CULTURE APPROPRIATE INDICATORS FOR MONITORING GROWTH AND DEVELOPMENT OF URBAN AND RURAL CHILDREN BELOW 6 YEARS

A. Dixit
S. Govil
N.V. Patel

ABSTRACT

In this cross sectional study, 2000 apparently normal children aged 0-6 years (1200 urban and 800 rural), were nutritionally and developmently assessed and their environment scrutinized for possible risk factors. Measurement of mid upper arm circumference (MUAC) using standard techniques revealed malnutrition in 44% of the rural and 24% of the urban children especially in the 2-6 years of age group. Culture appropriate indicators of psycho-social development picked up gross delays in gross motor (GM), vision and fine motor (V&FM) and language skills. Self help, concept hearing (SHCH) skills were recorded as normal while social skills were advanced particularly in the 0-2 years old urban group. By the use of the family protocols, low socio-economic status, malnutrition and 9 other risks factors have been generated for the urban group. No risk factor could be identified for the rural group. Better income emerged as the only real protective factor for the sample showing a direct positive relationship with the 45 skills tested, especially in the 2-6 years age group. Nineteen developmental skills were identified as powerful predictors of development. A prototype home based screening record was constructed for monitoring of growth and development which can be even used by minimally trained primary care worker.

The implementation of the strategy for 'Health for All by 2000 AD' through the Primary Health Care Programme has gene-ra-ted hope that all children can be reached by health services and benefit from it. The measurement of growth and psycho-social development has been designated as one of the few health based indicators to monitor the programme. While the "Road to Health Chart" provides a base for monitoring physical growth, information pertaining to psycho-social development remains res-tricted. The present study aims at identifying simple culture appropriate indicators of development; ger rating a list of possible risk/protective factors presented in the children's environment and assessing the nutritional status of apparently normal 0-6 years old urban and rural children.

Material and Methods

Two thousand children (1200 urban and 800 rural) below 6 years were studied between April 1987 and April 1989. They were randomly drawn from five corners of the city corporation limits (average area covered 1 × 1.5 km/locale) and 6 neighboring villages. Standard sampling techniques(1) were used and care was taken to draw a representative sample of every section of the population. Evaluation of all

children between 0-6 years was made by a door to door survey. Children holding authentic birth certificates with apparently normal antenatal, natal, postnatal experiences and an essentially normal pediatric examination were included in the study.

Information regarding risk/protective factors related to the children's development was obtained from the mother using the WHO family protocols(2). A quick nutritional assessment was made by measuring the mid upper arm circumference (MUAC) using the standard technique laid down by Jellife(3). The developmental status of the child was assessed using appropriate WHO suggested psycho-social test battery(4). The instructions in the accompanying manual were strictly adhered to with regard to testing and scoring of the items.

The unconscious bias of the examiner was eliminated by recording the developmental status and holding the family interview before making the nutritional assessment. The age of the child was confirmed after completing the documentation of all findings.

Standard developmental testing kit(5) with few modifications was used, e.g., slate and pencil were used instead of paper and crayons. Whenever feasible, material from the local market or from the children's immediate environment was used for testing, e.g., multicolored saree was used instead of color cards for testing color concept.

To obtain valid correlation between the skills achieved and the environmental variables, the data was subjected to extensive statistical treatment. The tests employed were Chi-square, 't' test, regression analysis, Fox base III programme and R2 model.Z80 and Wipro PC-XT computers were used for reliability in calculation and computation of data.

The percentage of children achieving the skills was computed at 25, 50, 75 and 90th percentiles. The skill least influenced by the environmental variables and representative of the best function of that age group was identified as the best indicator of development of that age group and was obtained directly by Fox base command questions and R2 model.

Results

The urban 2-6 years old group clearly showed the impact of protein energy malnutrition (PEM) and low socio-economic status (LSES) (per capita income Rs. 1000 per year) in the achievement of their skills. A delay of 4-6 months was recorded in the presence of PEM and of 7-8 months in the presence of LSES. In the other groups such marked differences were not observed. Hence, poverty and malnutrition were considered as major risk factors. The age and sex distribution along with the MUAC is depicted in *Table I*. According to the Wolanski standard the entire sample was malnourished while by the Shakir standard 44% of rural and 24% urban children were classified as malnourished. Majority of these children belonged to the 2-6 years age group. A list of the major macro environmental factors analysed appears in *Table II*. In all, 53 variables were analysed for their correlation with 45 skills. Ten positive factors and no negative factor could be identified in the rural group *Table III*.

A comparison of the 50th centile of the best indicator skills of the sample group with other important Indian(6-8) and Western(9-10) studies is made in *Table IV*. The percentiles of the achievement of the best indicator skills are shown in *Table V*.

TABLE I—*Age, Sex and MUAC Distribution of Urban and Rural Children*

Age group (mo)	Number		Male		Female		Mean MUAG (cm)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
0-2	99	38	48	18	51	20	12.0	12.0
2.1-4	101	48	47	23	54	25	13.2	12.4
4.1-7	98	73	48	38	50	35	13.5	12.8
7.1-12	99	65	46	30	53	35	13.8	13.0
12.1-18	102	98	47	45	55	53	14.1	12.9
18.1-24	101	63	60	30	41	33	14.6	13.5
24.1-36	155	84	76	42	79	42	12.4	13.8
36.1-48	154	85	79	42	75	43	13.9	13.8
48.1-60	153	106	79	52	74	54	14.4	13.6
60.1-72	153	140	78	69	76	71	14.8	13.4

TABLE II—*The List of the Environmental Variables Evaluated (Urban and Rural)*

Living conditions	Child	Parents	Miscellaneous
Type of dwelling	Sex	Maternal age 20 yrs	Space to play
Number of rooms	Birth order	Maternal literacy	School
Water	Total children born	Working mother	Radio
Electricity	Total children alive	Father's age 20 yrs	Television
Toilet with water Toilet + water	Number of children at home	Father's education	Cinema
Home well organized	Deliveries conducted by untrained personnel	Service	Comics
Clean homes (cleanliness) Grand parents at home	Parents dead Child stays with natural parents	Breast feeding Separated from mother	Working child Caretaker concerned with child's development
Family problems	Siblings	Early contact between mother and child	Strictness in upbringing
Economic status		Normal child care-taker-mother	Desire for baby
Subsidized housing			Toys
Health care			
Transport available (car)			
Access to main road			

TABLE III—*Factors Affecting Psychosocial Development (Urban and Rural)*

Positive (Protective)	Urban	Rural	Negative (Risk)	Urban	Rural
More roomed accommodation	+	—	Absence of electricity	+	—
Staying house/flat	+	—	Absence of early mother child contact	+	—
Higher economic status	+	—	Absence of mother	+	—
First borns	+	—	Working mother	+	—
More or additional children at home	+	+	Lower socio-economic status	+	—
Presence of elder sibling	+	—	Malnutrition	+	—
Increased maternal education	+	+	Strictness of the care-taker	+	—
Increased paternal education	+	+	Lower education of father	+	—
Television	+	—	Lower education of mother	+	—
Toys	+	+			

TABLE IV—*Comparison of the Best Indicators of Psychosocial Development (Age in Months)*

Field Skill	Urban	DDST	Illingworth	Phatak et al	Rural
A. Gross Motor 50th centile					
1. Standing alone (R)	12.8	−1.0	+1.0	N	−0.9
2. Walks heel to toe (RU)	37.3	−10.0	*	*	+29.9
B. Vision and Fine Motor					
3. Regards object momentarily (U)	1.1	N	N	N	N
4. Sustained attention (U)	2.0	−1.0	N	N	−1.0
5. Reaches object (UR)	5.1	−1.2	N	−0.7	−1.1
6. 3 or more cubes (U)	19.1	*	*	*	−1.9
7. Drawing straight line (R)	24.6	−4.0	N	N	+3.4
8. Draws circle (U)	30.3	−4.1	-4.0	*	+6.6
9. Draws square (UR)	46.3	−2.0	-1.0	*	+7.7
C. Hearing and Language					
10. Manipulate bell (R)	6.2	*	*	N	+0.2
11. Rings bell (U)	8.2	*	*	N	+0.9
12. Repeats number or words (U)	12.0	*	*	−2.0	−0.6
13. Says one word (UR)	22.3	−1.0	−4.0	N	−10.8
14. Relates 2 objects (R)	21.3	N	*	*	+21.6
15. Big and little (U)	23.4	*	*	*	+26.5
16. Heavy and light (R)	40.2	*	*	*	+19.4
17. Completes a sentence (R)	69.1	*	*	*	−0.4
D. Self Help Skills					
18. Bladder control during the day (R)	22.4	*	N	N	−2.4
E. Social Skills					
19. Gives name on request (R)	33.3	+7.0	*	*	+3.3

— Retardation, + Advancement, * Item not available.

TABLE V—*The Percentile Distribution of the Best Indicators of Development (Urban and Rural)*

Developmental indicators	25%		50%		75%		90%	
	U	R	U	R	U	R	U	R
1. Standing alone (R)	11	10.2	12.8	11.8	18.2	12.9	20.2	13.9
2. Walks heel to toe (RU)	26.4	63.1	37.8	66.4	41.3	69.3	43.5	70.8
3. Regards object momentarily (U)	0.5	*	1.1	*	1.2	*	1.3	1.0
4. Sustained attention (U)	1.2	*	2.0	*	2.5	1.0	3.0	*
5. Reaches object (UR)	4.2	*	5.1	*	6.1	3.0	7.1	4.0
6. Three or more cubes (U)	17.0	15.2	19.1	17.2	21.4	18.7	24.0	19.5
7. Drawing straight line (R)	22.5	24.7	24.6	28.0	*	30.5	*	31.8
8. Draws circle (U)	26.2	32.2	30.3	41.4	41.4	40.1	44.3	41.9
9. Draws square (UR)	34.3	50.0	46.3	54.0	66.0	57.1	*	59.0
10. Manipulate bell (R)	4.8	5.6	6.2	6.4	8.1	7.2	9.2	7.7
11. Rings bell (U)	7.2	8.1	8.2	9.1	9.2	10.1	11.0	10.6
12. Repeats number or words (U)	10.1	10.0	12.0	11.4	14.4	12.2	15.6	12.7
13. Says one word (UR)	21.3	10.6	22.3	11.6	26.4	12.3	30.4	12.7
14. Relates two objects (R)	19.7	40.0	21.3	42.9	26.3	45.4	36.3	46.7
15. Big and little (U)	22.1	47.1	23.4	49.9	33.4	51.5	41.4	53.0
16. Heavy and light (R)	33.2	55.5	40.2	59.6	37.2	63.0	59.2	64.5
17. Completes a sentence (R)	56.8	66.7	69.1	68.7	*	70.4	*	71.4
18. Bladder control during the day (R)	21.2	18.9	22.4	20.8	32.4	22.5	36.4	23.4
19. Gives name on request (R)	26.1	31.7	33.3	36.0	40.3	40.8	46.1	42.2

U = Urban,   R = Rural,   * = Item not available.

As is evident the performance of the urban and rural group was almost at par with the accepted Indian and Western norms.

Discussion

Health and well being of children represent an important investment in social capital and it is generally that child health, growth and development are major concerns that warrant close, continuous monitoring and promotion. Essential to monitoring is the identification of indicators which are valid, specific, sensitive and representative of the culture tested. An attempt has been made to identify such indi-

cators. The culture appropriate indicators used helped identify 19 best indicators in the sample surveyed—11 in the urban group, 12 in the rural group and 4 common to both the groups. Skills least affected by the environmental variables were picked up hoping that they were valid, specific, sensitive and true representative indicators of the psycho-social development of the children. Skills most valued in a culture are least affected by environmental variables(11). The overall performance of the best indicators skills by the urban sample and the rural sample was comparable (*Table IV*). The urban group performed 9 items earlier than the rural group, 8 items

later than them (in the range of 1-5 months) and 2 items at par (Table V).

Gross Motor

Two items related to balance have been identified as best indicators for this group (Tables IV & V). One indicator for the rural sample and one common to both (urban and rural)–'Walks heel' to toe' showed marginal delay in achievement by the rural group (1 month) for which it has been identified as a representative skill. The urban group revealed a delay of 10 months for this skill. However, the item 'standing alone' showed exceptional advancement in the urban sample (Table V) and was identified as a representative skill for the group.

The game of 'Hop Scotch' was very popular in the urban areas sampled which has contributed to the exceptional advancement of this skill. Super(11) has reported that valued motor behavior can be facilitated through practice. Balance, both static and dynamic, is least affected by both PEM and LSES(11).

Vision and Fine Motor

Of the 7 vision and fine motor items (Table IV) identified, 6 were for the urban, 3 were for the rural group and 2 were common for both. The visual and prehension items (Table IV) were better performed (1-4 months) in advance by the rural sample, while visual and fine motor items tested by the use of a pencil (viz., draws straight line, circle and square) were performed better by the urban sample. Use of pencil for testing has been accepted by Griesel(12) as a fairly 'culture biased test'. The urban sample has been perhaps more acculturated than the rural sample and was thus able to perform these items better. The

visual items are related more to early mother child contact, mothering and time spent with babies. The rural mother is probably under less stress of day to day living, has better mother infant interaction and is, therefore, better able to stimulate her young baby than her urban counterpart. Carvito and Delicarde and others(13,14) have concluded that visual motor capacity can be significantly affected by malnutrition. In our experience the earlier visual items developed normally while the later items particularly the ones which needed the use of pencil for testing were delayed. Whether this is due to the effect of the nutritional status of the sample, deprivation or the culture bias of the test remains unexplained.

Hearing Language and Concept Skills

Performance of both the groups was below par in this field in comparison to the western(9-10) and other Indian studies(6-8) (Table IV). Hearing skills were the only skills unaffected by PEM or LSES. It could be that hearing is a very basic innate and valued function and hence the environmental variables influenced it minimally(11). Eight items have been identified in this field, 4 for the urban and 6 for the rural sample with two items common to both (Table IV). Four items were performed better by the urban sample in comparison to the rural group. The better performance of the 2 language items in the rural group is difficult to explain.

Development is sequential but variations in the rate of development of the different aspects are known especially in association with malnutrition. The overall lack of language and concept skills in Indian children have been widely reported(6,8) and are attributable to traditional unstimu-

lating circumstances, lack of parental education, limited conversional abilities and comprehension and poor expectations. Bipolar concepts, *e.g.,* heavy and light and big and little are related to the nutritional status(13). The higher incidence of PEM and deprivation *(Table 1)* in the sample seems to be the cause of delays in these items in particular and in this field of development in general *(Table 1).*

Self Help and Social Skills

One skill each in the self help and social areas was identified in the rural sample as the best indicator skill. Both the skills were achieved late in comparison to the urban sample *(Table IV).* "Lack of value" of the skills seems to be the main reason for the delay. However, lack of training, education and discipline are contributory factors. This is brought out by the fact that these skills were achieved earlier in the urban group where the social milieu and values were different than those seen in the rural sample.

What is confounding is the fact that the study, has identified many skills which have shown delays(11) in their achievement, as best indicators of the age function. Whether this is because culture appropriate tests used tapped the real organizational state of development and selected natural or innate functions or because there exist some basic skills which are not affected by the environmental variables remains debatable. More elaborate, longitudinal studies will be required to answer this question.

The most influential element of the environment that a child interacts with is his family and it is usually considered that a child's well being is a function of the family well being. In order to assess the psycho-social well being of the individual children, the assessment of family functioning was carried out by the means of the family interview protocols(12). The results of its analysis are discussed below. The intimate relationship of poverty, deprivation and cognitive development has once again been highlighted in this study. Better income reflected as better performance at all ages throughout the study. Thus better income emerged as universal protective factor for children growing under less than optimal environmental, social and biological conditions. Almost all the positive factors listed *(Table III)* are directly or indirectly related to income. However, birth order of the child and presence of elder siblings are notable exceptions. LSES and PEM were the other observed major negative factors. Other correlated factors exacerbating their effects were absence of electricity, working mother and low parental education *(Tables I & III).* The impact of negative maternal factors upon child development are well documented(10) and need no further elaboration. Their impact was better observed in the 0-2 years old urban group.

It is noteworthy that in the rural group, the study failed to identify a single statistically significant 'risk factor'. This could be due to the positive educational and psychological influences of stable rural family life or the cultural appropriateness of the tests and test material or some other unknown factor operating in the rural environment.

Implications

With the best indicators identified and their percentiles known they can be arranged on the 'Road to Health Card' as shown in *Figs. 1 & 2* to formulate a home based screening record for children below 6 years (urban and rural). Since only one developmental item is to be tested per age,
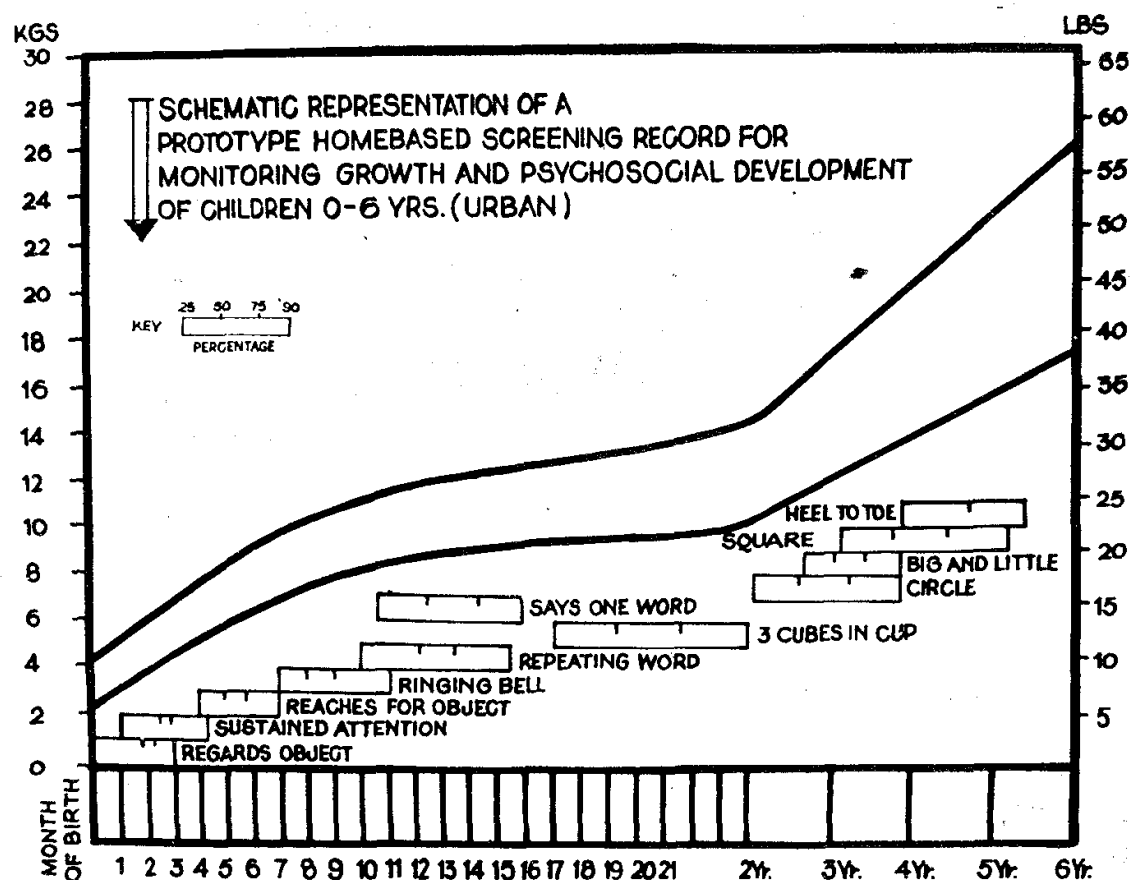
Fig. 1. A prototype home-based record for monitoring growth and psycho-social development of urban children below 6 years.
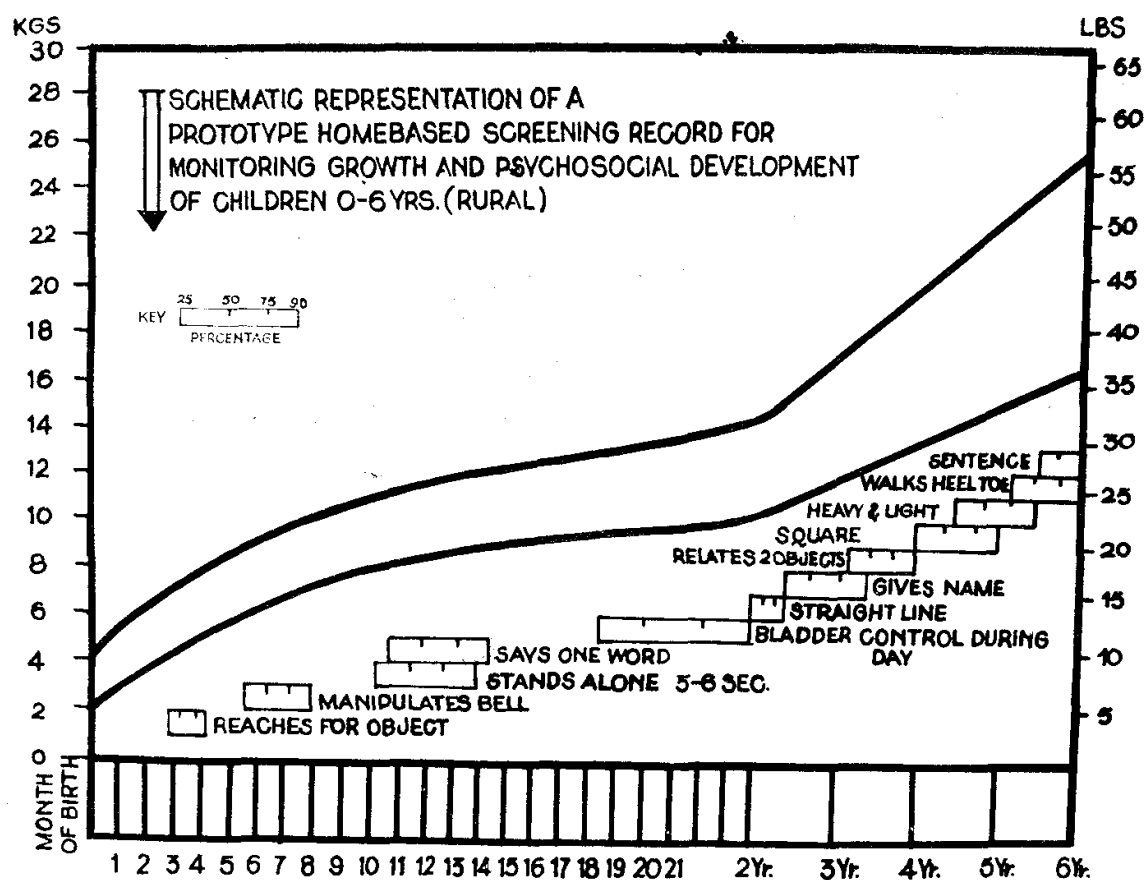

Fig. 2. A prototype home-based record for monitoring growth and psycho-social development of rural children below 6 years.

it would hardly take 5 minutes to test a child. Furthermore, the tests are simple enough to be taught easily to either paramedical worker or the mother. They do not require any elaborate or expensive testing kits, as material from the environment of the body can be used. In a country where there are 2 million mentally retarded children with a 35% increase predicted by the year 2000 AD, monitoring of growth and development of children below 6 years can pay handsome dividends.

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