

## Assessment of growth and global developmental delay: a study among young children in a rural community of India

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### Abstract

A cross-sectional study was done to assess the prevalence of growth and global developmental delay and the predisposing factors among children aged three years residing in rural communities of India. About 530 children at three years were assessed for growth and developmental delay. The Ages and Stages Questionnaire (ASQ) was administered to mothers by a trained interviewer. Growth measurements and hemoglobin estimation were done at the time of developmental evaluation. Socio-demographic characteristics of the families of children were ascertained. Prevalence of global developmental delay was estimated and association between development and maternal, child and household characteristics were explored. Physical growth was assessed by using WHO growth charts for weight for age, height for age and weight for height. Chi-square test was used to compare categorical variables. Differences were considered significant at  $P < 0.05$  level. The results showed that the prevalence of global developmental delay assessed by ASQ was 19.8%. Children displayed delay in personal-social (42.5%), gross motor (38.1.1%) and problem-solving skills (34.9%). Maternal educational level was positively associated with communication and problem-solving skills ( $P=0.000$ ) while monthly household income was positively associated with communication, gross motor and problem-solving skills ( $p=0.000$ ). The results suggest a high prevalence of developmental delay and poor child health in this rural population. Implementing early intervention programs may ameliorate the long term consequences of these developmental disorders.

**Keywords:** Ages and Stages Questionnaire, Child development, Global developmental delay

**Abbreviations used:** ASQ: Ages and Stages Questionnaire, WHO: World health organization, SES: Socio- economic status, PHC: Primary health centre.

### INTRODUCTION

Any country's future human resource development is determined by indices like infant mortality, morbidity, prevalence of disability, living conditions and education of children, especially the under fives. [1] Reducing child morbidity and promoting physical growth are important and necessary aspects of child development, but these criteria by themselves do not define the adequacy of children's development. In addition to physical criteria there are also behavioral - developmental criteria that emphasize the promotion of competence. [2] The child is a complete being - not a series of articulated skills, acquisitions or elements. [3] Child development is often hard to measure by its very nature. The various streams of development include gross motor, fine motor, language, cognitive

and adaptive behavior and are complex, interrelated within themselves. [4] The development of each area is dependent on other areas. By three years of age children will complete most of their motor, language, cognitive, social and emotional development. [5] A child's brain during the first three years of life is rapidly developing through generation of neurons, synaptogenesis, axonal and dendritic growth and synaptic pruning each of which build upon the other. Any interruption in this process, such as trauma, stress, undernutrition or lack of nutrients can have long-term effects on the brain's structure and on the child's socio-emotional development. [6]

Over the past two decades, there has been a distinct improvement in child survival in India. Secular trends from Sample Registration System data indicate that under-five mortality rate is declining at an average rate of 3% per annum. Concern has been expressed that this diminished mortality may simply be adding to the pool of substandard survivors. It is therefore, logical that urgent attention should be simultaneously directed towards the quality of life in the surviving children. [7]

Attention to developmental issues are likely to increase given the growing focus on child development, the importance of early experience on brain development and evidence that early identification of developmental problems and intervention will result

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in better developmental outcomes. [8] However, reliable national data on the prevalence of various developmental disabilities are scanty even in highly developed countries. In the Indian context, isolated macro (National Sample Survey, 1981-1983) and micro prevalence surveys have reported the prevalence of developmental disorders of 5.4% to 15.3%. [7] Therefore, the present study was conducted to determine the prevalence of growth and developmental disorders in a rural community of Karnataka at three years of age. The factors predisposing these children to the growth and developmental disorders were also assessed.

## METHODS

The present study was conducted on 530 children aged three years and residing in PHC area attached to J. N. Medical College, Belgaum. The study was approved by J.N. Medical College Institutional Ethics Committee for Human Subjects Research.

According to data for 2005 of the study PHC area, the total population was 31,000. Hence, the number of births were estimated to be 688 with a crude birth rate of 22.2/1000. However, the infant mortality rate for the study area was 38.17/1000 live births. Hence, the population of children of the age of one year would be 662 (688–26). The sample size was estimated to be 530 by allowing a further 20% reduction owing to mortality during the second and third years of life, refusal to participate or migration from the study area. Children born between April 1, 2005 and March 31, 2006 were enrolled in the study. Assessment was done in the month in which the child completed three years. These participants were identified through the Anganwadi centre registers. Children who were between 36–38 months were selected for the study. Written informed consent was administered to mothers of children in the local language in the

presence of a witness. Parents (primary care giver was considered as a parent) of enrolled children were administered the ASQ. The anganwadi worker and investigator provided assistance to illiterate parents in completion of the questionnaires. Mothers were interviewed to obtain socio-demographic information.

Three standard indices of physical growth - Height-for-age (stunting); Weight-for-age (underweight); and Weight-for-height (wasting) – that described the nutritional status of children were considered in the study. Standardized percentiles for anthropometric measures of chronic malnutrition were calculated using the new World Health Organization growth reference curves. Haemoglobin level was measured by Sahli's method.

Information regarding per capita income (in Rupees per month) was obtained and socioeconomic status was categorized using the Modified B G Prasad's classification for the study period (2008-2009). [10] Chi-square test was used to compare categorical variables. Differences were considered significant at  $P < 0.05$  level.

Test-retest reliability at the interval of 3 weeks was done for the enrolled subjects. To assess the criterion validity of ASQ, Indian adaptation of Bayley scale of infant development was used and assessed by the pediatrician.

## RESULTS

The prevalence of global developmental delay assessed by ASQ was 19.8%. A large proportion [225 (42.5%)] of children were found to lag behind in personal-social skill, followed by gross motor skills [202 (38.1%)] with ASQ. A large proportion [248 (46.8%)] could not perform self involved activities, while problem with communication was the second commonest [208 (39.2%)] (Table 1).

Table 1: Distribution of children with global developmental delay and delay in individual domain by ASQ

Developmental delay [ASQ]	N	%
Communication	181	34.2
Gross motor	202	38.1
Fine motor	147	27.7
Problem solving	185	34.9
Personal social	225	42.5
Global developmental delay	105	19.8

N=Number of children with developmental delay.

A higher proportion [249 (47%)] of mothers had just completed primary education and 140 (26.4%) of them were illiterate while 202 (38.17%) of the fathers were primary educated. Higher proportion of the mothers [262(49.4%)] were housewives followed by daily wage laborers 134 (25.3%). Majority of the children belonged to the family of class IV socioeconomic status followed by class III. A majority of the children 455 (85.8%) were from joint family and of these a majority 432 (81.5%) were of 1<sup>st</sup> and 2<sup>nd</sup> birth order. (Table 2)

Children who were between 3<sup>rd</sup> – 97<sup>th</sup> percentile in weight for

age and height for age performed significantly better in all the skills compared to children who were <3<sup>rd</sup> percentile ( $P=0.000$ ) as assessed by ASQ.

Children of mothers with higher literacy had higher scores a similar significant correlation was found with literacy of father in the groups in all the domains with both the screening tools ( $P=0.000$ ) (Table 4). There was also a trend towards higher score in all the domains among children from families with higher socio-economic status (Table 5).

Table 2: Socio-demographic characters of family

Socio-demographic characters	N		%	
Sex of Child				
Male	287		54.2	
Female	243		45.8	
Type of family				
Joint	455		85.5	
Nuclear	71		13.4	
3 <sup>rd</sup> Generation	4		0.8	
Literacy status of parents				
	Mother		Father	
	N	%	N	%
Illiterate	140	26.5	118	22.3
Primary	249	47	202	38.1
Secondary	120	22.6	171	32.3
Higher Secondary	17	3.2	17	5.1
Graduates	4	0.8	12	2.3
Occupation of parents				
Professional	3	0.6	5	0.9
Business	3	0.6	71	13.4
Govt. employee	2	0.4	7	1.3
Private employee	10	1.9	157	29.6
Daily wage laborer	134	25.3	164	30.9
Agriculture	116	21.9	122	23
Unemployed	262	49.9	4	0.8
SES				
Class I	1		0.2	
Class II	24		4.5	
Class III	165		31.1	
Class IV	271		51.1	
Class V	69		13	

N=Number of participants, SES=Socioeconomic status.

Table 3: WHO Growth Chart: Weight for Age and Height for age Vs developmental outcome

[ASQ]	< 3 <sup>rd</sup> Percentile		3 <sup>rd</sup> – 97 <sup>th</sup> Percentile	
	D	%	D	%
<b>Weight for age</b>				
*Communication	32	69.6	149	30.8
*Gross motor	30	65.2	172	35.5
*Problem solving	31	67.4	154	31.8
*Fine motor	24	52.2	123	25.4
*Personal social	31	67.4	194	40.1
<b>Height for age</b>				
*Communication	110	54.7	71	21.6
*Gross motor	115	57.2	87	26.4
*Problem solving	92	45.8	55	16.7
*Fine motor	106	52.7	79	24
*Personal social	124	61.7	101	30.7

\*P=0.000, D=Children with developmental delay.

Table 4: Literacy status of Mother Vs Developmental outcome

ASQ	Illiterate		Primary		Secondary		Higher Secondary	
	D	%	D	%	D	%	D	%
*Communication	79	47.6	83	33.3	17	14.2	2	11.7
*Gross motor	82	58.6	98	39.4	20	16.7	2	11.7
*Fine motor	67	47.9	66	26.5	14	11.7	0	0
*Problem solving	83	59.3	76	30.5	24	20	1	5.9
*Personal social	96	68.6	103	41.4	23	19.2	3	17.6

\*P=0.000, D=Children with developmental delay.

Table 5: Socio economic status Vs developmental outcome

ASQ	Class I and II		Class III		Class IV		Class V	
	D	%	D	%	D	%	D	%
*Communication	0	0	45	27.3	111	41	25	36.2
*Gross motor	2	8	54	32.7	124	45.8	22	31.9
*Fine motor	2	8	30	18.2	96	35.4	19	27.5
*Problem solving	3	12	41	24.8	116	42.8	25	36.2
*Personal social	4	16	57	34.5	138	50.9	26	37.7

\*P=0.000, D=Children with developmental delay.

## DISCUSSION

It has been recently estimated that in developing nations, 200 million children (roughly 39%) under age five are not reaching their developmental potential because of poverty, malnutrition, high rates of infection, lack of stimulation and education and instability in the home. [11] According to a recent estimate, 12% to 16% of American children have developmental or behavioral disorders and another study estimated developmental disabilities to affect 17% of children under the age of 17 years. [2, 4] In our study the prevalence of global developmental delay assessed by ASQ was 19.8%. These findings were similar with studies done in developed countries. [12, 13]

In this study, the gender of the participating children did not influence any of the outcomes. A majority of study participants 455 (85.5%) were from a joint family which is typical in Indian society. Similarly a majority of children were of first and second birth order. Very few children were with higher birth order inspite of the fact that this study was done in the rural region of India comprising low income families.

About half the mothers of children had received education for less than five years. Poor maternal education is one of the variables most often cited as having a predictive value for poor developmental outcome.[15, 16] Among the fathers, majority had completed minimum 10 years of education. The results of the present study indicate that higher education among the parents had a positive effect on child development. Since the literacy of the father and family income are interrelated, most of the families which were involved in the study were from low socio-economic class. Majority of the mothers were unemployed.

Despite heightened international efforts to bring more attention to poverty and human development, the most vulnerable children are also the most invisible. These children, aged zero to three, do not show up in mortality records, but poverty and hunger are negatively affecting their development. They survive while living in poverty during the most critical stages of cognitive, social and emotional development. Any sustained interruption to their nutrition or to their care, if not treated early, can result in irreversible damage to their development. As impoverished young children grow, they will be less likely to succeed in school and more likely to provide inadequate parenting. This will perpetuate the cycle of poverty and poor human development. [6]

Results of the present study demonstrate that the socio-economic status of the family had an influence on child development. Since employment, education and socio-economic status are interrelated, it can be concluded that parent's low income occupation had a negative effect on the child's developmental outcomes.

Validation of the developmental assessment tools in similar cultures is needed for implementing large scale screening programs by minimally skilled health workers in community settings. Because development is dynamic in nature and surveillance and screening have limits, periodic screening with a validated instrument should occur so that a problem not detected by surveillance or a single screening can be detected by subsequent screening.

The present study has important implications for initiation of early intervention programs in India. Early intervention programs can be particularly valuable when a child is first identified to be at high risk of delayed development, because these programs often provide evaluation services and can offer other services to the child and family even before an evaluation is complete.

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**Conflict of interest:** None

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