TRIAL OF A SCREENING TECHNIQUE OF THE DEVELOPMENTAL ASSESSMENT OF INFANTS AND YOUNG CHILDREN (6 WEEKS-2 YEARS)

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ABSTRACT

Six hundred and nineteen infants and young children from the slums of Jabalpur City were screened by twenty trained paramedical workers using the Woodside Screening Technique. A second screen was given by the author within three days of the first screen on 350 (56.5%) children. The tester/author agreement was 97%. The results of the Woodside Screening Technique were validated against the standard Gesell's Schedules. The specificity and sensitivity rates of 88 and 83%, respectively were better than the original Denver Developmental Screening Test (77% each). Over referral rates which vary between 10-28% were comparable to the original Denver Developmental Screening Test. The under referral rate was 24%. All children tested belonged to the deprived sections of society, having weights below 50th centile of Harvard Standards. Inspite of this 74% of children scored above and at par on the Gesell's Developmental Schedule, only 11% children showing any developmental abnormality. The need to eliminate the cultural bias from the test and draw a new threshold line to separate questionable cases from abnormal ones is highlighted. Recommendations and specific modifications of the Woodside Screening Technique are suggested.

Key words: *Development, Screening, Urban slums, Woodside Screening Technique, Gesell's Developmental Schedules.*

Admist constraints of lack of culturally suited test material attempts have been made in the last two decades to evaluate the status of behavior and intellect of our children and set guidelines for improvement. Today, most primary care physicians attempt to identify developmental handicaps in a very casual manner mainly due to lack of time. Only 10% pediatricians routinely evaluate development in their patients(1), even though developmental deviations are far more common than chronic diseases like diabetes, heart disease and renal problems and early screening is perhaps the most productive activity a pediatrician can undertake even in busiest outpatient clinics. To ensure this, while better utilizing human resource material, it is imperative that paramedical workers be trained to do developmental screening.

The present cross-sectional study was planned to evaluate the developmental status of six week to two year old urban slum children using a simple screening technique. It's suitability and efficacy in a developing country like India was assessed and results validated against a standard reference test.

Material and Methods

A random sample of six hundred and nineteen babies aged six weeks to two years was drawn from the slums of Jabalpur City. They were divided into seven key ages 6, 16, 28, 40 and 52 weeks and 18 and 24 months. Care was taken to

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include only those who were not mentally retarded, acutely ill or having congenital malformations. Nutritional grading was one according to the IAP classification only after the developmental assessment was completed. The Wood Screening Test (WSST) was used as a screening tool, instructions in the accompanying manual(2) being followed faithfully. Practical modifications were made in the testing materials of common use, *e.g.*, a katori or glass were substituted for a small cup and saucer. Gesell's Developmental Schedules (GDS)(3) were used as the reference test.

Twenty pretrained non-professional health workers(4) (Anganwadi workers) administered the WSST to all children below two years attending or registered at the Anganwadis of their area. Younger children were screened at their homes. Before commencing the screening the workers underwent and intensive training programme and achieved levels of proficiency commensurate with that recommended by Colorado workers(5). The scored sheets were collected by the supervisors, who randomly picked up 350 (56.5%) children (50 from each age group) for the author to apply the reference test (GDS). Care was taken to include some normal and all abnormal cases. Within seven days of the first screening, the children were subjected to a second screening by the author who evaluated them by both the WSST and the GDS at the same time. The record of every child included accurate age, per capita income, general examination including weight (recorded by paramedical worker on Salter Scale), systemic and developmental assessment.

The results obtained from the WSST were divided into three categories normal and above normal (N and N^+), borderline (N^-) and abnormal (AB). Gesell's Schedules were administered, interpreted and scored in the standard manner, results of the GDS were also categorized as at or above par (N and N^+) below (N^-) and abnormal (AB). Statistical analysis was done using the Chi square test of independence. The sensitivity, specificity, over and under referral rates were calculated using accepted formulae(6). Sensitivity or co-positivity is the probability that the result of the screening test would be abnormal, given that the result of the reference test was abnormal and specificity or co-negativity the probability that the result of screening test would be normal given that the result of the reference test was normal(6).

Results

The male to female ratio in the sample was 1 : 1 and the average per capita income Rs. 500 per year (range Rs. 300-700). Two hundred and nineteen were normally nourished, one hundred and ninety seven had Grade I and two hundred and three Grade II malnutrition. The sample showed almost equal distribution at all key ages. Sex and nutritional status did not show any bearing on developmental achievement.

The item agreement between the trained paramedical worker and the author was 97%(4) ($p < 0.05$). The tester/tester reliability in 50% of workers was comparable(4). Analysis of the development scores of the WSST administered by the paramedical worker and the GDS administered by the author at various key ages are given in *Tables I-IV*. A substantial number of cases reported normal by Gesell's test were reported by the worker as borderline or abnormal by the WSST. The pooled sensitivity and specificity values, under and over referral rates expressed as percentages are shown in *Table V* . The

TABLE I—*Comparative Developmental Scores of West by Worker and GDS by Author at 6 Weeks of Age*

WSST	Motor Gesell				WSST	Language Gesell				WSST	Adaptive Gesell				WSST	Personal Social Gesell			
	Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T
Ab	2	3	6	11	Ab	2	2	10	14	Ab	2	3	9	14	Ab	2	3	11	16
N⁻	2	2	12	16	N⁻	1	2	10	13	N⁻	2	2	10	14	N⁻	1	1	13	16
N	0	1	22	23	N	1	1	21	23	N	0	1	21	22	N	0	1	17	18
Total	4	6	40	50	T	4	5	41	50	T	4	6	40	50	T	3	6	41	50
Sensitivity (%)			50.0				50.0						50.0				66.7		
Specificity (%)			80.4				73.9						73.9				70.2		
Over referral (%)			18.0				24.0						24.0				28.0		
Under referral (%)			4.0				4.0						4.0				2.0		

TABLE II—*Comparative Developmental Scores of WSST and GDS at 16 Weeks of Age*

WSST	Motor Gesell				WSST	Language Gesell				WSST	Adaptive Gesell				WSST	Personal Social Gesell			
	Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T
Ab	4	4	5	13	Ab	4	3	5	12	Ab	4	4	5	13	Ab	4	4	6	14
N⁻	2	4	10	16	N⁻	2	6	11	19	N⁻	1	4	10	15	N⁻	1	5	10	16
N	1	2	18	21	N	1	2	16	19	N	1	1	20	22	N	1	1	18	20
Total	7	10	33	50	T	7	11	32	50	T	6	9	35	50	T	6	10	34	50
Sensitivity (%)			57.1				57.1						66.7				66.7		
Specificity (%)			79.1				81.2						79.5				77.3		
Over Referral (%)			18.0				16.0						18.0				20.0		
Under referral (%)			6.0				6.0						4.0				4.0		

Abbreviations: Ab : Abnormal; N⁻ : Border line; N : Normal; T : Total; WSST : Wood Side Screening Test; GDS : Gesell's Developmental Schedules

TABLE III—*Comparative Developmental Scores of WSST and GDS at 28 Weeks of Age*

WSST	Motor Gesell				WSST	Language Gesell				WSST	Adaptive Gesell				WSST	Personal Social Gesell			
	Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T
Ab	5	3	5	13	Ab	3	2	4	9	Ab	3	3	4	10	Ab	4	6	3	13
N⁻	1	4	12	17	N⁻	1	4	10	15	N⁻	2	4	9	15	N⁻	1	3	11	15
N	0	0	20	20	N	1	1	24	26	N	0	2	23	25	N	1	2	19	22
Total	6	7	37	50	T	5	7	38	50	T	5	9	36	50	T	6	11	33	50
Sensitivity (%)			83.3					60.0					60.0					66.7	
Specificity (%)			81.8					86.7					84.5					79.5	
Over Referral (%)			16.0					14.0					14.0					18.0	
Under referral (%)			2.0					4.0					4.0					4.0	

TABLE IV—*Comparative Developmental Scores of WSST and GDS at 40 Weeks of Age*

WSST	Motor Gesell				WSST	Language Gesell				WSST	Adaptive Gesell				WSST	Personal Social Gesell			
	Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T		Ab	N⁻	N	T
Ab	3	3	4	10	Ab	3	4	6	13	Ab	4	2	5	11	Ab	3	3	8	14
N⁻	1	2	10	13	N⁻	2	2	9	13	N⁻	1	2	11	14	N⁻	2	4	12	18
N	0	1	26	27	N	0	1	23	24	N	0	1	24	25	N	0	1	17	18
Total	4	6	40	50	T	5	7	38	50	T	5	5	40	50	T	5	8	37	50
Sensitivity (%)			75.0					60.0					50.0					60.0	
Specificity (%)			84.8					77.8					84.5					75.5	
Over Referral (%)			14.0					20.0					14.0					20.0	
Under referral (%)			2.0					4.0					2.0					4.0	

Abbreviations: Ab : Abnormal; N⁻ : Border line; N : Normal; T : Total; WSST : Wood Side Screening Test; GDS : Gesell's Developmental Schedules

TABLE V—*Pooled Sensitivity, Specificity, Over and Under-Referral Rates*

Key age in months	Sensitivity (%)				Specificity (%)				Over referral (%)				Under referral (%)			
	M	L	A	PS	M	L	A	PS	M	L	A	PS	M	L	A	PS
13 (52 wks)	66.7	60.0	66.7	60.0	88.6	82.2	84.0	75.5	18.0	16.0	14.0	22.0	4.0	4.0	4.0	4.0
18	60.0	83.3	60.0	71.4	88.9	84.0	82.2	79.0	11.1	14.0	16.0	18.0	4.0	2.0	4.0	4.0
24	66.6	60.0	66.6	83.3	79.5	80.0	81.8	72.2	10.0	10.0	15.0	20.0	4.0	4.0	4.0	2.0

Abbreviations: Ab : Abnormal; N^{-} : Border line; N : Normal; T : Total; WSST : Wood Side Screening Test; GDS : Gesell's Developmental Schedules

distribution of abnormal borderline and normal cases in language development in all the 7 key ages, based on the GDS scores are shown in *Fig. 1* and on WSST scores in *Fig. 2.*

Discussion

Both adequate nutrition and proper environmental stimulation are necessary for optimum development of the growing human organism. People living in poverty are often deprived of these essential factors. Since the youngest members of any population are the most suitable group for evaluating the effects of nutritional and environmental poverty we attempted to study this impact by surveying cross sectionally the younger children residing in the slums of Jabalpur city.

The annual per capita income of the majority the population studied fell below poverty line. Their living conditions showed lack of opportunities for learning and unstimulating circumstances. Even though the environment of the children tested did not support optimal mental or physical growth, 74% of them scored above and at par levels on the GDS, only 11% showing any developmental abnormality. Other workers have made similar observations in the past.

Like other Indian(7-9) and Western(10-11) experiences there was no statistically significant difference in the developmental performances of the two sexes in the study.

Garn(12) shows that larger children generally exhibit advanced motor development. In the region Rikhari(13) observed a significant drop in DQ with a drop, in the nutritional grade. However, our findings support those of Patel(18) and Arya's(9) group who did not find any statistical significant impact of nutritional status on development. Since children suffering from Grades III and IV malnutrition were not included in our study, inferences from our study are not comparable with studies which include such children.

The percentage of abnormal children reported by the trained non-professional health workers varied between 16 and 19% in the four major fields of development. The percentage of borderline cases varied between 28.7 and 31.6% and normal cases between 49 and 55%. On validation by the GDS 72 to 74% performed as expected, 15-17% were below par, and only 10.8% were abnormal. It, therefore, follows that the WSST classified a substantial number of normal children as borderline and abnormal, particularly in the lower ages. The findings are similar to the original results of the Denver Developmental Screening Test(10-11). The high number of abnormal cases reported by the GDS is because the sample tested by the author contained all the cases reported abnormal by the WSST. The high over and under-referral rate is perhaps because the WSST is heavily culturally loaded and because the workers found it difficult to score some items (*e.g.,* social smile) correctly at the lower key ages. With 29% of the items being scored on history alone, proper recall of developmental milestones is essential. Since the population surveyed was generally deprived and illiterate, their ability to recall correctly and precisely is questionable. The test items used were unfamiliar to the children (cubes, small cups and saucers) so a large number refused to perform the given tests using them.

The experiences gained and difficulties encountered while using WSST are discussed below. Testing of gross motor development posed a problem because there

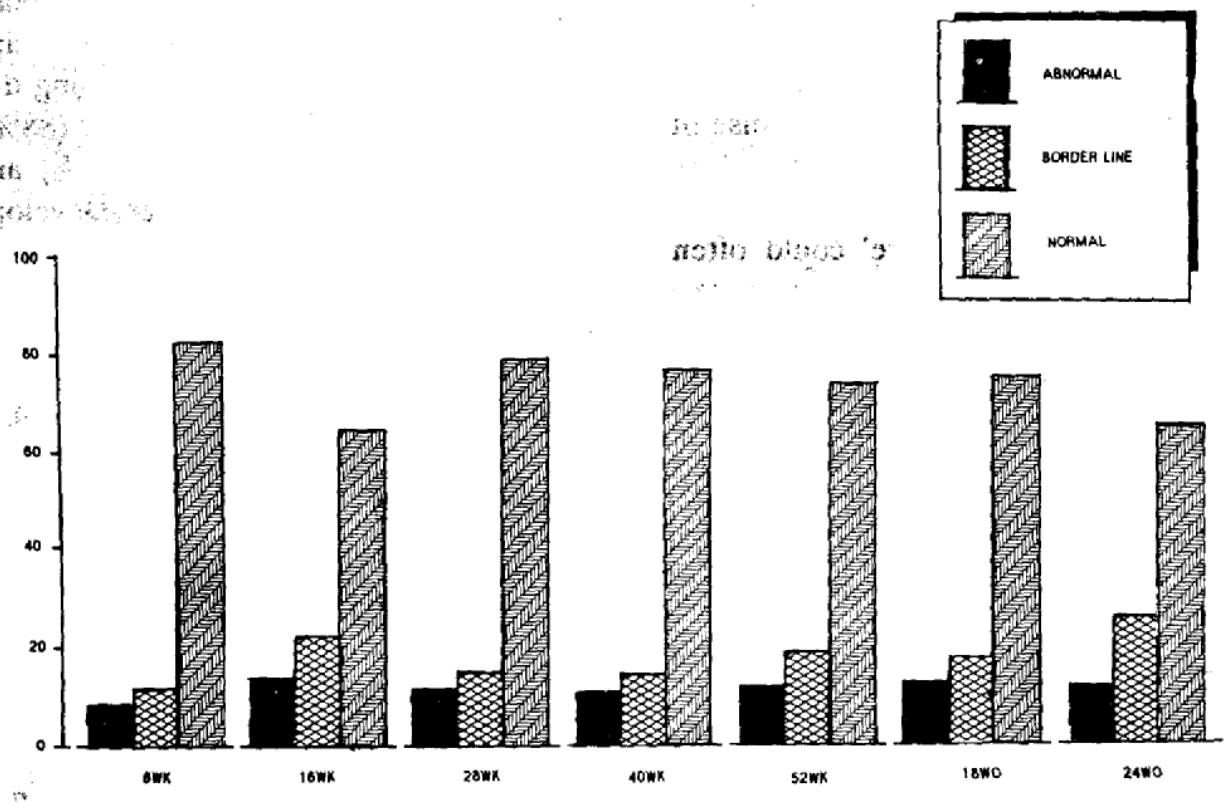

Fig. 1. Distribution and classification of cases according to the GDS scores in the field of language development.

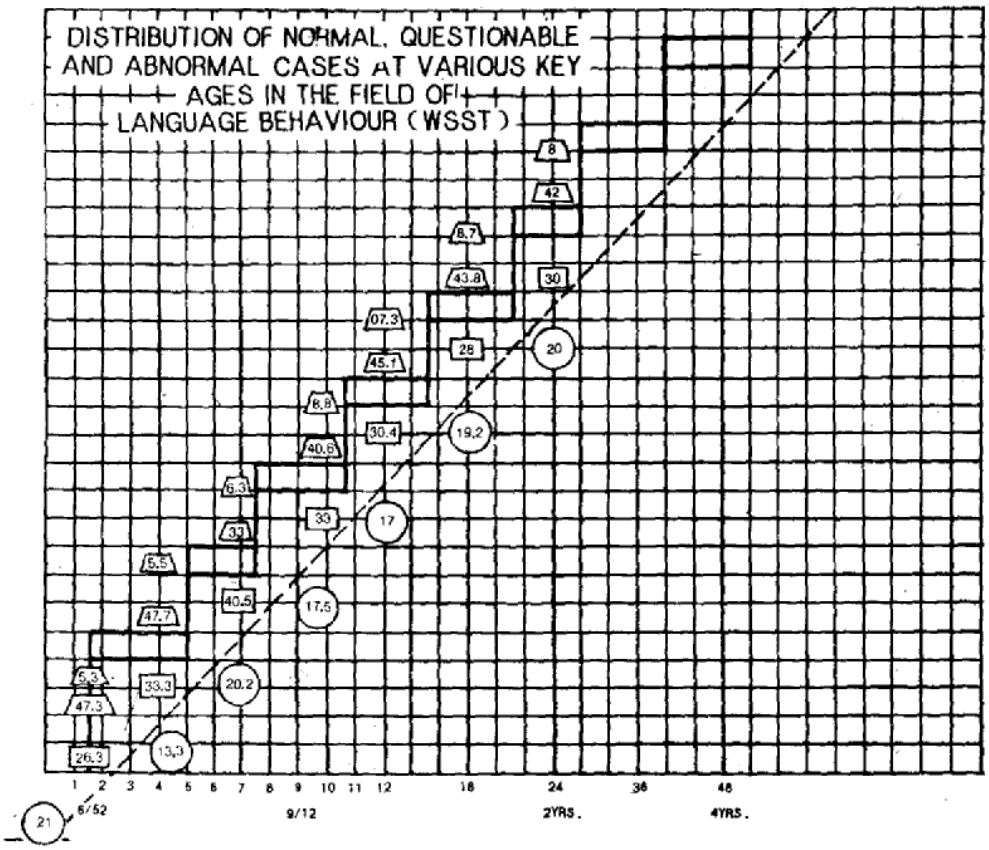

Fig. 2. Distribution and classification of cases according to the WSST scores in the field of language development. Figures in boxes represent actual number of cases.

were no staircases and hardly any furniture in the houses where the children lived; hence when confronted with stairs, they could not climb them, probably because of lack of practice(14). Similarly items such as 'Pulls to standing holding on to furniture' and 'cruises round furniture' could often not be scored correctly. In some items the instructions in the manual were equivocal and children were wrongly labelled as not having passed (questionable or abnormal) in them (*e.g.,* 'pull from lying little or no head lag: 'ventral suspension', head in plane of body). These items were recorded as normal by GDS at comparable key ages.

Low sensitivity (*Tables I-V*) was also found in the field of adaptive development at certain key ages; because of unfamiliarity of the test material (pencil and paper cubes), children were reported as abnormal or borderline, but normal on the GDS.

Limitations in language development were probably due to unstimulating circumstances, limited verbal communication of parents and a host of mother substitutes. Special difficulty was encountered in testing hearing as prescribed in the WSST. Noise pollution and a higher threshold of hearing may be contributory factors. 'Unintelligible babble' was one of the ill understood items and was often wrongly interpreted by the Anganwadi workers.

Administration of the item ('drinking from cup') in the field of personal social development was altered slightly by substituting a more culture appropriate object, *e.g.,* a glass or katori for a cup. Since weaning in India is usually delayed especially in poorer sections babies are not accustomed to swallowing solid food, resulting in more items in the field being scored as borderline on the WSST.

Inspite of the many arguments forwarded against it and it's cultural bias, the WSST with some modifications appears to be a useful tool for screening deprived children. The high specificity (88%) and sensitivity (83%) rates (*Table V*) are better than the original Denver Developmental Screening Test(11). Rescreening of 350 babies (56.5%) showed that not only was the tester-author agreement satisfactory, but the test-pretest stability was also good for a screening test. No child labelled abnormal by the GDS was judged as normal by the WSST, though the reverse was true, *i.e.,* children judged abnormal by the WSST were found to be abnormal, below par or at par by the GDS (*Tables I-IV*). Caution is therefore, necessary in interpreting a delay on the WSST by re-examining the child at the next 2-3 key ages and comparing the results of each performance with previous levels. If delay persists, the baby should be investigated more fully.

The rather high over and under referral rates (*Tables I-IV*) seem to be due to discrepancies in the understanding and thus scoring of the test items. However, the figures (10-20%) are comparable with the results of the original Denver Developmental Screening Test(11). In order to decrease over-referrals, local norms will have to be established, cultural bias removed and the separation of questionable from abnormal cases redefined, as was done in the revised Denver Developmental Screening Test(15).

When screening for asymptomatic disease, the best test is one which is accurate and also economical in terms of cost and professional manpower. The present study demonstrates that non-professional health workers can economically be trained to administer the WSST, which takes hardly 5-10 minutes per child. The high validity is based upon the screening performed by the

workers and the reference test (GDS) applied by the author. This study supports the contention that WSST, with a few modifications, meets all the criteria for an efficient screening test.

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