

Family environment and child's cognitive development: an epidemiological approach

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Keywords

Family relations. Cognition. Child development. Cross-sectional studies.

Abstract

Objective

To assess the association between quality of stimulation in the family environment and child's cognitive development considering the impact of mother's schooling on the quality of stimulation.

Methods

A cross-sectional study comprising 350 children aged 17-42 months was carried out in central and peripheral areas of Salvador, Northeastern Brazil, in 1999. A socio-economic questionnaire was used, along with the Home Observation for Measurement of the Environment Scale (HOME Inventory), and the Bayley Scale for Infant Development. Bivariate and multivariate analyses were carried out through linear regression at 5% level of significance.

Results

There was a positive ($\beta=0.66$) and statistically significant association between quality of stimulation in the family environment and child's cognitive development. Part of the effect was mediated by the mother's working circumstances and educational level. It was verified that a better quality of stimulation is provided for those who come early in the birth order in family, and live with only a few others under five years of age. This pattern of stimulation is better among children who live with their parents and whose mothers have better education, have a job and a partner involved in the family environment.

Conclusions

Quality of stimulation in the family environment is crucial for child's cognitive development, besides the significant role of the available resources and family dynamics. The study findings show the pertinence to cognitive development of interventions which improve the quality of the environment and the child-caregiver relationship.

INTRODUCTION

In the early childhood, the family provides the most significant attachments as well as the care and stimulation required for children's growth and development. The quality of care – physical, affective and social – results from steady life conditions, both socio-economic and psychosocial.¹⁶ The marked social inequality in Brazil, especially in the Northeastern region,

prevents children from exercising their rights and enjoying these benefits.

Such precarious conditions become evident in the level of schooling of people over 10 (only 4.3 years on average). The 2000 Brazilian Demographic Census showed that 32.8% of Northeastern mothers take sole the responsibility for their children's education.⁸ According to Carvalhaes & Benicio,⁷ access to health

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*Based on a Master's dissertation presented at the Instituto de Saúde Coletiva da Universidade Federal da Bahia in 2003. The study was funded by the Secretaria de Infraestrutura do Estado da Bahia (Grant n. 001/2002) and Programa de Núcleo de Excelência (PRONEX/CNPq/MCT - Contract n. 661086/1998-4).

[†]In memoriam

Received on 9/1/2004. Reviewed on 18/3/2005. Approved on 5/5/2005.

resources and services is hindered due to these women's condition as single mothers, as they tend to rely on other family members. Besides, their income may need to be allocated in a way that does not necessarily meet their children's needs.

The interaction of children with adults and their peers is key for an adequate stimulation in the family environment. The proximal processes serve as basic mechanisms of this interaction and help children to develop their perception, and guide and control their behaviors. In addition, it helps gain knowledge and skills by developing relationships and building up their own physical and social environment.⁶ Studies on the association between environment stimulation and cognition have showed that mothers who were advised to stimulate their babies through a variety of perceptive experiences with people, objects and symbols have contributed to their children's cognitive development and to favorable outcomes in the long term.¹⁰

The family still acts as a mediator between children and the social community, promoting their socialization, which is essential to children's cognitive development. As an open system that evolves through the exchange of relationships with other systems, the family went through changes reflecting widespread social changes. Thus, there have arisen new dispositions, other than those of the formerly prevailing core family comprised by the couple and their children. No matter what its structuring, the family remains the basic relational link between children and the world.¹³ In their conception of the ecology of human development, Bronfenbrenner & Ceci⁶ emphasizes the complexity of interrelations in the nearby environment. Human development is affected by the nature of the existing interconnections with other complementary environments, which contextualize the developmental phenomena at the different social levels.

Paradoxically, in the family environment, children can either get protection or be exposed to risks for their development. Reported risk factors are often associated to low socio-economic status and weak family ties,⁴ which could impair their ability for problem solving, language, memory and social skills.

Many authors agree that maternal schooling has an impact on children's development through factors such as environment structuring, parents' expectations and practices, experiences with cognitive stimulation materials and variety in daily stimulation.⁴

A study conducted in Brazil in low income popula-

tions identified levels of psychosocial risk to children's development in the family environment. Environments identified as potentially harmful were those where there was low interaction between adults and children and poor social-emotional attachment, control through restriction and punishment and low levels of family organization.¹⁶

Given the importance of the family in building up a homely environment which could provide psychosocial practices that promote child development, the present study had the purpose of describing the association between the quality of stimulation in the family microenvironment and children's cognitive performance by assessing the impact of mother's schooling on the quality of stimulation.

METHODS

A cross-sectional study comprising children aged between 17 and 42 months, living with their families in central and peripheral areas of the city of Salvador, Northeast Brazil, was carried out in 1999. The population of the city of Salvador during the study period was about 2.3 million inhabitants, of which 155,972 were children from zero to three years. These children were taken as the base population for the study. Based on a sample of 1,153 children from a longitudinal study on growth and diarrheal disease burden,¹⁵ a subsample of 373 children was drawn from those aged up to 42 months. A mean of 102 and standard deviation of 18.2 cognitive score points, a sample error of 2.64 and 80% power were set for this sample. The age cut-off was set according to the psychological measure instrument, the Bayley Scale for Infant Development. After excluding losses and refusals, the study sample comprised 350 children.

A socio-economic investigation was carried out using a pre-coded standardized questionnaire on socio-demographic profile, socio-economic status and family organization. The Home Observation for Measurement of the Environment Scale (HOME Inventory) was used for assessing the quality of family environment in the first five years of life. The HOME Inventory version applied in the study for the age group zero to three years comprised 45 items filled out based on observations and answers given during the household interview with the child's mother or other surrogate caregiver. The six HOME subscales included the following: emotional and verbal responsiveness of the caregiver; avoidance of restriction and punishment; organization of physical and temporal environment; appropriate play materials and games available; caregiver's involvement with the child; opportunities for variety in daily stimulation.

The Bayley Scale for Infant Development² was applied separately to assess children's mental development. The items for the different ages were applied and assessed according to the scale's instructions for use. Gross scores were converted using the respective age tables and yielded the Mental Development Index (MDI).

Data was collected from households by a team of psychologists and psychology students. Interviewers applied psychological measure instruments and carried out interviews with the main caregiver, which was the child's mother in 94% of cases.

First, the study population was described according to gender, age and child's birth order in the family; main caregiver's schooling, age and marital status; number of children under five in the household, father's involvement and working mother. In univariate analyses, the differences between HOME Inventory means were tested using t-Student test. The quality of stimulation in the family environment, measured through the overall HOME Inventory score, was included as the main independent variable and the child's cognitive performance, measured through the Bayley scale was included as the dependent variable, and both were used as continuous variables. The normal distribution of variables was assessed using the Shapiro-Wilk test at 5% significance level.

Multiple regression with normal errors, based on

the backward method, was used to estimate the association between the overall HOME Inventory score and MDI, adjusting for potential confounders. Variables that showed a statistical significance below 20% were included in the multiple regression model. Interaction was assessed through partial F-test, comparing full and reduced regression models. STATA software, version 7.0, was used in all data analysis at 5% significance level.

The present study was approved by the *Hospital das Clínicas* Ethics Committee of the *Faculdade de Medicina da Universidade Federal da Bahia*.

RESULTS

Of 350 children studied, 54.9% were boys and 66.6% aged two years and over. The mean score for the quality of stimulation in the family environment was 27.0, standard deviation 5.6.

Table 1 shows that mean scores for stimulation in the family environment were significantly higher for children up to second in the birth order in the family (27.8 vs. 25.1), among those who did not share the family environment with other children aged less than five years (27.6 vs. 25.7) and those having father involvement in their lives (27.6 vs. 25.5). The same was seen for children whose mothers had a partner living together (27.3 vs. 25.7), had more than five years of schooling (27.9 vs. 24.1) and a job (28.0 vs. 26.5).

Table 1 - Quality of stimulation in the family environment (HOME Inventory) and cognitive score (Bayley Scale) according to children and their caregivers characteristics. Salvador, Brazil, 1999.

Variables	N	%	Mean	HOME score SD	p-value
Total	350	100.0	27.0	5.6	—
Gender					
Female	158	45.1	27.2	5.5	0.488
Male	192	54.9	26.8	5.6	
Child's age					
≤2 years	117	33.4	27.1	5.7	0.729
>2 years	233	66.6	26.9	5.5	
Birth order in family					
1 st to 2 nd	243	69.4	27.8	5.4	<0.001
3 rd to 11 th	107	30.6	25.1	5.4	
Under 5 years at home					
1 child (herself/himself)	225	64.3	27.6	5.5	0.002
2 to 3 children	125	35.7	25.7	5.5	
Working mother					
No	245	70.0	26.5	5.4	0.017
Yes	105	30.0	28.0	5.8	
Caregiver's schooling					
>5 years	261	74.6	27.9	5.3	<0.001
≤5 years	89	25.4	24.1	5.2	
Caregiver's age					
21-40 years	269	76.9	27.2	5.6	0.181
14-20/ 41-79 years	81	23.1	26.2	5.2	
Caregiver's marital status					
Married/ Living with a partner	267	76.3	27.3	5.6	0.016
Others	83	23.7	25.7	5.1	
Father's involvement					
Yes	240	68.6	27.6	5.4	0.001
No	110	31.4	25.5	5.6	

*HOME: Home Observation for Measurement of the Environment Scale

Table 2 - Maternal schooling and stimulation score in each HOME Inventory subscale. Salvador, Brazil, 1999.

Variables	Mean	Schooling		p-value
		≤5 years 95% CI	>5 years 95% CI	
Emotional and verbal responsiveness of the mother	7.1	(6.6; 7.6)	7.8 (7.6; 8.1)	0.004
Avoidance of restriction and punishment	5.5	(5.2; 5.8)	5.4 (5.2; 5.6)	0.656
Organization of physical and temporal environment	3.5	(3.3; 3.8)	4.1 (3.9; 4.2)	<0.001
Provision of appropriate play materials and games	3.8	(3.5; 4.2)	5.2 (5.0; 5.5)	<0.001
Mother's involvement with the child	1.7	(1.5; 2.0)	2.5 (2.4; 2.7)	<0.001
Opportunity for variety in daily stimulation	2.3	(2.0; 2.5)	2.8 (2.6; 2.9)	<0.001

95% CI: 95% confidence interval

Table 2 shows the importance of maternal schooling assessed in each HOME subscales. Only the item "avoidance of punishment" showed to have no association with schooling.

The mean cognitive performance score was 96.3, standard-deviation 11.2.

Table 3 shows different regression models of the main association – quality of stimulation in the family and child's cognitive performance – adjusted for potential confounders. The univariate linear regression model showed that an increase of one score in the HOME Inventory scale resulted in a 0.659 increase of cognitive performance ($R^2=10.6\%$). The full regression model showed a 0.507 increase in cognitive performance ($R^2=15.4\%$). The variables "having a job" and "maternal schooling" had a greater impact as confounders, 5.1% and 24.1% respectively.

DISCUSSION

The study results indicate the better the quality of stimulation in the family, the better the child's cognitive performance. In addition, they show that maternal years of schooling have a positive association with the quality of stimulation of the child in the family. Schooling of more than five years had a positive association with better organization of physical and temporal environment, better opportunities of variety in daily stimulation, appropriate play materials and games available, and better mother's emotional and verbal involvement with the child.

Several studies have pointed out maternal schooling as a protective factor of healthy child's development, both overall and specific, for instance, result-

ing in increased vocabulary acquisition and intelligence scores.^{3,12} Cognitive theories identify lexical acquisition – "the inventory of a language words"⁹ – as related to intelligence test scores and therefore to vocabulary accessibility.¹⁴ The greater the vocabulary, the better the ability to learn new words and acquire more global information. From a psychological perspective, it provides a better emotional balance, since words make the world predictable and predictive.¹⁰ Thus, the higher maternal schooling, the better mothers master the language, which will lead to an increased awareness of their maternal role as protectors of their child development.

The fact that having a job yielded higher scores in the HOME Inventory scale might be explained by maternal schooling. The general Brazilian population has on average 5.8 years of schooling, and that increases to 6.3 years among working population, stressing the importance of schooling to one's future working life.⁸ On the other hand, when mothers have a job it means they have an income, which could give them access to play materials and other resources that promote child development.^{13,16} It could also be that job satisfaction promotes one's self-esteem and encourages positive involvement of mothers with their children.¹³ Also, developmental care provided by mothers to their children has been investigated as one of the aspects for resilience development.¹¹

Poor quality of stimulation was seen among those children whose main caregiver was single and among those deprived of father's involvement in their lives. Having a partner positively affected the quality of stimulation in the family environment, which could be associated to their positive effect on mother's performance. Also, being third and over in the birth order

Table 3 - Regression models of the association between home stimulation and child's cognitive performance. Salvador, Brazil, 1999.

Variables	Univariate model ($R^2=10.6\%$)		Whole model ($R^2=15.4\%$)		Final model ($R^2=16.1\%$)	
	β	95% CI	β	95% CI	β	95% CI
Home stimulation	0.659	(0.457-0.860)	0.507	(0.291; 0.722)	0.490	(0.284-0.695)
Children aged less than 5 in the household			-1.031	(-3.412; 1.350)		
Caregiver's marital status			-1.061	(-4.413; 2.292)		
Birth order in the family			-0.526	(-3.087; 2.036)		
Father's involvement			1.561	(-1.539; 4.661)		
Working mother			2.744	(0.326; 5.161)	2.707	(0.324; 5.089)
Caregiver's age			-0.132	(-2.858; 2.593)		
Maternal schooling			-6.023	(-8.686; -3.360)	-6.065	(-8.668; -3.462)

in the family and living with other children younger than two yielded lower HOME scores.

Having a better education improves one's self-awareness and, in women, increases awareness of their affective-emotional needs (choice of their partners) and provides them reproductive empowerment.

The present study showed the impact of maternal schooling on the quality of stimulation in the family microenvironment and the resulting impact on children's cognitive performance. The final regression model was able to evidence the effect of maternal schooling and job on the cognitive performance score measured in the Bayley scale.

The lack of epidemiological studies in Brazil focusing this association in the age group studied here prevents domestic comparisons with the present findings.

Despite the Bayley scale and HOME Inventory have not been validated for the Brazilian population, generalizations on the study findings are considered acceptable since there were no cutoffs, and instead internal group comparisons were made in its different strata. It should be noted that the mean scores (96.3; SD 11.2) of the group studied lay within the predicted normal variation (85 to 115) for the standard population.

A cross-sectional study design, which simultaneously evaluates cause and effect, is limited for not making it possible to evaluate whether the level of child's cognitive development derives from the stimulation in the family environment, and only allows to verifying the association between these variables. Longitudinal designs are recommended for further investigating causality relations on the matter here

under examination. It is outlined the need of hierarchical approaches comprising a larger number of predictive variables, both distal and proximal, aiming at clarifying the effect of the family microenvironment on child's cognitive development.

It is also stressed the importance of this study matter, though scarcely investigated within the national collective health, since the World Health Organization has given careful consideration to the issues concerned here. The role of early family stimulation to mental health condition of children aged between five and 14 years has already been underlined in previous population-based studies conducted by Bastos and Almeida-Filho¹ in the 80's.

The study findings presented here suggest the need for intervention programs targeting low-income families. The Family Health Program (PSF) serves as an encouraging opportunity for providing care to children living in underprivileged communities as it actually incorporates a new concept of health focused on the promotion of quality of life.⁵ The recommendation of developing recreational activities focusing on mother-child or caregiver-child relationship can be included in the PSF. Moreover, this program has technical and human resources capabilities to intervene in the family environment, incorporating a psychosocial approach to child care. It is therefore a major contributor for cognitive development of Brazilian children.

ACKNOWLEDGMENTS

Rosana Tristão of the *Universidade de Brasília*, for her help in the choice of the cognitive assessment instrument; Ana Patricia Borges of *Universidade Federal da Bahia*, for her help with data collection.

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