Developmental assessment at four years: are there any differences between children who do, or do not, cooperate?

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SUMMARY Among preschool children failure to cooperate in a developmental assessment is not uncommon, but many reports do not mention this awkward situation. Can such children be ignored? The abilities of 203 children were assessed at age 4 years and 7½ years. At 4 years 37 (18%) did not cooperate fully and an overall developmental score could not, therefore, be calculated. For those sections in which they did achieve a score, the mean values, in all areas of development, were lower than those of complete cooperators and the differences were significant for visuomotor function, language, and comprehension. At 7½ years children in the lower social classes who had been uncooperative at age 4 years had lower scores in all six areas of ability tested than those who had cooperated fully at 4 years. No differences were found for upper class children. Refusal to cooperate may in some cases indicate inability to perform and such children should not be ignored or discarded from follow up analyses.

As perinatal mortality decreases more importance is placed on perinatal morbidity and the child's ability to attain his own unique developmental potential. Changes in obstetric and neonatal management need to be monitored by following the progress of the children's development for many years. Although some of the more subtle deviations from normal development may not become evident until children are at least of school age, some form of feedback is needed before this time and in many follow up studies assessment is therefore made at the age of 4 years. To compare groups of children, tests covering a wide range of abilities are administered and a developmental (DQ) or intelligence quotient (IQ) computed. Is it legitimate to assume that children who are uncooperative during the assessment do not differ from those for whom a complete score is available? And how best should they be dealt with?

Patients and methods

Two hundred and three children (108 boys and 95 girls) whose developmental progress had been followed from birth were examined at the ages of 4 and 7½ years. The 4 year examinations were undertaken in the children's homes by medical members of a small research team, but at 7½ years most of the children were seen at school by one psychologist

(JC). On each occasion the developmental assessment was part of a comprehensive examination covering many aspects of somatic growth, health, behaviour, and development.

The developmental assessment at 4 years had been standardised on a random sample of children born in the same hospital during the same period of time as those in the present study.^{1,2} It comprises 5 sectors reflecting different aspects of developmental achievement (gross motor, fine motor, visuomotor, language, and comprehension). Each sector contains 5 to 7 test items. The sectors had been standardised to give a mean score of 10 and standard deviation of 3. An overall score is obtained by adding the scores of the 5 sectors.

When a child refuses to try a test item it often seems apparent to the observer that this is because he thinks he cannot do it. But excessive shyness, recalcitrance, and distractibility also inhibit cooperation, and no inferences can be made about these children's abilities in the area concerned. The rule was therefore made that if a child refuses to try 2 or more items in 1 sector of the assessment no score would be given for the sector, and an overall score could not, therefore, be calculated. For each child with an incomplete assessment the examiner's opinion of the main reason for lack of cooperation was recorded.

Ten tests selected from the British Ability Scales (BAS)³ were used to assess the children's intellectual development at 7½ years. The tests were grouped into pairs representing five different intellectual 'processes': reasoning, spatial imagery, perceptual matching, memory, and retrieval and application of knowledge. The ability scores for each test were converted to T-scores with a mean value of 50 and SD of 10. Thus the standardised mean value for each process was 100. The Holborn Reading Test was also administered, and a reading quotient obtained.

Results

At age 4 years 37 (18%) children did not cooperate in one or more sectors, including 6 who refused all the tests. There was a slight but insignificant excess of boys ($\chi^2_1=1.9$) and children from the lower social classes ($\chi^2_1=0.3$) among those who did not cooperate. Nineteen children refused in one sector only—12 in the gross motor sector. Refusals in the gross motor sector also occurred in all the 12 children who were uncooperative in two or more sectors. The reasons given for lack of cooperation among these 37 children were: shy 19, 'bolshy' 10,

loss of concentration 4, 'dim' 2, and environmental distractions 2.

In Table 1 the scores at 4 years for cooperative children are compared with those of uncooperative children in the sectors for which they did achieve a score. In all areas of development the scores for complete cooperators were higher, and the differences were significant for visuomotor, language, and comprehension.

At the age of 7½ years boys and girls had similar scores for the 5 BAS processes, but the girls were in general more advanced in reading. The mean reading quotients for boys, some of whom had refused at 4 years, did not differ; but among girls highly significant differences were found (cooperative: mean 108.1, SD 17.6, n 82; uncooperative: mean 94.2, SD 16.8, n 13. $P<0.01$). In Table 2 six different aspects of intellectual ability at 7½ years are compared separately for the upper and lower social classes. In the non-manual classes no differences were found between children who had cooperated or not at 4 years, but in the manual classes previously uncooperative children had significantly lower scores in all aspects of ability at the age of 7½ years.

Table 1 Four year scores for complete and partial cooperators

Section	Complete cooperators			Partial cooperators			F*	P
	Mean	SD	n	Mean	SD	n		
Gross motor	9.2	2.8	163	7.4	2.9	7	2.39	NS
Fine motor	9.0	2.9	163	8.5	3.4	30	0.14	NS
Visuomotor	9.1	2.9	163	7.4	3.1	24	4.85	<0.05
Language	10.0	3.0	163	7.9	3.4	17	3.93	<0.05
Comprehension	9.6	2.9	163	7.4	2.8	24	10.41	=0.001

*Ratio of two variance estimates derived from an analysis of variance. Adjusted for sex and social class (unclassifiable in 3 cases).
NS = non-significant.

Table 2 Refusals at 4 years and intellectual ability at 7½ years

	Cooperative at 4 years			Uncooperative at 4 years			F	P
	Mean	SD	n	Mean	SD	n		
<i>Reading quotient</i>								
Non-manual	110.8	19.7	71	105.8	15.5	12	0.69	NS
Manual	100.8	16.0	92	93.1	20.2	25	4.09	<0.05
<i>Reasoning</i>								
Non-manual	109.8	14.9	71	109.3	14.3	12	0.01	NS
Manual	103.5	12.9	92	96.5	13.6	25	5.67	<0.05
<i>Spatial imagery</i>								
Non-manual	116.4	17.3	71	124.3	14.1	12	2.28	NS
Manual	110.6	16.8	91*	101.3	16.1	25	6.13	<0.05
<i>Perceptual matching</i>								
Non-manual	114.7	12.6	71	115.1	11.8	12	0.01	NS
Manual	114.6	13.4	91*	104.7	14.8	25	10.2	<0.01
<i>Memory</i>								
Non-manual	109.4	15.1	71	111.7	17.9	12	0.22	NS
Manual	104.6	14.5	92	96.9	19.8	25	4.69	<0.05
<i>Retrieval and application of knowledge</i>								
Non-manual	111.2	13.0	71	106.8	13.1	12	1.20	NS
Manual	106.0	13.5	92	100.0	9.9	25	4.32	<0.05

*Test equipment not available for one child.
NS = non-significant.

Discussion

Bishop and Butterworth⁴ examined 169 children aged 4½ years in a quiet room at a general practice health centre using the Wechsler Pre-school and Primary Scale of Intelligence (WPPSI). Thirty children (18%) refused to complete some or all of the WPPSI subtests; and scores for 4 additional children were prorated 'because they missed one or two subtests.' If refusals in the gross motor sector, which is not included in the WPPSI, are excluded, the comparable refusal rate for our children was 12%; and the conditions under which we worked were often less conducive to cooperation. The children in Bishop and Butterworth's study were examined again at the age of 8½ years using the revised version of the Wechsler Intelligence Scale for Children (WISC-R). The mean IQ of the children who had refused to cooperate in some or all the tests when they were younger was significantly lower ($P < 0.05$) than that of those who had formerly been cooperative. The authors commented, 'We are not aware of previous research on children from normal populations who do not cooperate, and it seems likely that such children are typically discarded from studies.'

Alden *et al.*⁵ examined 20 children whose birth-weight had been less than 1000 g. Twelve had a normal DQ (>90) and two, with severe congenital abnormalities, were retarded. For three of the six children with an abnormal to borderline DQ (70–89) they noted that there was 'difficulty in getting the child's attention.' This again suggests that in some cases unwillingness to try may be associated with inability to perform.

Rawlings *et al.* and Stewart *et al.*^{6,7} assessed the psychological development at age 4 or 5 years of children who had been low birthweight babies. The test chosen was the Stanford-Binet Intelligence Scale, but with uncooperative children the Merrill-Palmer scale was used. Unfortunately, although the distribution of IQs was given, there was no information relating test scores to the scales used.

In our study the highest refusal rate was in the gross motor sector, which came at the end of the assessment when many of the children were becoming tired. Also, once mobility was allowed, rapport was more easily lost. We had anticipated, therefore, that lack of cooperation in this sector alone might be associated with a normal range of ability in the other sectors. The mean of the individual scores in other sectors for children who refused in one or more sectors in addition to gross motor (mean 8.0, SD 2.6, $n = 12$) was, however, slightly higher than that for children who refused items in the gross motor sector only (mean 7.4,

SD 3.3, $n = 12$). The 6 children who refused all tests at 4 years covered the whole range of ability at 7½ years.

Although manual class children who were uncooperative at 4 years had appreciably lower scores in all six areas of ability at 7½ years than cooperative children, no differences were found in the non-manual classes. Bishop and Butterworth⁴ did not examine social class differences in this respect. In their study 33% of children who did not cooperate at 4½ years obtained WISC-FSIQs of less than 85, compared with 11% of other children, and 4 out of the 10 children who had completely refused the WPPSI and did poorly on the WISC-R were thought to show conspicuously abnormal behaviour on the latter occasion. They commented that although it would be wrong to assume that uncooperative children (at 4½ years) would have problems later, they should be followed up carefully until the tester was satisfied that there was no cause for concern. Perhaps we should now add the rider—particularly if they are in the lower social classes.

It seems clear that it is not legitimate to assume that there are no differences between children who do and do not cooperate in developmental assessment at 4 years. Prorating missing scores also assumes a high correlation for different types of ability in individual children. Using different scales for assessing DQ may also be misleading. There is increasing evidence, however, that in research studies children who do not cooperate cannot just be ignored.

Appendix

I Four year assessment

Gross motor tests

Balance on one foot
Hops on one foot
Heel/toe walk forwards
Heel/toe walk backwards
Walk carrying cup 2/3 filled with water

Fine motor tests

Build a tower of 1 inch cubes
Draw a man
Draw a straight horizontal line
Draw a straight horizontal line between two vertical lines
Penhold

Visuomotor tests

Copy model gate (built of 1 inch cubes)
Imitate model gate
Draw a circle
Draw a cross
Draw a square
Copy hand movements
Catch bounced ball (3 trials)

Language

- Identify colours (red, blue, green)
- Counting bricks (one for one)
- Word definition (9 words)
- Sentence repetition
- Picture description (2 pictures, score better of 2)

Comprehension

- Obeys command
- Comprehends: cold, tired, hungry
- Selects longer of 2 lines (3 trials)
- Opposite analogies 3 samples
- Composition of shoe, spoon, door

II 7½ year assessment (British Ability Scales processes and subtests)

Reasoning

- (A) Matrices: The child is given a booklet containing incomplete patterns and asked to complete each by drawing the correct figure in the blank cell of the pattern matrix.
- (B) Similarities: The child is given three words which are all members of a class—eg, orange, strawberry, banana—and asked: (1) to name a fourth member of the class, (2) to state what the class is.

Spatial imagery

- (A) Block design level: The child is asked to copy a two dimensional pattern using three dimensional black and yellow blocks. A score is given for each (of 11) correct design.
- (B) Block design power: For each correct design an additional score is given if it is completed within a stringent time limit.

Perceptual matching

- (A) Copying: The child is asked to copy designs and letter-like characters. It involves perceptual organisation and visuomotor coordination, with particular emphasis on the former when scored.
- (B) Verbal-tactile matching: The child is asked to take certain specific objects out of a bag. It involves the understanding of concepts—eg, 'soft,' 'round,' 'wool'—and the ability to coordinate what is described verbally with what he feels but cannot see.

Memory

- (A) Recall of designs: The child is asked to study a

drawing for 5 seconds. It is then removed and the child draws it from memory. Up to 6 drawings are used.

- (B) Recall of digits: The child is asked to listen to and then repeat immediately a digit sequence. The sequences increase from 2 to 8 digits in length.

Retrieval and application of knowledge

- (A) Word definitions: The child is asked to define or describe the meaning of words of increasing complexity. It is not sufficient to use them correctly in context.
- (B) Verbal fluency: A measure of the child's ability to generate names of members of a given class—eg, name as many things to eat as he can in 30 seconds. This indicates effective vocabulary rather than understanding of words used (as in A).

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