Ability and Adjustment of Children Who Have Had Measles

J. W. B. DOUGLAS,* B.M.

Brit. med. J., 1964, 2, 1301-1303

A recent study in 47 large boroughs in England and Wales (Miller, 1964) showed that about 1 in every 15 persons with measles suffered from a potentially serious complication, the incidence being highest in infants and adults. Four in every thousand had neurological disturbances, and one of these four had encephalitis or impaired consciousness. Mass vaccination against measles is now practicable. It has been argued that in Britain to-day the extent of complications, nearly all of which are susceptible to effective treatment, is insufficient to justify the cost and possible dangers of mass vaccination (*Brit. med. J.*, 1964). Before reaching a decision, however, it is desirable to know whether children who have had apparently uncomplicated measles are handicapped at later ages. Reports from America of abnormalities in the electroencephalograms of a large proportion of patients with apparently uncomplicated measles suggest that this might be so and make it desirable to look at the relation between measles and later educational and behavioural development. To make an *ad hoc* inquiry of this sort would, of course, mean waiting for 10 years or so before reaching firm conclusions, whereas the results are needed now so that we can assess the need for measles vaccination.

A unique opportunity to obtain this information is, however, provided by the National Survey of Health and Development. This is a follow-up study of some 5,000 children born during the first week of March 1946 (Douglas and Blomfield, 1958; Douglas, 1964). Information on measles was recorded by health visitors and school nurses who visited the mothers at approximately two-yearly intervals. This information is limited to a statement of the age at which the child fell ill with measles, whether or not he was admitted to hospital, and whether the diagnosis was confirmed by a doctor. For those admitted to hospital, extracts from the notes are available. This information is linked below, first to the educational progress of the children and then to their behaviour as reported by their mothers and teachers.

Educational Progress of Children who had Measles

Tests of mental ability and school achievement, selected by the National Foundation for Educational Research in England and Wales, were given to these children at 8 and 11 years.¹ Four tests were used at each age, three of them being tests of school performance and one of intelligence. The most satisfactory measure of ability is the average score for the four tests made at each age. This score is expressed as a T score, with a mean of 50.

A total of 3,797 of the survey children for whom full medical information was available sat the tests at both 8 and 11 years.² By the age of 11, 3,319 of them had had measles, the diagnosis of which had been confirmed by a doctor; 68 had had doubtful measles, and 410 had not yet had it.

It is convenient to consider first the children who were admitted to hospital after having had measles, as they are likely to be the most severely affected. Of the 3,319 children who had measles only 24 were treated in hospital, and, of these, six

contracted measles while they were in hospital for other reasons. Of the remainder, one had encephalitis, eight had severe respiratory complications, two had other complications, and seven had no complications and presumably were admitted for social reasons.

The test scores of the 24 children in hospital are given in Table I. They are, on the average, well below those for children who had not had measles. The lowest score was made by a lower-middle-class child who was admitted to hospital at the age of 2 with measles encephalitis. At both 8 and 11 years he made scores that were approximately one and a half standard deviations below those to be expected after taking account of his family background; he is described by his teacher as lazy and inattentive in class.

TABLE I.—*Test Scores at 8 and 11 Years of Children in Hospital with Measles and of Those Who Did Not Have Measles*

	No. of Children	Average Test Score at 8	Average Test Score at 11
Encephalitis	1	42.00	41.00
Respiratory complications	8	43.88	45.25
Other complications	2	62.00	64.50
Uncomplicated measles or developed in hospital	13	48.46	48.69
No measles before the age of 11	410	51.20	51.68

The eight hospitalized children who had respiratory complications following measles made low scores in the tests, but their poor performance is completely explained if the social class of their parents and their home circumstances are taken into account. At 11 years, for example, a similar group of children who had not been admitted to hospital with measles would, on the average, have scored 45.50 in the tests as compared with the score of 45.25 achieved by the children with respiratory complications. A similar explanation holds for the low scores made by the 13 children admitted with uncomplicated measles or who developed measles in hospital. With the possible exception of the child who had encephalitis, there is no evidence that children who were treated in hospital for measles and complications of measles were educationally handicapped in the primary schools.

We now consider all children with measles, whether nursed in hospital or at home. The average test score at 11 years of those who had measles before this age was 51.75, and for those who had not yet had it was 51.20. The difference between these scores is not statistically significant. When, in Table II,

TABLE II.—*Average Test Scores at 8 and 11 Years of Children Having Measles at Certain Ages*

Average Test Score	Age When Having Measles						
	Before 2	2-	3-	6-	9-11	After 11 If At All	
11 years* ..	50.87	51.59	52.16	51.68	52.00	51.20	Total 3,729†
8 years* ..	50.88	51.43	52.09	51.64	51.98	51.68	
Difference ..	-0.01	+0.16	+0.07	+0.04	+0.02	-0.48	
No. of children	640	480	1,619	535	45	410	

* It will be noted that these average test scores are above 50. This is because they are based on the actual sample numbers and are not population estimates, see *The Home and the School* (Douglas, 1964), p. 4.

† Sixty-eight children who were said to have had measles but who were not attended by a doctor were omitted. Their average test scores were 50.38 at 11 years and 49.40 at 8 years.

* Director of the Medical Research Council Unit for the Study of Environmental Factors in Mental and Physical Illness.

¹ Further tests were given at 15 years, but the results were not available for the present study.

² These include Scottish children.

children are further subdivided by the age at which they contracted measles, it appears that those who had measles before the age of 2 make, on the average, rather low scores in the 8-year and 11-year tests. They are, however, a selected group. Many come from large families living in overcrowded homes, into which infection is brought by an elder brother or sister from school. When these family characteristics are allowed for, the children who have measles early in life do as well in the tests as would be expected; for example, at the age of 11 they score an average of 50.87 in the tests as compared with an expected 50.84.

A few children—45 in all—contracted measles between the ages of 8 and 11, and, as Table III shows, the scores they made at 8 before contracting measles were no higher than those made after they had had measles—that is, in the 11-year tests.

These average figures might obscure an excess of children who, after having measles, made particularly low scores in the tests. That this is not so is evident from Table IV, which shows the proportion who made scores which were low (more than one standard deviation below the mean) or very low (more than one and a half standard deviations below the mean). These low-scoring children are not more commonly found in any one of the groups who had measles, whether early, late, or not at all.

TABLE III.—Average Scores of Children Having Measles After the 8-Year Tests and Before the 11-Year Tests

Average Test Score	Middle Class		Manual Working Class		All Classes
	Upper	Lower	Upper	Lower	
11 years	61.44	56.07	42.80	46.35	52.00
8 years	60.11	57.21	41.60	46.41	51.98
Difference	+1.33	-1.14	+1.20	-0.06	+0.02
No.	9	14	5	17	45

TABLE IV.—Proportion of Children With Scores (a) More than 1 Standard Deviation and (b) More than 1½ Standard Deviations Below the Mean in the 11-Year Tests

Social Class	Age When Having Measles							
	Before 3		3-5		6-11		After 11 If At All	
	More Than 1 S.D. Below	More Than 1½ S.D. Below	More Than 1 S.D. Below	More Than 1½ S.D. Below	More Than 1 S.D. Below	More Than 1½ S.D. Below	More Than 1 S.D. Below	More Than 1½ S.D. Below
Middle class { Upper	1.5	nil	0.8	nil	2.0	nil	1.5	nil
Lower	4.3	0.9	3.4	0.4	5.6	1.0	3.1	1.6
Manual working class { Upper	10.3	4.9	9.0	3.5	13.6	4.9	7.4	1.5
Lower	15.4	4.2	17.1	5.5	18.2	6.6	17.2	6.9

So far I have considered only the children at ordinary primary or independent schools, and in doing so I may have missed some with severe defects who needed special education. In the whole sample, 68 children were either educationally abnormal or severely mentally deficient. The proportion of the mentally defective children and educationally subnormal who had measles before the age of 2 (16%) is almost exactly the same as in the group of unretarded children at primary schools (17%), and the proportion who did not get measles at all is higher (29% as compared with 11% of the primary-school children), presumably owing to the early removal of some of these children from normal contacts. There is, then, no suggestion of an excess of measles, or of measles contracted at an early age, among defective and educationally subnormal children.

Behaviour of Children who have had Measles

The following information is available on the behaviour of children in the national survey:

1. Counts were made at 6 and 11 years of certain symptoms which in the opinion of the Underwood Committee (Report, 1955) were suggestive of disturbed behaviour. These were stam-

mering, nail-biting, thumb-sucking, or other similar habits, bed-wetting, night terrors, and vomiting or abdominal pain which were unexplained clinically. The proportion of children having two or more of these symptoms in shown in Table V, where they have been further divided according to the age at which they had measles. There is no significant difference at either age between the children who had measles early, late, or not at all.

TABLE V.—Symptoms of Disturbed Behaviour Related to Age of Having Measles

		Age When Having Measles			
		Before 2	2-5	6-11	After 11 If At All
% having 2 or more symp- toms	at 6	30.9	32.2	34.5	24.5
	at 11	16.6	19.9	18.9	17.5

2. A further indication of the adjustment of these children was obtained at 13, when they were asked to fill in a 45-item inventory which had been designed to provide three scales—one of extraversion/introversion, one of neuroticism, and one of aggression. It will be seen in Table VI that the mean scores on each of these scales are similar at whatever age measles was contracted.

TABLE VI.—Average Scores on Inventory Given at 13 Related to Age of Having Measles

		Age When Having Measles			
		Before 2	2-5	6-11	After 11 If At All
Average score for {	Extraversion	8.5	8.6	8.6	8.6
	Neuroticism	4.0	3.9	3.6	3.8
	Aggression	5.9	6.0	5.9	5.8

3. The teachers, when the children were 13 years old, and again when they were 15, were asked to give a number of ratings of different aspects of their behaviour. The validity of these ratings was established by taking groups of known maladjusted children clinically divided into aggressive and nervous groups and seeing how well they could be identified by teachers' ratings (Mulligan *et al.*, 1963). On the basis of this study, methods of scoring the ratings were decided upon, and in Table VII the children are divided up into those who were consistently—that is, at both 13 and 15—described by their teachers as aggressive, nervous, and mixed aggressive and nervous. It will be seen that on each of these assessments the children who had measles after 11 or not at all had relatively high scores, and there is, in particular, a statistically significant and steady increase in the proportion of nervous children as one passes from those who had measles before the age of 2 to those who had it after the age of 11.

TABLE VII.—Teacher Ratings of Behaviour at 13 and 15 Related to Age of Having Measles

		Age When Having Measles			
		Before 2	2-5	6-11	After 11 If At All
% rated consistently as {	Aggressive	3.0	3.8	2.6	5.8
	Nervous*	9.0	9.3	12.6	13.8
	Mixed aggressive and nervous	4.2	3.8	3.6	5.4

* χ^2 8.76; $n=3$; $0.05 > P > 0.02$.

Further examination of these figures suggests that the apparently high incidence of reported maladjustment among children who have had measles at a relatively late age stems from the large proportion of only or eldest children among them. When, in Table VIII, the children are further divided by position in family and social class, the association between age of having measles and proportion classified as nervous largely disappears—entirely so in the middle classes. It may be that the working-class child who gets measles late is an overprotected child and so likely to be rated by his teachers as "nervous."

TABLE VIII.—*Children Rated by Teachers as Nervous at 13 and 15 Classified by Position in Family, Social Class, and Age When Having Measles*

% Rated Consistently as Nervous		Age When Having Measles			
		Before 2	2-5	6-11	After 11 If At All
Middle-class	Eldest ..	9.6	6.6	11.1	8.8
	Other ..	6.4	9.3	10.3	9.5
Manual working class	Eldest ..	18.6	10.7	16.5	23.1
	Other* ..	7.3	9.9	11.1	14.6

* χ^2 4.781; $n=3$; $0.2 > P > 0.1$.

4. The last aspect of behaviour to be considered is delinquency. We know of all children who are brought before the courts between the ages of 8 and 17. The proportions are closely similar for those having measles before the age of 6 (4.9% delinquent) and for those having measles later or not at all (4.7% delinquent),³ so that there is no evidence that early measles is associated with troublesome behaviour in later school life.

Summary

The National Survey of Health and Development provides information about the history of measles, and the educational progress and emotional stability of 3,729 children who were followed up over a period of 15 years. There is no suggestion from this survey that children who have measles are impaired in their later educational progress. Those who get measles early, before the age of 2, do rather worse in tests of mental ability and school performance than the rest of the children, but this is sufficiently explained by their adverse home circumstances. There is also no evidence from this survey that children who get measles early show an excess of later

* Girls and boys are combined in these figures, and the incidence of delinquency is artificially low because of the sampling procedure used in this inquiry, see *The Home and the School* (Douglas, 1964), p. 4.

abnormalities of behaviour; indeed, those who get measles late are rather more nervous than the rest, perhaps because they have been overprotected in infancy and childhood. These conclusions are by no means incompatible with those of the much larger survey made by Miller (1964) on the frequency of complications in measles in 1963. He notes that measles yields a formidable toll of complications; however, most patients recover completely, though in an important minority permanent disabilities may result. This is no doubt a correct assessment, but in a survey of only 3,729 children these serious complications are rare and the great majority of children who have measles do not suffer any detectable educational or behavioural handicaps.

The National Survey of Child Health and Development was sponsored by a joint committee of the Institute of Child Health, the Society of Medical Officers of Health, and the Population Investigation Committee. It is now being directed from the Medical Research Council Unit at the London School of Economics. In its early years the inquiry was financed by the Nuffield Foundation, and grants for continuing it through the school years have come from many sources, including the Ford Foundation and the Population Council, Inc.

This study was possible only because of the generous help given by medical officers of health, school medical officers, health visitors, directors of education, school nurses, and teachers in all parts of Great Britain. We should also like to thank the mothers who willingly answered numerous detailed questions, and their children who were on several occasions examined by the school medical officers.

REFERENCES

- Brit. med. J.*, 1964, 2, 72.
 Douglas, J. W. B. (1964). *The Home and the School*. MacGibbon and Kee, London.
 — and Blomfield, J. M. (1958). *Children Under Five*. Allen and Unwin, London.
 Miller, D. L. (1964). *Brit. med. J.*, 2, 75.
 Mulligan, G., Douglas J. W. B., Hammond, W. A., Tizard, J. (1963). *Proc. roy. Soc. Med.*, 56, 1083.
 Report of the Committee on Maladjusted Children, 1955. H.M.S.O., London.

Value of Premixed Nitrous-oxide-and-oxygen Mixtures in the Relief of Post-operative Pain

Double-blind Trial of 25% Nitrous Oxide in Oxygen, 15% Nitrous Oxide in Oxygen, and Oxygen

GEOFFREY D. PARBROOK,* M.B., CH.B., F.F.A. R.C.S.; BRYAN R. KENNEDY,† M.B., CH.B., F.F.A. R.C.S.

Brit. med. J., 1964, 2, 1303-1305

A previous trial (Parbrook *et al.*, 1964) showed that a 25% nitrous-oxide-in-oxygen mixture had considerable potency for relief of post-operative pain without serious side-effects. To investigate the practicability of its clinical use a double-blind trial was made with varying strengths of the mixture, using apparatus of the type already in routine ward use for oxygen administration.

The trial was limited to patients under the age of 60 who were to have upper abdominal operations and who were willing

to co-operate in the trial. A series of pain-free volunteers acted as controls. Pain relief was assessed by the technique of Overholt (1930), and Bromage (1955), and Masson (1962), who showed that wound pain reduces the vital capacity of patients after operation, and the degree of improvement of the vital capacity with treatment can be used to provide an index of the degree of pain relief.

Apparatus and Method

Comparative vital capacity readings were obtained using a Wright respirometer with a rubber mouth-piece attached and a nose-clip *in situ*. Three consecutive readings were taken on

* Senior Registrar, Department of Anaesthetics, the Royal Infirmary and University of Aberdeen.

† Senior House Officer, Department of Anaesthetics, the Royal Infirmary and University of Aberdeen. At present: Registrar, United Cardiff Hospitals.