition to important health inequities resulting from economic, racial and ethnic inequalities[6].

This way, children living in low- and middle-income countries are, since early childhood, more vulnerable to inequalities and issues involving risks affecting child development. These accumulated developmental deficits in early childhood have a negative impact on the cognitive and psychological functioning in the adult life, affecting future education and income, thus contributing to continuous inequalities, generation after generation. Then, it is evident that prenatal and early childhood exposure to biological and psychosocial risk factors affects the structure and function of the brain, compromising the development of children and their future development[7].

According to a report developed in 2016 about the global situation of childhood[4], by 2030 almost 120 million children will present growth retardation, impairing their physical and cognitive development, with some irreversible consequences. Then, based on evidence, child development, especially in early childhood, should be a priority in all sectors; as well as equity for children, since investing in needy people has moral and strategic importance. These efforts are mainly a matter of political will, which must be translated into actions through public policies, programs and investments focused on equity to improve the life of the most disadvantaged people[8,9].

Knowing that the development process is dynamic and can be shaped by different external stimuli, an early identification of children exposed to risk factors and an assessment of their development are critical to minimize future problems[10,11].

In this context, considering the importance of child motor development monitoring, this study aimed to assess the motor development of children aged four to 17 months and investigate its association with sociodemographic risk factors.

METHODOLOGY

Study design and participants

This is a cross-sectional descriptive study with convenience sampling, that is, all subjects whose parents accepted to answer the questionnaires and met the inclusion criteria participated in this study. Data were collected between July and December 2017, with the sample consisting of patients hospitalized in the pediatric unit of Hospital Materno Infantil Presidente Vargas (HMIPV), in Porto Alegre (RS). The study included children aged four to 17 months, clinically stable, without oxygen support to be discharged

soon, whose parents or guardians signed an Informed Consent Form (ICF) after being informed about the study. This study excluded children (1) diagnosed with a neurological disease; (2) who were in a physical or motor rehabilitation program; or (3) that, for some reason, did not meet the inclusion criteria.

Evaluation procedure and instruments

The evaluations were conducted in a room of the sector specifically dedicated to this purpose, with furniture that allowed spontaneous and safe movements of children.

Identification questionnaire

A questionnaire was used to obtain general information about every child; it was developed by the researchers based on current literature that broadly addresses the biological, social and environmental aspects that can be considered risk factors for motor development. The questionnaire addressed the main health information of the child, from pregnancy to hospitalization at the time of the study, and information related to the health of family members and socio-environmental data. The questionnaire was applied in about 15 minutes as an interview.

Motor development

Then, the Alberta Infant Motor Scale (AIMS)[12], an observation instrument translated, adapted and validated for the Brazilian population[13], was used in motor development evaluation. The AIMS assesses the motor development of full-term and preterm newborns, from 38 weeks of gestational age to 18 months of corrected age, allowing the quantification of spontaneous movement and motor skills of a child; this scale analyzes 58 items organized into four positions: supine (9 items), prone (21 items), sitting (12 items) and standing (16 items). Each posture has positions that the baby assumes and one point is assigned, generating a final score at the end. The scores of these four positions are added and a total score is obtained and then converted into a percentage of motor level, comparing it to levels of individuals of equivalent ages from standard samples in a table, ranging from 0% to 100%. With this motor percentage level, babies can be categorized as typical (motor level above 25%), suspected delay (between 5% and 25%), and delay (below 5%)[12]. Raters had a previous 2-week training with physicians from the area and were blinded during the evaluation. This scale was kindly provided by the Motor Evaluation and Intervention Group of Escola de Educação Física, Universidade Federal do Rio Grande do Sul (UFRGS).

Statistical analysis

Descriptive statistical analysis was performed by calculating frequency, percentage, mean and standard deviation (SD), according to the nature of data. The chi-square test was used to analyze the frequencies for dichotomous variables. The effect size was calculated using the Cohen test for variables that did not show significant differences in the motor performance of the children. The level of significance was 5% ($p \leq 0.05$) for all tests, and the analyses were processed in Statistical Package for the Social Sciences (SPSS), version 22.0.

RESULTS

This study evaluated 110 children, mean age of 8.95 months (SD±4.315), 61 male children (55.5%). Regarding their gestational age, 24 were premature (21.8%) as their gestational age was less than 37 weeks, and 89 (80.9%) had adequate weight at birth. Of all children evaluated, 66 (60%) had no underlying pathology and 91 (82.7%) were hospitalized due to respiratory causes, 70 (63.6%) of them were hospitalized for the second time or more, and 67 (61%) had incomplete vaccination. Table 1 shows the sociodemographic characteristics of the sample.

Also, 37.2% of all children did not have a paternal presence at home, 48.7% lived with smoking at home and only 13.9% attended daycare. Regarding their families, 29% of mothers did not have six prenatal consultations, which is the minimum number recommended by the Ministry of Health[14], and 29% of the mothers smoked during pregnancy. Most parents did not complete basic education (38.7% of mothers and 28.1% of fathers), 61.1% had an income of up to twice the minimum wage, 51.9% received some socioeconomic benefit, and 41.7% of the families reported living with violence (Table 1).

Table 1. Sociodemographic characteristics of the sample

Variables	n*	%
Ethnic group (n=110)		
White	53	48.2
Black, brown and indigenous	57	51.8
Maternal age (n=108)		
Up to 20 years old	31	28.7
21 years old and over	77	71.3
Paternal age (n=100)		
Up to 20 years old	16	16
21 years old and over	84	84
Income (n=108)		
Up to twice the minimum wage	66	61.1
More than twice the minimum wage	42	38.9
Socioeconomic benefit (n=108)		
No	52	48.1
Yes	56	51.9
Basic sanitation system (n=110)		
No	28	25.4
Yes	82	74.6
Local violence (n=108)		
No	63	58.3
Yes	45	41.7

*n (number) differed according to the variable as some information was not provided.

Figure 1 shows the results of AIMS application. According to these results, the motor performance of more than half of the children evaluated (63.6%, n=70) was below expectations.

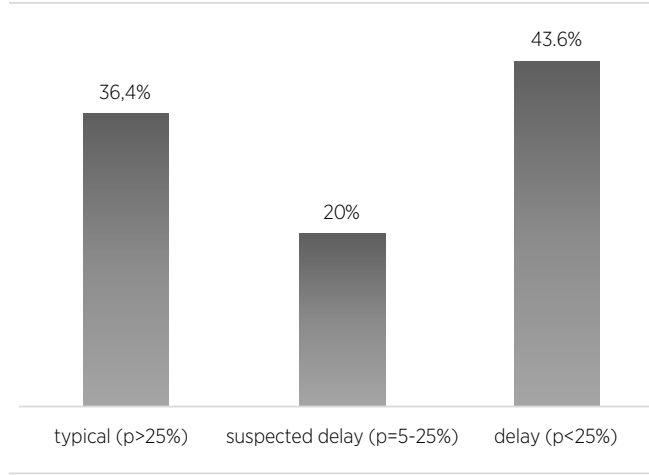

Figure 1. Classification of motor development of the sample, according to the percentile (P) obtained in AIMS

Table 2 shows the results of association between the motor development of children and potential social risk factors. Of the children with suspected delay and delayed motor development, 70% (n=49) had incomplete vaccination, with an association between these two variables (p=0.005). Children whose families received socioeconomic benefits also presented delayed motor development (p=0.036). An association was also observed between motor development and the presence of smokers at home (p=0.047).

Table 2. Classification of motor development and association with social risk factors

Variables	Typical		Suspected delay		p value	d value[a]
	n	%	n	%		
Maternal age						
Up to 20 years old	13	32.5	18	25.7	p=0.447	d=0.2126
21 years old and over	27	67.5	52	74.3		
Taken all vaccines requested						
No	17	42.5	49	70	p=0.005*	-d=0.0224
Yes	23	57.5	21	30		
Prenatal consultation						
0-5 consultations	8	20	23	32.9	p=0.149	d=0.1239
6 consultations or more	32	80	47	67.1		
Smoking during pregnancy						
No	31	79.5	45	66.2	p=0.144	d=0.1218
Yes	8	20.5	23	33.8		
Smokers at home						
No	25	64.1	31	44.3	p=0.047*	d=0.0695
Yes	14	35.9	39	55.7		
Presence of father at home						
No	12	30	29	41.4	p=0.233	d=0.1551
Yes	28	70	41	58.6		
Mother's education						
Incomplete basic education	20	50	38	54.3	p=0.665	d=0.26
Complete basic education or above	20	50	32	45.7		

(continues)

Table 2. Continuation

Variables	Typical		Suspected delay		p value	d value[a]
	n	%	n	%		
Father's education						
Incomplete basic education	11	27.5	23	32.9	p=0.559	d=0.2412
Complete basic education or above	29	72.5	47	67.1		
Income						
Up to twice the minimum wage	20	51.2	46	66.7	p=0.115	d=0.1088
More than twice the minimum wage	19	48.8	23	33.3		
Socioeconomic benefit						
No	24	61.5	28	40.6	p=0.036*	d=0.0608
Yes	15	38.5	41	59.4		
Basic sanitation system						
No	11	28.2	17	24.3	p=0.653	d=0.261
Yes	28	71.8	53	75.7		
Local violence						
No	21	53.8	42	60.9	p=0.477	d=0.2226
Yes	18	46.2	27	39.1		
Attend daycare						
No	33	84.6	60	87	p=0.735	d=0.2772
Yes	6	15.4	9	13		

*chi-square test; [a]effect size (Cohen's d): 0.2-0.4 small effect; n (number) differed according to the variable as some information was not provided.

For the other variables evaluated in this study, no statistically significant association with motor development was found; however, relevant data were observed. Of all children with delayed motor development, 41.4% (n=29) do not live with a paternal presence, and 87% (n=60) do not attend daycare. Regarding mothers, 25.7% (n=18) are 20 years old or younger, 33.8% (n=23) smoked during pregnancy and 54.3% (n=38) had not completed basic education. Table 2 also shows the effect size calculation, and the variables that did not show a statistically significant difference in motor performance presented a small effect (d=0.2-0.4) regarding an impact on motor development.

DISCUSSION

When evaluating the motor development of 110 children aged four to 17 months, this study found that most of them (63.3%) demonstrated motor development below expectations, with delay or suspected delay in motor development. Other recent studies[15,16] with similar populations and using different scales also found high rates of delay in motor development. Sá et al.[17] conducted an evaluation and intervention study with 100 infants aged 0 to 18 months, also using the AIMS. An initial evaluation found delayed motor development in 55% of all children, a similar number to that found in this study. In view of the above, child development requires more attention and care, not only from researchers, but mainly from health and education professionals and public authorities, who must monitor all age groups, no matter the scenario these children are inserted.

This study statistically associated motor development with the presence of smokers at home (p=0.047), and maternal smoking during pregnancy also showed high frequency (33.8%), although not statistically significant (p=0.144). Several studies[18,19] that evaluated children of similar age found a significant association between delayed child motor development and prenatal exposure to passive and active smoking. A study conducted by Ribeiro, Perosa and Padovani[20], which analyzed 65 children of around one year old, reported a significant association between postnatal maternal smoking and the overall development of children, in agreement with the findings of this study. A study performed in Great Britain and Greenland[21] that evaluated children aged eight to nine years old, concluded that children of smokers had more motor issues when compared to children of nonsmokers, suggesting that the effects of exposure to smoking are not restricted to early childhood, as they may persist in subsequent years.

In addition to being directly related to delayed development, frequent exposure to smoking can explain other situations, such as the high number of hospital admissions due to respiratory causes found in this study, as 82.7% of children were hospitalized for that reason.

In addition to the direct and well-known damage caused by frequent exposure to smoking, this variable is also related to frequent hospital admission, as observed in this study, where 63.6% of the studied population was in the second hospital admission or more. Frequent admission also has an impact on the quality of life, as hospitalized children experience physical limitations, pain and fear; miss classes and are away from home routine and family members[22]. All these aspects indirectly affect their development, reinforcing the importance of health professionals to provide information and guidance to family members about these issues, which can be avoided.

Regarding socioeconomic variables, in this study, family income and delayed motor development were independent (p=0.115). However, after observing the highest percentage of study participants had a family income of two to three times a minimum wage, an association of motor delay with receiving some socioeconomic benefit was also analyzed. One of the most frequently mentioned benefits was Bolsa Família, an allowance for families in poverty and extreme poverty whose monthly per capita income is max. BRL170[23]. This analysis showed a statistically significant association (p=0.036), confirming low family income as a risk factor for child development. Also, when analyzing the results of a cross-tabulation analysis for family income and delayed development, in the categories of suspected delay with income up to twice the minimum wage, the number of expected cases was 42.2 children and the number of cases actually found was 46 children; that is, if the number of expected cases was lower than the number of cases actually found, the hypothesis of independence would be rejected. The same occurred in the categories of typical development with income above two minimum wages: the number of cases was 19 and the actual number was 15.2.

Several studies[24-27] have demonstrated income as a significant risk factor when related to child development. Crestani et al.[24] evaluated 182 mother-baby dyads, between zero and 18 months, and concluded that in families with per capita income under BRL200, the chance of a child with compromised development was six times greater in relation to children from the group with an income above BRL200 per capita. Likewise, Wei et al.[25] conducted a study that assessed the development of children aged one to 35 months using a questionnaire of five domains: communication, gross motor skills, fine motor skills, problem-solving skills, and personal-social relationship. The authors concluded that family income was associated with child development in all domains, including motor skills, in agreement with this study.

This study also showed that, although without a statistically significant association, most mothers (54.3%) had not completed basic education and 25.7% were 20 years old or younger. According to the literature, different studies[26-29] have demonstrated an association between the level of maternal education and development scores, assessed by different scales and with similar populations. Pereira, Saccani and Valentini[27] evaluated 49 babies aged three to 16 months using AIMS, just like this study, and observed significant associations between motor development and income and maternal and paternal education, suggesting, in this aspect, a stronger influence of environmental factors when compared to biological factors.

Then, family income is closely related to child development, since a good economic condition can offer better physical space, toys, entertainment experiences, among other things, in addition to better general conditions for the family. In other words, income is directly responsible for the quality of life of these children[30,31]. So, this study emphasizes the importance of monitoring child development, especially those children in unfavorable living conditions, in order to reduce the likelihood of negative and even irreversible consequences caused by these risk factors.

This study also showed an association between delayed motor development and incomplete vaccination (p=0.005). The literature has few studies correlating these two variables. Veleda, Soares and César-Vaz[32] analyzed the neuropsychomotor development of 220 children aged eight to 12 months and found that children with incomplete vaccination are twice as likely to develop suspected delay in development when compared to children with complete vaccination, although this association presented only a trend towards statistical significance. Pedraza, Sales and Menezes[33] evaluated 353 children aged six to 72 months and found a statistically significant association between delayed vaccination and height deficit and per capita income lower than half a minimum wage. That is, children with delayed vaccination are smaller and remain in economically disadvantaged groups.

Different studies[34,35] found an association between incomplete vaccination with family income and education of parents/guardians. They suggest that these factors contribute to delayed development due to several conditions: difficult access to health services, transportation issues, lack of health facilities in peripheral areas, parent/

guardian's poor knowledge of the importance of vaccines, poor understanding of the guidelines provided by health professionals, among others. Then, some studies[36-38] highlighted the determinants in delayed vaccination. The main reasons mentioned by parents/guardians for delayed vaccination were: lack of vaccines at the health centers, child was sick on the vaccination day, lack of time, distance from the health center, parent/guardian forgot about the vaccine, poor understanding between parents/guardians and health professionals, and impossibility to attend the health service due to working hours or health issues. All these determinants highlight the importance of having the government ensure health care services to everyone and having health units develop strategies and actions that take into account local specificities in an attempt to reduce non-vaccination rates.

Delayed vaccination causes indirect influence on child development, since non-immunization may expose the child to diseases and morbidities, causing health-related risks. For this reason, vaccination coverage is an important indicator and deserves special attention at all levels of health, as well as other biological, social and environmental factors discussed in this study.

Some study limitations must be considered. The small sample of this study (110 children) does not allow a more robust statistical analysis or extrapolating results to the entire population. The analysis based on family income in minimum wage may also have affected the analysis of results, which perhaps would not have happened if this variable had been measured as per capita income. Another aspect to be considered was the impossibility to specify the total hospitalization time of the children, since this study did not monitor them until discharge. In addition, some data were not provided in the answers of parents/guardians, especially in questions about the use of illicit drugs and other psychoactive substances, even with explanations about study objective and confidentiality of information provided, which may have influenced the results of this study.

CONCLUSION

This study identified social factors such as delayed vaccines, living with smokers at home and receiving socioeconomic benefits as risk factors for the motor development of children aged four to 17 months. The results show the importance of physical therapy not only in the hospital, but also in primary and secondary care, services that are closer to families and where they are often assisted.

Data of this nature are important, not only for the scientific community and for the field of physical therapy, but also for the entire population, since an early identification of these risk factors allows the development of preventive actions, avoiding negative impact on child development. Since 1990, the Statute of the Child and Adolescent has ensured full protection to children and adolescents and the guarantee of all fundamental rights to them, as well as physical, mental, moral, spiritual and social development, in conditions of freedom and dignity; and everyone – family, community, society and public power – should guarantee these rights, without any type of discrimination.

With knowledge of all these risk factors, physical therapists should participate in the identification, prevention, promotion and rehabilitation of children at risk or already compromised. The results of this study emphasize that, in addition to surveillance and preventive actions, public policies must be developed to ensure full child development and a better quality of life and biopsychosocial well-being not only for children, but for their social and family groups.

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