Developmental surveillance in primary health care: absence of child development milestones and associated factors

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Abstract

Objectives: to identify the absence of one or more general child development milestones and by domains, and associated factors.

Methods: cross-sectional study with 334 children under three years of age conducted out at Primary Health Care Facilities, São Paulo, Brazil. The dependent variable was the general child development and the fine motor, gross motor, social and psychic domains evaluated using the Developmental Surveillance Instrument of the Brazilian Ministry of Health. Data were obtained by interviewing the mothers and observing children. The chi-square test and logistic regression analyses were used.

Results: absence of one or more milestones of general child development was found in 52.1% of children, especially, in the fine motor domain. We found an association between general child development with age (OR = 4.4; CI95%= 2.0-9.9) and the place of stay of the child who does not attend daycare (OR = 3.7; CI95%= 1.3-10.5).

Conclusions: the absence of one or more milestones of general child development is high and associated with aspects of the child and the environment. This emphasizes the importance of promoting developmental surveillance in Primary Health Care Facilities among health professionals using the official instrument recommended by the Brazilian Ministry of Health.

Key words *Child development, Child health, Primary health care, Health promotion, Nursing*

Introduction

Evidence shows that in low- and middle-income countries, children under the age of five are at risk of not reaching their maximum development potential.[1,2] According to the Inter-American Development Bank, despite the progress in health and nutrition conditions of the child population in the Latin American region, data related to child development are incipient.[3] In Brazil, there is a high prevalence of suspected developmental delay ranging from 21% to 53%,[4-7] mainly in populations with less social insertion.[8]

Child development is a complex process that begins from conception and involves aspects of physical growth, neurological, behavioral, cognitive, social and emotional maturation. It is the result of the interaction of biological, socio-environmental, health and nutritional characteristics, such as: birthweight,[4,9] nutritional status,[4,10] hemoglobin level,[9] breastfeeding,[10] income and educational level of parents,[4,11,12] maternal age and care.[12,13] Additionally, there has been an increase in the use of electronic devices, even among young children, which can also have adverse effects on the development.[14]

In Brazil, since 1984, the surveillance of children's growth and development has represented one of the main axes of care to children's health. However, only when a significant reduction in infant morbidity and mortality rates was achieved that greater emphasis was given to the promotion and surveillance of child development, with the enactment of public policies such as the National Policy for Comprehensive Child Health Care (Portuguese acronym: PNAISC)[15] and the Legal Framework for Early Childhood.[16] Despite these policies and the existence of an official instrument included in the Child Health Handbook, studies show its underutilization by health professionals.[17] In addition, the scientific production using this instrument for the identification of children with probable developmental problems is scarce.

In this context, the objectives of this study were to identify the absence of one or more general child development milestones and by domains, and the associated factors in primary care.

Methods

This is a cross-sectional, descriptive-analytical study in which was used data from a larger study that evaluated the growth, development and nutrition of children under three years of age.[18]

It was developed in Primary Care Facilities in a city in the state of São Paulo, Brazil, with about 50 thousand inhabitants. For the sample size calculation, inappropriate eating practices (*p*=0.50) were considered as parameter, a requirement of the broader study, as well as the total population of children under three years of age registered in the 12 primary care facilities of the city (N=3904), 95% confidence level and margin of error of *p*=0.05. The calculation for a finite population indicated the need for a sample of 350 children. The percentage distribution of children registered in each primary care facility was calculated to obtain a representative and proportional sample to the number of minors registered in each health center. Inclusion criteria were children under three years of age registered in primary care facilities, accompanied by their biological mothers, while exclusion criteria were children with health problems (genetic, neurological and metabolic) and twins.

The selection of children comprising the sample was non-probabilistic, therefore, all mothers of children under three years of age who presented to the health service during the data collection period were invited to participate.

Data were collected from February to April 2013, through interviews with mothers at health centers using a form prepared by the researchers and pre-tested. The interviews were performed by 11 nurses and a nursing student, who received theoretical-practical training to make the evaluations, including child development evaluation. Quality control was ensured through the accompaniment and rigorous supervision of researchers throughout the data collection process and 10% of mothers were contacted by telephone to corroborate the information obtained.

In this study, were used children's aspects of age in months (< 12; 12 |— 24; ≥24) and sex (male/female). The nutritional aspects analyzed were birth weight in grams (<2,500; ≥2,500), nutritional status (eutrophy, excess weight, thinness), presence of anemia in those older than 6 months (not anemic/anemic), breastfeeding of children under 24 months at the time of the interview (yes/no) and introduction of timely complementary feeding (timely/untimely). The socio-environmental aspects included were maternal age in years (<20; 20 |— 35; ≥35), maternal education in years of study (≤8; >8), maternal work outside the home (no work/work), well-child care at the health center (yes/no), child attendance at daycare (does not attend/attends), place of stay of the child who does not attend daycare (parents' house/another place), main care-

giver of the child who does not attend daycare (mother/others), and the daily time of television exposure in hours of children aged one year or older (< 1; ≥1).

The dependent variable of the study was general child development and the fine motor, gross motor, social and psychic domains, evaluated using the Developmental Surveillance Instrument of the Ministry of Health of Brazil,[19] the official instrument used in primary care during the study period. This instrument is as a guide for the observation and identification of children with probable developmental problems by evaluating the presence or absence of development milestones domains (except for the psychic domain) included in most of the more used scales, such as the Denver, Sheridan and Gesell.[20] For this study, the results obtained were classified as the presence of all milestones or the absence of one or more development milestone for the respective age group evaluated.

The nutritional status was evaluated through the anthropometric measurements of weight and height following the recommended techniques.[21] For children under two years of age, a digital pediatric scale (Welmy brand) and a wooden anthropometer were used; and for those children older than two years, the platform-type anthropometric scale (Welmy brand) with an attached anthropometer was used. For the classification of nutritional status, the z-score of the Body Mass Index (BMI) for age was used with the following cut-off points: thinness (BMI<-2); eutrophy (BMI≥-2 and ≤1); and excess weight [including risk of being overweight (BMI>1), overweight (BMI>2 and ≤3) and obesity (BMI>3)].[21]

To assess the presence of anemia, a capillary blood sample was obtained by finger stick for the measurement of hemoglobin, performed with a portable AGABÊ® brand hemoglobinometer. Anemia was defined as hemoglobin levels below 11g/dL in children older than 6 months of age.[22]

Breastfeeding in children under 24 months was evaluated at the time of the interview. It was defined as feeding with breast milk, regardless of any milk supplement consumption or not. Lastly, the introduction of supplementary feeding was considered timely when it began after the sixth month, and not timely when any other food or liquid was introduced before six or after eight months of life together with breast milk or artificial milk.[23]

The database was built by double typing in the Epi-Info version 3.5.1 software. The Anthro program was used for analysis of nutritional status and the Stata version 15 was used for statistical analysis. The results were described by absolute and relative frequencies, means and standard deviation. The chi-square test was applied to examine the differences between the two proportions of child development (general and by domain) according to child and socio-environmental variables.

The aspects associated with the general child development dependent variable were assessed by logistic regression. The independent variables were: age and sex of the child; well-child care at the health center; attendance at daycare; place of stay of the child who does not attend daycare; and main caregiver of the child who does not attend daycare. The variable daily time (hours) of television exposure was not included in the regression model, since only children older than one year were evaluated. The maternal education variable was used to adjust the multiple regression model. Only the variables that presented association $p<0.20$ in the bivariate analysis were included in the multiple regression. The entry of each variable in the model followed the order of statistical significance, that is, those with the lowest p-value were assigned first. A significance level of $p=0.05$ was adopted.

This study was approved by the Research Ethics Committee of the School of Nursing at the University of São Paulo (CAAE: 02081612.7.0000.5392). All participating mothers signed the informed consent form.

Results

A total of 399 mothers were invited to participate in the study. Of these, 35 did not agree to participate and six children did not meet the eligibility criteria (two with neurological diseases, one was not a biological child and three were twins). Out of the 358 children, there was a loss of 24 due to incomplete information on child development, thereby resulting in a sample of 334 children included in the study.

More than half of the sample was less than one year old (60.5%), with a predominance of the male sex (54.8%), more than a quarter were overweight (27.2%), there was high proportion of anemia (41.5%) and of untimely introduction of complementary feeding (81.2%). It was also found that more than half of children presented absence of one or more general child development milestones (52.1%), with a higher proportion of absence of milestones in the fine motor domain, followed by the psychomotor, social and psychic (Table 1).

Table 2 shows that most mothers were between 20 and 35 years old (72.3%), had more than eight years of study (66.4%) and at the time of the inter-

view, they did not have a job outside the home (61.6%). Only 12.3% of children attended daycare and three-quarters of children older than one year (74.8%) were exposed to television for an hour a day or more.

Tables 3 and 4 present the proportions of the

developmental domains according to child and socio-environmental variables. In the four domains, the absence of one or more milestones showed significantly different proportions for the child's age ($p<0.001$) and for the daily time of television exposure in the psychomotor ($p=0.008$) and social

Table 1

Distribution of children according to child, nutritional and child development aspects. São Paulo, SP, Brazil, 2013 (N=334).

Aspects	N	%
Child		
Age (months)		
Mean (SD)	12.0 (9.8)	
< 12	202	60.5
12 ├ 24	78	23.3
≥ 24	54	16.2
Sex		
Male	183	54.8
Female	151	45.2
Nutritional		
Birthweight (grams)*		
< 2500	33	10.2
≥ 2500	292	89.8
Nutritional status*		
Eutrophy	222	67.9
Excess of weight	89	27.2
Low weight	16	4.9
Anemia (≥ 6 months of age)*		
Not anemic	121	58.5
Anemic	86	41.5
Breastfeeding at the time of the interview (< 24 months of age)*		
Yes	168	61.3
No	106	38.7
Introduction of complementary feeding*		
Timely	51	18.8
Not timely	220	81.2
Child development		
Global child development		
Present	160	47.9
Absent	174	52.1
Fine motor domain of child development		
Present	236	70.7
Absent	98	29.3
Gross motor domain of child development		
Present	249	74.5
Absent	85	25.5
Social domain of child development		
Present	256	76.9
Absent	77	23.1
Psychic domain of child development		
Present	271	81.4
Absent	62	16.6

*Information was not obtained for the entire sample.

(*p*=0.012) domains. The absence of milestones in the psychic domain was significantly different for the variables control of the well-child care at the health center (*p*=0.002), place of stay of the child who does not attend daycare (*p*=0.006) and the main caregiver of the child who does not attend daycare (*p*=0.027).

The results of the bivariate and multiple analysis are shown in Table 5. In the raw analysis, the absence of one or more general child development milestones was associated (*p*<0.20) with the variables age, sex, place of stay of the child who does not attend daycare and primary caregiver of the child who does not attend daycare.

In the final multiple analysis model adjusted for maternal education, the age and place of stay of the child who does not attend daycare maintained a

significant association with general child development. Children aged 24 months or older were 4.4 times more likely to have absence of one or more general child development milestones, compared to children younger than 12 months. Children who did not attend daycare and stayed in another place were 3.7 times more likely to have absence of one or more general child development milestones, compared to children who stayed at their parents' home.

Discussion

The absence of one or more general child development milestones was high among children under three years of age in much higher proportions than those found in similar studies, which were 35.5%[5]

Table 2

Distribution of children according to socio-environmental aspects. São Paulo, SP, Brazil, 2013 (N=334).

Aspects	N	%
*Socio-environmental**		
Maternal age (years)		
Mean (SD)	27.2 (6.7)	
< 20	39	12.1
20 ├ 35	232	72.3
≥ 35	50	15.6
Maternal education (years of study)		
Mean (SD)	10.0 (3.2)	
≤ 8	111	33.6
> 8	219	66.4
Maternal work outside the home		
No work	204	61.6
Work	127	38.4
Well-child care at the health center		
Yes	292	91.8
No	26	8.2
Child attendance at daycare		
No attendance	292	87.7
Attendance	41	12.3
Place of stay of the child who does not attend daycare		
Parents' house	263	90.7
Another place	27	9.3
Primary caregiver of the child who does not attend daycare		
Mother	261	88.2
Others	35	11.8
Daily time (hours) of television exposure (>1 year of age)		
Mean (SD)	1.6 (2.0)	
< 1	31	25.2
≥ 1	92	74.8

*Information was not obtained for the entire sample.

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Table 3

Fine motor and gross motor domains of child development according to child and socio-environmental aspects. São Paulo, SP, Brazil, 2013 (N=334).

Aspects	Domains of child development									
	Fine motor				$p*$	Gross motor				$p*$
	Presence of all milestones		Absence of one or more milestones			Presence of all milestones		Absence of one or more milestones		
	N	%	N	%		N	%	N	%	
	236	70.7	98	29.3		249	74.5	85	25.5	
Age (months)					<0.001					<0.001
< 12	145	71.8	57	28.2		176	87.1	26	12.9	
12 ├ 24	69	88.5	9	11.5		52	66.7	26	33.3	
≥ 24	22	40.7	32	59.3		21	38.9	33	61.1	
Sex					0.063					0.249
Male	137	74.9	46	25.1		141	77.1	42	22.9	
Female	99	65.6	52	34.4		108	71.5	43	28.5	
Well-child care at the health center†					0.635					0.055
Yes	204	69.9	88	30.1		219	75.0	73	25.0	
No	17	65.4	9	34.6		15	57.7	11	42.3	
Child attendance at daycare†					0.137					0.176
No attendance	202	69.2	90	30.8		221	75.7	71	24.3	
Attendance	33	80.5	8	19.5		27	65.8	14	34.2	
Place of stay of the child who does not attend daycare†					0.085					0.455
Parents' house	188	71.5	75	28.5		202	76.8	61	23.2	
Another place	15	55.6	12	44.4		19	70.4	8	29.6	
Primary caregiver of the child who does not attend daycare†					0.189					0.115
Mother	185	70.9	76	29.1		203	77.8	58	22.2	
Others	21	60.0	14	40.0		23	65.7	12	34.3)	
Daily time (hours) of television exposure (>1 year of age)†					0.523					0.008
< 1	20	64.5	11	35.5		23	74.2	8	25.8	
≥ 1	65	70.6	27	29.4		43	46.7	49	53.3	

*Chi-square test; † Information was not obtained for the entire sample.

Table 4

Social and psychic domains of child development according to child and socio-environmental aspects. São Paulo, SP, Brazil, 2013 (N=334).

Aspects	Child development domains									
	Social				p*	Psychic				p*
	Presence of all milestones		Absence of one or more milestones			Presence of all milestones		Absence of one or more milestones		
	N	%	N	%		N	%	N	%	
	256	76.9	77	23.1		271	81.4	62	18.6	
Age (months)					<0.001					<0.001
< 12	179	88.6	23	11.4		185	92.0	16	8.0	
12 ⊦ 24	42	53.8	36	46.2		55	70.5	23	29.5	
≥ 24	35	66.0	18	34.0		31	57.4	23	42.6	
Sex					0.982					0.558
Male	140	76.9	42	23.1		151	82.5	32	17.5	
Female	116	76.8	35	23.2		120	80.0	30	20.0	
Well-child care at the health center†					0.200					0.002
Yes	223	76.6	68	23.4		241	82.8	50	17.2	
No	17	65.4	9	34.6		15	57.7	11	42.3	
Child attendance at daycare†					0.841					0.316
No attendance	223	76.6	68	23.4)		239	82.1	52	17.9	
Attendance	32	78.1	9	21.9)		31	75.6	10	24.4	
Place of stay of the child who does not attend daycare†					0.313					0.006
Parents' house	205	78.0	58	22.0		221	84.4	41	15.6	
Another place	18	69.2	8	30.8		17	63.0	10	37.0	
Primary caregiver of the child who does not attend daycare†					0.189					0.027
Mother	203	77.8	55	22.2		218	83.9	42	16.1	
Others	23	67.6	11	32.4		24	68.6	11	31.4	
Daily time (hours) of television exposure (>1 year of age)†					0.012					0.637
< 1	24	77.4	7	22.6		21	67.7	10	32.3	
≥ 1	47	51.6	44	48.4		58	63.0	34	37.0	

* Chi-square test; † Information was not obtained for the entire sample.

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Table 5

Bivariate analysis and final multiple logistic regression model between the absence of one or more general child development (GCD) milestones and child and socio-environmental aspects. São Paulo, SP, Brazil, 2013 (N=334).

Aspects	Absence GCD		Bivariate		Final model*		p †
	N	%	OR_{crude}	CI95%	$OR_{Adjusted}$*	CI95%	
Age (months)							<0.001
< 12	89	44.1	1.0	-	1.0	-	
12 ├ 24	43	55.1	1.6	0.9-2.6	1.7	0.9-3.1	
≥ 24	42	77.8	4.4	2.2-8.9	4.4	2.0-9.9	
Sex							0.067
Male	87	47.5	1.0	-	1.0	-	
Female	87	57.6	1.5	1.0-2.3	1.3	0.8-2.1	
Well-child careat the health center‡							0.215
Yes	154	52.7	1.0	-			
No	17	65.4	1.7	0.7-3.9			
Child attendance at daycare‡							0.635
No attendance	154	52.7	1.0	-			
Attendance	20	48.8	0.8	0.4-1.6			
Place of stay of the child who does not attend daycare‡							0.001
Parent's house	128	48.7	1.0	-	1.0	-	
Another place	22	81.5	4.6	1.7-12.6	3.7	1.3-10.5	
Primary caregiver of the child who does not attend daycare‡							0.005
Mother	128	49.0	1.0	-			
Others	26	74.3	3.0	1.3-6.6			

* Adjusted model for maternal education; † Chi-square test; ‡ Information was not obtained for the entire sample; CI95%=confidence interval of 95; OR=odds ratio; GCD= general child development.

and 32.0%.[24] This result is very relevant because it indicates that one out of every two children registered in primary care facilities has not achieved some development milestone for their age.

In this situation, the Ministry of Health recommends that health professionals anticipate the next consultation, investigate the environmental situation of the child and the relationship with the mother, and to guide mothers on the importance of child development and the meaning of progression of the milestones for each age that are included in the Child Health Handbook.[20] This document contains the Developmental Surveillance Instrument in Brazil.

Despite this recommendation, in a systematic review of the literature was identified the underutilization of the Developmental Surveillance Instrument in Brazil.[17] In a study that evaluated different data included in the Child Health Handbook, the child development milestones were the most incomplete.[25]

In relation to associated factors, both the general child development and all development domains were associated with the child's age. This reinforces the findings of other studies, which showed that child development depends on the child's age.[24,26]

Thus, it is necessary to know the normal development of children according to their age group, so those in need for specialized care can be identified and timely referrals can be done. This way, they can receive a prompt and suitable intervention in order that children can achieve their full development potential.[27] Under this principle, the American Pediatric Association establishes that every child must be evaluated for the early identification of developmental disorders.[28]

General child development was also associated with the place of stay of children who do not attend daycare. According to data from the National Survey by Continuous Household Sample, the public education and childcare systems fail to provide the necessary quantity of places in daycare centers for the care of children under three years of age.[29]

Consequently, mothers who work outside the home and cannot find places in public daycare centers or pay for private daycare, have to leave their children in places other than their home, with relatives, neighbors or other people. There is extensive evidence showing the influence of the environment on child development.[1,9,12,30] A possible assumption is that children who remain in a place other than their parents' home may receive lower-quality care with less interaction and fewer learning opportunities through experiences promoting the development.

In relation to the limitations of this study, the Developmental Surveillance Instrument included in the Child Health Handbook used in this study does not show diagnoses of developmental delays, which may have made it difficult to assess the factors associated with the absence of one or more development milestones.

Another limitation could refer to the size of the sample that was not specifically planned for the analysis of child development and may have been insufficient to detect significant differences for some variables, such as nutritional aspects.

However, this study enabled advances in aspects related to knowledge about the surveillance of child development in primary care and in the use of the official instrument recommended by the Ministry of Health, which has been little used in scientific publications.

The high proportion of children with absence of development milestones identified with the official instrument of the Brazilian Ministry of Health is a very relevant result that needs to be widely disseminated and discussed with health professionals and those responsible for child care. The association with the child's age and the place of stay of children who do not attend daycare represent potentially important factors to be considered in developmental surveillance within primary health care.

Authors' contribution

Solís-Cordero K: data analysis, interpretation of results, writing, formatting and review of the article. Palombo CNT: conception and design of the project, data collection and writing of the article. Duarte LS:data collection, data analysis, interpretation of results and writing of the article. Munhoz RI: data collection and contributed to the writing of the article. Toriyama ATM and Borges ALV: writing and critical review of the content of the article. Fujimori E: project orientation, writing and review of the article. All the authors approved the final version of the article.

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