Culturally appropriate measures for monitoring child development at family and community level: a WHO collaborative study

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Culturally appropriate techniques for monitoring child psychosocial development were prepared and tested in China, India and Thailand on a total of 28 139 children. This is the largest study of its kind ever undertaken. Representative groups aged between birth and 6 years were examined and the results were used to produce national development standards — separately for rural and urban children in China and India, and for all children combined in Thailand — which are considered to be more satisfactory than foreign-based standards.

In each country, between 13 and 19 key milestones of psychosocial development were selected for a simplified developmental screening operation and these have been incorporated on a home-based record of a child's growth and development. Between 35 and 67 tests have been devised in each country to test the children at first-referral level.

Introduction

If a simple, validated system of monitoring child development were taught to mothers and community health workers (CHWs), they could be reassured when they find their children are developing normally and be warned when development is regressing or slow. In the latter situation, if appropriate interventions are applied early, it may be possible to reduce any handicaps, and thus to maximize the potential of the child.

In 1983 the WHO Divisions of Family Health and Mental Health held a consultation in Geneva to consider the international use of indicators of psychosocial development. One result of that meeting is the collaborative study described in this paper.

The consultation reviewed several child development assessment systems that have been found to be of value, including the Scottish Woodside Health Centre Screening instrument and the Denver Developmental Screening Test from the USA (*1*, *2*). However, none of these is suitable for cultures other than those in which they have been developed. Even when the cultures are similar it is necessary to derive a locally valid set of norms or reference values. As there can be no single, universally valid test of psychosocial skills, individual countries should be encouraged to devise their own culturally appropriate scales, with their own normative data.

All communities, including those in remote areas, have their own ideas on a child's normal development and the transfer of these standards from one culture to another may not be valued in certain communities. For example, in the Baoulé community in Côte d'Ivoire, "intelligence is related to social behaviour, service to the group, being reliable, helpful and polite." It includes taking initiative in tasks useful to the family and community (*3*). The same attitude has been found among people in Guatemala, Niger, Nigeria, Uganda and Zambia (*3*, *4*). In a study in rural Guatemala, children were ranked on their "intelligence" or "cleverness" by young adult women from the community.

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Their ranking correlated significantly with tests of vocabulary and perceptual analysis, years of schooling, and self-managed sequences — one of the natural indicators of cognitive development in the community (*3*, *4*).

The case for the use of international standards in height and weight is not universally accepted, and such an approach is not feasible when measuring psychosocial development because of enormous cultural variations. Even in skills like sitting and walking there may be variation between cultures. In some societies, for example, swaddling may restrict a baby's movement and delay the development of motor milestones like rolling over or crawling so that locally derived reference values are essential. Culturally-accepted milestones of development are known, but few have been developed into tests and been standardized (*5*). There is, therefore, an established need to produce instruments that are both culturally and psychometrically acceptable.

The WHO collaborative study

Protocols and objectives. After the WHO consultation a set of four study protocols was developed,[a-c] and a multicentre study on the development and standardization of culturally appropriate scales of psychosocial development for children aged 0–6 years was initiated in China, India (3 centres) and Thailand, with the following objectives.

(1) To facilitate the local development of culturally appropriate testing methods and the establishment of local reference values for children aged 0 to 6 years. Details of the procedure are given in Protocol I.[a]

(2) To determine environmental factors that were risks or benefits to a child's development, based on local circumstances and a family interview. Details of this are given in Protocol II.[a]

(3) To identify a small number of key milestones of development and to add them to a child's home-based record. A subsidiary aim was to encourage family and community level developmental assessment of children and to consider building this into growth monitoring. Details are given in Protocol III.[b]

(4) To devise and test interventions that could be applied at the primary health care (PHC) level to help children who are developmentally slow or retarded. Details are given in Protocol IV.[c]

This paper summarizes the observations and discusses the implications of the work related to Protocols I and III conducted at five centres in China, India and Thailand. The environmental factors promoting or hampering the psychosocial development and the height and weight standards of these children are not reported here.

Materials and methods

A local team, composed of a principal investigator, child psychologist, child development specialist, statistician, field supervisor, primary health care specialist, and a social scientist or anthropologist, was convened at each centre. International workshops were supplemented by experts' visits and local meetings.

Selection of test items

The teams met to review existing tests and to decide if they contained any items that would be culturally acceptable in their settings. Apart from cultural acceptability the criteria for the choice of tests were:

- *Simplicity*. From the outset it was planned that these tests would be administered by health workers who had not had more than a modest education and who would not be familiar with this kind of activity.
- *Reliability*. All tests have to reach acceptable levels of reliability and this was no exception. Great care was taken to write instructions with clarity and precision.
- *Acceptability to the community*. Care was taken to ensure that children were asked to perform tasks that were meaningful to parents and others in the community in order to maintain confidence in health workers.
- *Low cost*. Only everyday objects or materials that were cheap to produce locally were used.
- *Validity*. This was borne in mind when selecting items but it could not be fully assessed until the scale had been completed.

[a] *Physical growth and psychosocial development of children: monitoring and interventions. Protocols I and II. The development and field-testing of techniques for monitoring.* Unpublished WHO document, MCH/91.11, 1992.

[b] *Physical growth and psychosocial development of children: monitoring and intervention. Protocol III. Design and evaluation of the home-based record.* Unpublished WHO document, MCH/91.12, 1992.

[c] *Physical growth and psychosocial development of children: monitoring and intervention. Protocol IV for study on infant and preschool child psychosocial stimulation/intervention programmes.* Unpublished WHO document, MCH/91.13, 1992.

The following developmental areas were selected by each team, many of which can be assessed by simple observation and all can be quantified.

— gross motor tests (concerned with posture and movement of the body, head and limbs);

— vision and fine motor tests (e.g., picking up a small object or copying a diagram);

— hearing, language and concept development;

— self-help (e.g., feeding and dressing); and

— social skills (e.g., interactions with other individuals, first the mother and then others and groups).

In each country a large pool of between 75 and 135 tests was then arrived at and administered to 100 children. Unreliable or redundant tests were eliminated or rewritten. Statisticians reviewed the data at this stage to ensure internal consistency. A local record form was designed and used by the trained workers. In each area, field workers were trained and monitored by an experienced field-supervisor. Field visits were undertaken to check the quality of data collection and recording. Local conditions determined whether there could be a national or local sample; the former was feasible in Thailand, but not in the other countries. Decisions then had to be taken on the stratification to be used and the sample size.

A "local events calendar" was developed in each centre. This included weather patterns, crop seasons, festivals, public holidays, and special events such as elections which the families remembered as occurring at the time of the birth of the children. These calendars facilitated the calculation of the age of the child to the nearest month when parents did not know the exact date of birth.

Sampling design and statistical analysis

A sample size of at least 2540 children was calculated to be appropriate for each area, and age-stratification into eight groups was adopted; birth to 6 months, 6–12 months, 12–18 months, 18–24 months, 24–36 months, 36–48 months, 48–60 months and 60–72 months of age. In order to have a satisfactory mix of rural and urban and different geographic areas, stratified sampling was used in the study areas. All available children residing in the area were included so that the standards which were found would not be skewed towards any particular group. This meant that the findings and the developmental milestones were representative of the population as a whole.

A special statistical package (GROSTAT (Growth and Development Statistics))[d] for producing local norms was developed at the Institute of Education, University of London. An IBM-compatible computer was supplied to each country and training was given in the use of the package to their representatives.

In China, the study was coordinated by the WHO Collaborating Centre at the Shanghai Institute of Pediatric Research and was completed in six provinces; 8995 children between birth and six years of age, with about half from rural and half from urban populations and a male to female ratio of 1.1:1.0, were assessed. No family refused to take part.

In India, there were three separate studies in Chandigarh (in the north), Hyderabad (south), and Jabalpur (centre). These were supported by the Indian Council of Medical Research (ICMR) and moderated by the National Institute of Nutrition, Hyderabad. The number of children tested were: Chandigarh, 3709 from a rural area; Hyderabad, 3781 rural children; Jabalpur, 3011 rural tribal (least developed hilly or forest rural areas) and 3219 urban slum children.

In Thailand, a set of 119 items was used, with several culturally specific tests included (e.g., the ability to thread flowers on a straw). A multistage cluster sampling technique was used to identify 5424 children between birth and 6 years of age from 78 subdistricts of 38 districts in 11 provinces. About 85.7% were from rural areas. Both geographical and sex distributions conformed to the national statistics.

As a measure of validity the results on body weight were plotted against children's weight-for-age status, using the Gomez classification (*6*). It was hypothesized that there would be an association between developmental progress and nutritional status, using the latter as a marker for a wide range of causal factors. For each nutritional grade, the centile values for development were calculated for the 5th, 50th and 95th levels.

Results

A summary comparison of the results, as 50th centile data, in the three countries is shown in Tables 1 and 2. The data for boys and girls in each country were

[d] **Rasbash J, Pan H, Goldstein H.** *Physical growth and psychosocial development of children: monitoring and interventions. GROSTAT. A programme for estimation of age-related centiles using piecewise polynomials.* Unpublished WHO document, MCH/91.19, 1992.

Table 1: **Inter-country comparison of selected items in child development (50th centiles in months)**

Item	China		India		Thailand
	Rural	Urban	Rural	Urban	
Lifts head	1.4	1.9	2.7	1.0	2.3
Sits	6.9	6.2	6.4	6.2	5.4
Stands alone	12.5	12.7	12.5	12.3	10.6
Reaches for object	4.4	4.2	4.4	5.3	3.3
Grasps pebble	5.8	5.3	4.8	6.1	4.3
Opposes thumb and finger	—	—	7.1	8.8	7.7
Watches object	1.8	2.3	1.8	1.0	1.2
Copies line	38.5	32.7	28.1	24.4	26.2
Copies circle	42.4	37.1	39.5	36.1	44.7
Copies square	68.2	58.7	55.0	59.4	55.2
Responds vocally	2.2	2.1	3.0	—	2.8
Says one word	9.8	9.3	15.0	9.7	12.7
Says two words	21.4	20.1	25.4	18.7	19.5
Points to two parts of body	16.0	13.7	20.4	20.5	20.6
Points to big/small	27.5	24.6	34.4	39.5	30.4
Points to heavy/light	33.4	29.2	39.9	41.3	34.7
Bowel control	19.8	18.7	20.0	19.2	22.4
Dry by night	27.6	26.6	30.5	29.8	31.5
Uses cup	11.4	11.6	22.3	35.4	9.5
Washes hands	23.2	22.1	26.6	24.8	22.5
Washes face	33.0	28.7	28.5	24.8	25.1
Dresses self	—	—	53.1	53.1	36.2

pooled since more than 50% of the milestones showed no difference between them, and the rest showed only very minor differences, none of which was consistently in favour of either boys or girls.

China. Initially, 70 developmental items were analysed. Most were applicable to any children, but a number of culturally appropriate tests were incorporated, including the use of chopsticks to pick up a small date and a pea-sized gelatin capsule. Reliability checks were undertaken on the test items during the pilot phase showing an inter-tester coefficient of 0.95 and a test–retest coefficient of 0.91.

There were differences between urban and rural children after the early reflex movements in the first few months of life; urban children nearly always achieved the test activity earlier than those from rural areas. An exception was the use of chopsticks.

A measure of concurrent validity and an indication of the value of a large, well-selected sample, came with an examination of the differences between the results of the test battery and those of the Shanghai standardization of the Denver Developmental Screening Test. The comparison was possible because a small number of test items were common to both. The 50th centiles were similar but there was a wider variation in the WHO Collaborating Centre results, partly because of the difference in sample size (8995 compared with 1041), which allowed more reliable findings for the extreme centiles. The difference is of considerable practical significance since

Table 2: **Examples of culturally appropriate milestones in child development (50th centiles in months)**

Item	China		India		Thailand
	Rural	Urban	Rural	Urban	
Feeds self with fingers	—	—	21.5	14.3	17.0
Peels a banana	—	—	—	—	18.6
Understands money	—	—	25.3	22.5	51.2
Peels a tangerine	—	—	—	—	25.7
Threads flowers/beads	—	—	25.8	32.7	25.7
Gets up from squatting position without help	—	—	26.1	29.3	—
Walks backward 4 steps	24.1	25.2	24.3	22.1	17.3
Bathes self	—	—	—	—	29.2
Makes a ball from dough or clay	—	—	34.2	23.1	—
Picks up a small date using chopsticks	32.9	31.6	—	—	—
Picks up a capsule/small pea with chopsticks	35.9	36.0	—	—	—
Understands rules of trial game	35.4	27.5	50.5	55.2	—
Unites a slip knot	—	—	—	—	32.7
Recites a prayer/sings a song	—	—	48.9	39.0	33.0
Snaps thumb and finger	—	—	33.3	26.2	—
Visits key places in village/district	—	—	35.9	43.5	—
Cleans self after defecation	—	—	—	—	44.0
Ties sticks together with string	—	—	—	—	45.7
Sits still during a ceremony	—	—	—	—	44.7
Carries a wooden block on head for five steps	—	—	45.0	46.7	—
Makes salutation of respect	—	—	—	—	47.0
Threads a needle	—	—	—	—	50.7
Can touch opposite ear by taking the hand over the head	—	—	—	49.9	—
Apologizes	—	—	—	—	54.5
Can close one eyelid (wink)	—	—	60.2	60.0	—
Plays hopscotch	—	—	—	—	62.7
Ties a knot	64.7	61.9	—	—	—
Jumps over a rope	—	—	—	—	66.5

the cut-off points of a screening instrument are important.

India. Of the total of 13 720 children there was a refusal rate of less than 5%. The inter-tester reliabilities for all three centres were between 0.90 and 0.95.

From an initial pool of 100 items, a list of 67 was finally derived. Thirteen milestones for screening were selected for incorporation on the child's home-based record (Table 3). As there were differences between the scores of urban and rural children, separate norms were produced. The results of the single urban slum study in Jabalpur were separated from the three rural and the tribal area studies because of the different environment and lifestyle. In general, there was a linear association between poor nutritional status and slower development. The association between malnutrition and development was least for gross motor and social skills and for young infants. The effect was greatest in the areas of vision, hearing, fine movements, language and concept development, and self-help skills.

The results of these Indian studies have been reported in a comprehensive document entitled "Development and field testing of simple indicators of growth and psychosocial development in children" (WHO-ICMR Collaborative Study, National Institute of Nutrition, Hyderabad 500 007, India — 1991) and also separately (*7–10*).

Thailand. Only 0.3% of the families approached to take part refused to do so. Reliability checks showed an inter-tester coefficient of 0.96 and a test–retest coefficient of 0.92. The differences in the range of ages for attainment of test items were not large enough to warrant separate treatment of rural and urban children or of various regions in the country. The results of the work in Thailand have been published separately (*11*, *12*). An illustrated manual of instructions produced for field workers in this study is a model of such documentation.

Comparisons within and between centres. Comparison of the ages for the 50th centile in different centres indicated that there was similarity for most items but very wide differences for the attainment of some, both between and within countries (Tables 1 and 2).

In the case of some basic and easy to measure motor skills there was relative consistency between different countries and communities. For example, the ability to "stand unsupported" showed a difference of only 2 months over all the study cohorts (10.6–12.7 months, Table 1). In contrast, the test for "is able to use a cup" varied from 35.4 months in urban Indian children to 9.5 months in Thai children. There was also a surprising difference in the Indian groups on this item: the rural children could apparently use cups more than a year earlier than the urban children.

Table 3: **Thirteen key items in child development and their centiles (in months) from the Indian multicentre study**

	Centiles						
Milestones	3rd	5th	25th	50th	75th	95th	97th
Gross motor							
1. No head lag in sitting position	1.2	1.5	2.8	3.6	4.4	5.7	6.0
2. Crawls	4.1	4.5	6.1	7.1	8.1	9.8	10.4
3. Stands alone	7.1	8.0	10.7	12.5	14.4	18.0	19.3
4. Walks backwards	12.1	13.7	20.0	24.3	29.5	43.5	—
Vision and fine motor							
5. Grasps object	2.4	2.8	4.1	4.8	5.7	7.0	7.5
6. Scribbles	8.4	9.2	12.3	14.4	16.9	22.8	26.0
7. Draws a square	38.6	40.6	48.8	55.0	64.1	—	—
Hearing and language							
8. Responds to sound	—	—	0.1	0.7	1.4	2.6	3.9
9. Says one word	5.8	7.0	11.9	15.0	18.8	27.1	30.8
10. Points to two body parts	13.1	14.1	17.8	20.4	23.4	30.8	35.0
Self-help skills							
11. Dresses without help	32.6	35.3	45.9	53.1	61.3	—	—
Social skills							
12. Plays with other children	6.8	8.4	14.5	18.7	23.7	36.2	46.0
13. Tells name	17.0	19.1	16.8	31.6	36.6	45.4	48.2

Table 4: **Differences in the average age of attainment of milestones between urban and rural/tribal Indian children**

Milestones	50th centiles (in months)		Difference (in months)
	Urban	Rural/tribal	
Gross motor			
1. No head lag in sitting position	3.7	3.6	–0.1
2. Crawls	7.2	7.1	–0.1
3. Stands alone	12.3	12.5	0.2
4. Walks backwards	22.1	24.3	2.2
Vision and fine motor			
5. Grasps object	6.1	4.8	–1.3
6. Scribbles	15.3	14.4	–0.9
7. Draws a square	59.4	55.0	–4.4
Hearing and language			
8. Responds to sound	1.6	0.7	–0.9
9. Says one word	9.7	15.0	5.3
10. Points to two body parts	20.5	20.4	–0.1
Self-help skills			
11. Dresses without help	53.1	53.1	0.0
Social skills			
12. Plays with other children	22.6	18.7	–3.9
13. Tells name	32.5	31.6	–0.9

Comparisons with existing scales. The primary focus of this work was the need to devise local scales. However, it is possible in general to compare these results with existing American and British tests, but this must be done with caution because the latter groups of children were assessed some years ago, using different sampling techniques and criteria for passing skills.

A social skill expected to have significant cultural variations and interpretations is "washing hands". In the Asian series the mean varies between 22.1 months and 26.6 months, while Gesell (*13*) adds the task of "drying" and gives a mean age of 30 months and the Denver is even later at 32 months. Vazir et al. (*7*) compared the 50th centile of four Indian and three American development assessment studies. Most of the gross motor skills were attained at a similar age. There was a relative delay in the attainment of vision and fine motor skills, language and concept development in Indian children, especially in the older age group. Their conclusions were that "wherever comparisons are possible, the Indian scales show sufficient agreement between each other to indicate that they are likely to be valid measures of Indian rural children's development".

Urban versus rural children. Environmental influences increased with the child's age; some differences appeared between urban and rural children in China and India but not in Thailand. In all countries the findings were roughly the same in the child's first year since these behaviours depend primarily on functional maturation (e.g., smiling, vocalization, visual and auditory orientation and exploration) and on learning opportunities which are equal in urban and rural settings (e.g., feeding by oneself and bowel and bladder control). Discrepancies in later development (e.g., visual, auditory and fine motor skills and use of language) reflected differences in the nurturing environments. Thus, in China the urban children were quicker with skills of drawing lines, circles and squares and with verbal skills and discriminating between large and small, heavy and light objects. In India the urban children were well ahead of those in rural areas in the age of learning colours; the urban–rural differences were sufficient to lead to the calculation of different norms for the two groups (Table 4).

Discussion

This is the largest multicultural exercise in child development ever conducted, and it was not without difficulties and surprises. One difficulty was in interpreting the very wide range of differences in the age of attainment of a small number of items, for which there are a number of possible explanations, the most obvious being the differences due to cultural variation.

Other possible contributory factors are (1) the samples included all children, irrespective of their perceived mental or physical status, and so the range of responses at the 5th and 95th centiles would be expected to be larger than those obtained from more homogeneous groups, and (2) despite the great care taken to standardize questions and criteria for passing, there were some variations in test administration or scoring. In this context it should be noted that although there was very high intertester reliability within centres, constraints of time and money prevented any attempts at achieving reliability checks between centres. A similar variation is sometimes found in Western tests: on the Gesell scale (*13*) the mean age for "drinking well from a cup" is 6.5 months, while the Denver Scale gives 12 months with a wide standard deviation.

The differences between urban and rural children in China and India (but not in Thailand) may reflect a wider variation between urban and rural living conditions in these countries. Since no attempt was made to include tests in which rural children might be assumed to have an advantage (e.g., recognizing different types of grain or plant), this point should be borne in mind in future work. Two of

the culturally appropriate tests initially selected in Thailand (walks on coconut shells, and walks on sticks before 72 months of age) were discarded since so few children could achieve them before the age of 6 years. These tests were initially included in the study because the researchers remembered them from their own childhood but they seem to have passed from the cultural scene, except in some rural areas (*10*, *11*).

Although there have been previous scales with Indian norms, the present instrument is likely to be more appropriate because of the sample size, the random selection of children, and the standardized instructions.

Incorporation of milestones into the child's home-based record

The criteria for the selection of milestones of development for the child's home-based record were reliability, validity, simplicity (for illiterate families it is necessary to depict the items by means of a simple line drawing), and ease of interpretation or scoring. All three countries selected appropriate milestones (test items) and incorporated them on the weight-for-age home-based record. In China, 19 culturally appropriate milestones were included in the child's home-based record and 35 test items were selected to form the South-East China Developmental Screening Test (*14*). In India, 13 milestones for screening were selected for incorporation on the child's home-based record (Table 3). Consistency in the age of attainment of items between the three centres was one of the crucial points for selection. A similar selection was made for the Thai record card.

On the Chinese weight-age chart the milestones are presented in pictorial form, with red and yellow to indicate high and moderate risks. The records are used by mothers, health workers and rural doctors who have been trained to monitor the child's development and record it on the chart.

The next objectives of the multicentre study are to see if developmental screening can be used in the home, the community and in primary health care to detect developmental delays early enough so that simple interventions could improve the performance and prognosis.

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Résumé

Techniques culturellement appropriées de surveillance du développement de l'enfant au niveau familial et communautaire: une étude collective de l'OMS

Des techniques culturellement appropriées de surveillance du développement psychosocial de l'enfant ont été testées en Chine, en Inde et en Thaïlande sur 28 139 enfants. Il s'agit de la plus vaste étude de ce type jamais entreprise. Des groupes représentatifs d'enfants âgés de 0 à 6 ans ont été examinés et les résultats ont été utilisés pour établir des normes nationales pour le développement de l'enfant, jugées plus satisfaisantes que les normes étrangères. Des normes séparées ont été établies pour les enfants des zones rurales et urbaines en Chine et en Inde, et des normes générales en Thaïlande.

Dans chaque pays, 13 à 19 étapes clés du développement psychosocial ont été sélectionnées pour l'évaluation simplifiée du développement et intégrées dans une fiche d'enregistrement de la croissance et du développement de l'enfant tenue à domicile. Pour l'utilisation au niveau supérieur, 35 à 67 étapes clés ont été retenues.

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