Archives of Disease in Childhood, 1976, **51**, 820.

Children of low birthweight in the 1946 national cohort

Behaviour and educational achievement in adolescence

J. W. B. DOUGLAS and RUTH GEAR

From the MRC Unit on Environmental Factors in Mental and Physical Illness, London School of Economics

Douglas, J. W. B., and Gear, R. (1976). *Archives of Disease in Childhood*, **51**, 820. **Children of low birthweight in the 1946 national cohort: behaviour and educational achievement in adolescence.** Among 12 468 legitimate single births in the first week of March 1946, 163 weighed 2000 g or less (LBW group) and of these 80 survived to 18 years. 6 of the LBW survivors emigrated with their families and 5 have not been traced since birth. The remaining 69 were followed up to the age of 15 at which time two early school leavers were lost to the study. There is evidence that none of the survivors who emigrated or left the sample had serious physical or mental impairment.

Compared with individually matched controls, the LBW children showed similar proportions with severe physical, mental, or behavioural handicaps. There are small and statistically nonsignificant differences in favour of the controls in ability and attainment scores at 15 years and in the level of academic qualifications gained by the age of 18. If the mean ability and attainment scores are expressed as an 'intelligence quotient' with a mean of 100 and a standard deviation of 15, the LBW group has an average IQ of 93 and the controls of 97.

Hospital stay after childbirth was much longer in 1946 than today and many LBW children spent more than 3 weeks in hospital. There is no evidence that long hospital stay was associated with problems of behaviour or learning in adolescence.

This paper traces the progress to age 18 of 163 individuals weighing 2000 g or less at birth. They were born in 1946 before the introduction of the National Health Service and at a time when co-operation between obstetricians and paediatricians was rare; indeed paediatrics was just beginning to emerge as a specialty. Few maternity hospitals at that time had units for the care of very small babies or the facilities for transporting them from home to hospital if they needed special care. This study, then, is concerned with the survival and later development of children of low birthweight (LBW) who were born at a time when their special needs were largely unknown and uncatered for. As they were born just before the unfortunate period in the late 1940s and 1950s when a number of misplaced innovations in the care of LBW infants were introduced and discarded, they form a useful reference group against which to judge the effectiveness of present day care.

As this sample of LBW children includes many who remained in hospital for several weeks after birth, we have taken this opportunity to look for an association between length of initial hospital stay and later disturbances of behaviour and learning.

Data

This study of children weighing 2000 g* or less at birth (LBW children) is based on a national sample gathered from the 1946 Maternity Survey (Royal College of Obstetricians and Gynaecologists and Population Investigation Committee, 1948), and is part of a larger study of children weighing 2500 g or less at birth (Douglas and Mogford, 1953a, b; Douglas, 1956, 1960).

The national survey population which provided the 163 LBW children described in this paper consisted of

Received 23 January 1976.

*Birthweights were recorded in pounds and ounces and have been converted to grams.

12 468 liveborn legitimate singletons. Twins were excluded as having specific developmental problems in addition to those associated with LBW, and illegitimate children because it was felt, in 1946, that there would be formidable problems in keeping in contact with them. Apart from these exclusions the survey population covered all live births in the first week of March 1946 in 424 of the then existing 458 maternity and child welfare authorities in England, Wales, and Scotland.

The number of LBW children is small, but it should be emphasized that they are the product of approximately one week's births in the whole country. We did not, as in the main logitudinal study, follow up only a stratified sample of the LBW children and all figures given in this paper refer to the whole weeks' legitimate single births.

After completing an analysis of the circumstances associated with low birthweight (Douglas, 1950) each LBW child was matched individually with a control weighing more than 2500 g at birth. The matching took into account sex, age, birth order, home circumstances, mother's age, father's occupation, and geographical location. Though there were 11 761 children weighing over 2500 g from which the controls could be drawn, 4 LBW children could not be satisfactorily matched.

Losses. 163 liveborn legitimate singletons in the 1946 cohort weighed 2000 g or less at birth (1·3%). Table I shows the extent and nature of subsequent losses. The major source of loss was death in the first month. Below 1000 g none survived. At higher birthweights the neonatal survival rate rose to 32% (14 survivors) of those weighing 1001–1500 g, 38% (12 survivors) of those weighing 1501–1750 g, and 80% (60 survivors) of those weighing 1751–2000 g. All who reached 3 years survived to age 18. The only source of information on cause of death comes from the death certificates and is insufficient to indicate either how many additional babies might have survived with present day standards of care or the chances that such might be handicapped.

Six LBW children emigrated with their families. Their reported developmental milestones were well within expected limits and no congenital abnormality was described at birth or at the time of the second visit when they were 2 years old. One of them completed the 11-year tests of ability and attainment and scored exactly average for the whole survey population.

Five children probably still live in this country but have not been seen since 1946. 4 were excluded because a satisfactory matched control could not be found. In retrospect this was an unfortunate decision. There is no evidence that they were handicapped and we have checked that all were attending normal infant schools at the age of 5. A fifth child was lost owing to his mother's refusal after the first interview. Again there was no reported abnormality and at the age of 5 he was attending a normal infant school. It seems safe to assume that none of the LBW children who left the country or were untraced had a serious physical or mental handicap. 2 more children were lost after they left school at the age of 15. Both were at secondary modern schools and neither gained a qualification before leaving.

TABLE I

Losses from low birthweight group 1946–64

Died in first month	77
Died >1 month*	6
Emigrated with family	6
Not seen since birth	5
Untraced after leaving school (at 15)	2
In study till 18	67
	163

*There was no death after the end of the third year of life.

Availability of special care. 68 of the LBW children were delivered at home and 95 in hospitals or nursing homes. As 19 of the home-born children were later transferred to hospital, a total of 114 received institutional care from birth or shortly after it. For 9 of these there were no details of the type of care given, 35 were nursed in 'premature baby units', and a further 12 were given some form of special care, that is to say they were neither placed in an ordinary baby's nursery nor kept on the ward at their mother's side. 18 of the 47 children who received 'special care' were for some period in an oxygen tent and an additional 11 were in incubators. The neonatal death rate was 49% for those born and nursed at home, 53% for those born at home and later transferred to hospital, and 45% for those born in hospital.

Comparisons of low birthweight groups and matched controls

Controls who died, left the country, or whose parents were unwilling to co-operate were replaced using the same criteria as at the initial matching. The following analysis is based on comparing individual pairs and both members of a pair have been excluded when information is missing for either of them.

Handicaps. Table II lists the LBW children and their controls who are regarded as handicapped for one or more of the following reasons. (a) They were in long stay institutions. (b) They were at a special school. (c) When tested at 8, 11, or 15 years for ability and attainment they were on one or more occasion more than 2 SDs below the mean for the whole National Survey population. (d) More than one fit was recorded between birth and 15 years. (e) They had a persisting handicap that limited activity or had involved prolonged medical care.

Special schools include approved schools and borstal as well as schools for ESN (educationally subnormal), delicate, or handicapped children. No child was admitted to a school for maladjusted children and the only child attending a child guidance clinic, a control, is not included in the list.

Questions on fits were asked repeatedly from birth to 15. 2 LBW children who each had one fit associated with the onset of tonsillitis or with food poisoning have

TABLE II

Handicapped children in low birthweight group and in matched controls

A. LBW group

Handicap	Birth-weight (g)	Last school or institution	Age at leaving school	Employment at 18
Severely subnormal	1814	Long stay institution	—	—
Hemiplegia; spastic L arm and leg; low test score, 8 & 15	1729	Special school	16	Hosiery packer
Deaf (hearing aid); left shoulder sags, left foot drags	1842	Secondary modern	15¼	Clerk
Spina bifida, talipes equinovarus (caliper at 15)	1899	Special school for delicate children, then county secondary	15	Fitters apprentice
Many fits, 6–7 yrs, controlled by pheno-barbitone	1814	Secondary modern	15	Sales assistant
Splenomegaly and microcytic anaemia; low test score at 8 & 15	1928	Open air school, then secondary modern	15	Packer
Cataract L eye; low test score at 15	1791	Secondary modern	15	Trainee chef
Down's syndrome	1928	ESN school and occupational centre	16	Bath attendant
Low test score at 8*	1985	Secondary modern	15	Counter hand
Low test score at 15	1928	Secondary modern	15	Sales girl
Low test score at 8	1588	Secondary modern	15	Van boy
Low test score at 8	1814	ESN school	16	Factory worker

* Not tested at 15. ESN, educationally subnormal.

B. Control group

Handicap	Last school or institution	Age at leaving school	Employment at 18
Hydrocephalic; severely subnormal	Long stay institution	—	—
Frequent fits 7–10 yrs, controlled by phenobarbitone, fits at 15	Secondary modern	15	Apprentice hairdresser
2 fits at 3 and 5 yrs, none subsequently	Secondary modern	15	Shop assistant
Septal defect, no limitation of activity	Secondary modern	15¼	Trainee electrical engineer
Bronchiectasis and tuberculosis	Secondary modern	15¼	Shop assistant
Low test score at 15	ESN school	16	Labourer
Low test score at 15	Secondary modern	15	Sand blaster
Restless wandering, pilfering, truancy	Approved school	—	Labourer
Pilfering, resentful, severe maladjustment	Secondary modern then borstal	—	Labourer
Truancy and disturbed behaviour, schizophrenia	Secondary modern then approved school, then psychiatric hospital	—	Labourer when working

been excluded and also a control who was reported to have had one fit at 15 years.

Twelve LBW children and 10 control children are listed as handicapped. The main difference lies in the greater proportion of LBW children qualifying on the basis of low test scores with or without other handicaps (9 LBW compared with 3 controls), and the greater proportion of controls qualifying on the basis of attendance at approved schools or borstal. The excess of LBW children with low test scores is partly explained by those who did badly in the tests at 8 years and improved in subsequent years. If performance at 15 had been used for selection there would have been 6 LBW children making low scores and 3 controls, and a total of 9 handicapped LBW children and 10 controls. It is noteworthy that the 3 children at approved schools or borstal

came from the control group, all having had a history of seriously disturbed behaviour during their earlier years at school.

When less serious conditions are considered there is no further evidence of differentiation between the LBW and control children with the one exception of squints which were more often found in the LBW group (11) than in the controls (5). Other visual defects were equally common in both groups and no child in the 1946 sample had retrolental fibroplasia. Apart from the one deaf LBW child listed, 9 had minor impairments of hearing compared with 15 of the controls. Only one of the LBW group and one control never worked; in addition one control at the last contact was being treated as an inpatient for schizophrenia.

In reading through the collated records of these LBW and control children we have been struck by the great similarity in the pattern of illness reported. There is no evidence here that the LBW children are making an excessive contribution to the handicapped and maladjusted in the community.

Teachers' assessments. When these children were 13 and 15 years old their teachers were asked to rate them on a number of items of behaviour both in and out of class. From these ratings scores were obtained for 'attitude to work', 'inattentive behaviour in class', 'nervous behaviour out of class', and 'troublesome or aggressive behaviour out of class' (Douglas, Ross, and Simpson, 1968). The LBW children were not more adversely rated than their controls for either attitude to work or behaviour in class, but the LBW boys were rated as less troublesome and rather more nervous than their controls and the LBW girls were rated as more nervous than their controls. This may be related to their size. Teachers tend to rate big children as troublesome and small children as nervous, and the LBW boys and girls are considerably smaller than their controls (153·9 cm at 15 years compared with 159·6 cm for the controls, $P < 0{\cdot}001$).

Test performance. These children were tested at 8, 11, and 15 years for ability and attainment. At 15 the tests used were the Watts-Vernon reading test, a graded arithmetic/mathematics test, and the Alice Heim 4 verbal and nonverbal test. All test scores were standardized on the whole national survey population and expressed in terms of a mean of 50 and a standard deviation of 10. An aggregate test score derived from the sum of all test scores at 15 and standardized on a population of children who had been tested at all three ages was also available. The following tables present the individual test scores at 15 and the aggregate scores at 8, 11, and 15. Details of the tests are given by Pidgeon (1964, 1968).

Table III shows the mean test scores for LBW children and their controls. Although the LBW children at 15 are consistently below their controls in each test and in the aggregate of tests, there is in no instance a difference that is significant at the level of $P < 0{\cdot}05$. The greatest LBW/control difference at 15 was in the nonverbal test. At 8 years the LBW/control difference in aggregate test score is larger than at any subsequent age and is statistically significant. The small extent of handicap in the LBW group may be more readily appreciated by converting the aggregate score at 15 into an 'IQ equivalent score' with a mean of 100 for the whole sample and a standard deviation of 15. The LBW group then has a mean 'IQ' of 93 and the controls of 97.

Two sources of bias should now be mentioned. First, during the 15 years between choosing the matched controls and testing the children there has been a tendency for the LBW and control pairs to become less well matched. The home circumstances of the controls have improved more substantially than the home circumstances of the LBW children (Douglas, 1960). For this reason it is probable that the differences shown in Table III are somewhat exaggerated. On the other hand, if the LBW children had been compared with the whole sample, their deficit in test score would have been double that shown in Table III and they would have appeared to be handicapped at a statistically significant level.

Second, the 15-year test scores exclude a number of children who were tested at earlier ages but, for various reasons including allocation to special schools, could not be retested at 15. When gaps in the 15-year scores are filled with the most recent earlier test score a somewhat larger LBW/control difference is obtained, but it is still not a significant level (LBW 44·7, controls 47·5, $0{\cdot}1 > P > 0{\cdot}05$).

Further subdivision of the LBW/control pairs by the birthweight of the LBW child does not alter the picture. For those weighing 1751–2000 g the difference in aggregate scores at 15 is 2·6 points, for those weighing 1501–1750 g 2·3 points, and for those weighing 1500 g or less 2·4 points. When the pairs are divided according to MacDonald's (1967) criteria into 'light-for-dates' and 'others', the 15 children in the light-for-dates group scored 6·7 points below their controls ($0{\cdot}1 > P > 0{\cdot}05$) and the 21 children in the 'intermediate or other' group scored 0·3 points above their controls. Small numbers make these results indecisive, but as far as they go they support MacDonald's findings.

MacDonald reports low test scores for girls in semi-skilled or unskilled manual workers families. Again numbers are small in the present study but the figures given in Table IV support her findings in the early years when the only substantial LBW/control differences are found among girls in the lower manual working group. At 15, however, the test performance of the LBW girls is substantially lower than their controls in each social group though not at a significant level in either.

25% of the LBW children who were tested were born and reared at home. They came mainly from rural areas and their families were predominantly lower manual working class. Their mean aggregate test score (latest age available) was 43·3, a low figure that is not, however, materially different from that of their controls, 44·9. Of the remaining 75% who were born in hospital

TABLE III

Mean test scores for low birthweight group and matched controls compared (1946 study)

Type of test*	Low birth-weight group	Matched controls	Difference	No. of pairs	P ('t' test)
Individual tests at 15					
Nonverbal	45·9	49·0	−3·1	53	0·08
Verbal	46·4	47·4	−1·0	53	0·57
Reading	46·7	49·3	−2·6	52	0·13
Mathematics	45·6	46·5	−0·9	52	0·53
Aggregate of all tests†					
At 15	45·1	47·5	−2·4	52	0·13
At 11	45·4	47·7	−2·3	58	0·14
At 8	44·5	49·4	−4·9	60	0·01

*Each test has been standardized on the survey population (after adjusting for the original sampling). The mean for each test is 50 and the SD 10.

†The sum of the individual test scores was re-standardized on the population of children who had completed tests at 8, 11, and 15 years.

Note on exclusions from Table III. 64 pairs were tested at one or more of the following ages, 8, 11, or 15 years. When those not tested at 15 are credited with the score of the latest test taken, the mean aggregate test score is 44·7 for the LBW children and 47·5 for the matched controls ($0{\cdot}1 > P > 0{\cdot}05$). In 52 instances the latest score was at 15, in 10 at 11 and in 2 at 8 years. One LBW child with an aggregate test score of 38 at 15 years was excluded because the control was in a long stay institution and untestable. 2 LBW children, one in a long stay institution and the other a mongol, could not be tested and another one had to to be excluded owing to a prolonged failure to trace. In addition to the 4 pairs excluded for the above reasons, 5 were not seen since birth (see Table I).

TABLE IV

LBW/control mean difference in aggregate test score at 8, 11, and 15 years by sex and father's occupation

	Mean differences at		
	8 years	11 years	15 years
Boys			
Nonmanual and upper manual	−3·6 (7)	−0·6 (9)	+3·4 (7)
Lower manual*	−3·0 (18)	−1·9 (15)	−1·9 (16)
Girls			
Nonmanual and upper manual	+2·1 (15)	+2·9 (16)	−4·7 (14)
Lower manual*	−12·4‡ (20)	−8·2† (18)	−3·5 (15)

*Lower manual are families in which the father is a manual worker, and both father and mother were the children of manual workers and had no more than elementary education. They are 'two generation' manual working class families.

Numbers on which means are based are given in parentheses.

†$0{\cdot}02 > P > 0{\cdot}01$. ‡$P < 0{\cdot}01$.

or admitted as emergencies after birth, half received some form of special care and half were nursed in a cot by the side of their mother or in an ordinary babies nursery in the hospital, whichever was the normal arrangement. There was no social selection for these two groups. The mean aggregate latest score for the 'special care' group was 45·0 and for their controls 46·7, a nonsignificant difference. The corresponding scores for the 'ordinary care' group were 43·8 and 50·6 ($0{\cdot}02 > P > 0{\cdot}01$). While this is a statistically satisfactory result, the high mean score for the control group throws some doubt on its meaning, and it would be unwise to assume that these figures imply that failure to provide more than normal maternity hospital care for these small babies was associated with later depression of their test performance.

Schools and qualifications. The controls had a slight educational advantage over the LBW children. Of the 69 pairs whose complete educational records are available, 3 LBW children and 5 controls entered further or higher education and 2 LBW and 5 controls were at selective schools though they did not continue to follow a full-time course after leaving school. The teachers had higher expectations for the controls than for the LBW children. 42% of the former were expected to get at least one 'O' level compared with 20% of the latter. The proportions fulfilling these expectations were lower though in the same direction (28% and 12% respectively). Both these differences, however, could well be explained as chance variations.

Length of hospital stay

Many of the LBW children were retained in hospital for several weeks after birth, 57% being discharged after 3 weeks, the longest stay being 3 months. From the observations of Klaus *et al.* (1972) it might be expected

that these long periods of initial separation of mother and child would be followed by problems of care and adjustment when the baby returned home which in turn might lead to later disturbances of behaviour. There is, however, no evidence of long-term disturbances in children who were kept in hospital for several weeks after birth (see Table V). Indeed the long stay group, though it included a high proportion of babies who were described as in poor condition at birth, was favourably assessed by the teachers for behaviour at 13 and 15 years and made relatively high scores in the 15-year tests. These long stay children were more likely than the rest to have been cared for in special preterm baby units and were on average heavier when discharged, 2438 g compared with 2200 g for those kept in hospital for less than 21 days. Both these factors may have been associated with the favourable outcome for this group. Whatever the short-term consequences of keeping a baby in hospital for many weeks after delivery there is no evidence from this study of long-term adverse effects on either behaviour or learning. This is in striking contrast to the behaviour and learning handicaps of children admitted to hospital between the ages of 6 months and 4 years (Douglas, 1975).

Discussion

Two major criticisms have been made of this study. First, that it includes too few children of very low birthweight and second, that the use of controls has been found to be not 'reliable' (MacDonald, 1967). The first criticism rests on Drillien's (1964) comment that the National Survey can contribute little to the understanding of the problems of the low birthweight child because of the small number of very small children among whom 'problems of excessive morbidity, mental dullness, physical handicap, and behaviour disorder are commonly encountered'. The aim of the 1946 study was to cover births in a complete population and the LBW sample described amounts to approximately 2% of LBW children born in Great Britain in 1946. Our numbers are small because these children are relatively rare in relation to all births, though in hospitals with special units for their care they may appear common. It is a function of population studies to show the true dimensions of problems whose importance may have been exaggerated by the investigation of highly selected groups. The clear implication of the present study is that in 1946 LBW children were contributing little to the total burden of handicapped children supported by the community.

The use of matched controls raises problems which become increasingly evident with the passage of time. It is never possible to match for all the factors that should be taken into account and therefore in some instances there may be increasing differentiation between the experimental and control groups because of some difference (e.g. in attitudes) that was not taken into account when the original match was made. In the present instance it seems likely that the greater improvement in the circumstances of the control families stems from their greater drive and social responsibility. Looking back, this might have been guessed from the poor antenatal and postnatal care which the mothers of the LBW children received. These changes, however, which were mentioned in an earlier paper

TABLE V

Test performance at 15 years and teachers' assessments of behaviour at 13 and 15 years of LBW children grouped by place of delivery and length of hospital stay after birth

	Born and reared at home	Born in hospital and discharged	
		Within 21 days	21–91 days
Aggregate test* score at 15 years	43·2 (13)	43·3 (12)	46·2 (19)
Nervousness (mean teachers' rating)			
At 13 years	3·1 (14)†	1·5 (14)	1·8 (22)
At 15 years	2·9 (14)†	1·1 (12)	1·4 (22)
Troublesome (mean teachers' rating)			
At 13 years	0·36 (14)	0·14 (14)	0·05 (22)
At 15 years	0·21 (14)	0·17 (12)	0·09 (22)

Numbers on which means are based are given in parentheses.

*Only 44 out of 52 LBW children tested at 15 years are shown here. The 8 excluded were born in hospital and their mothers returned home within 21 days. As it is not certain that the babies also left hospital within 21 days, they have been excluded from the table. If they had been included, the mean test score for those discharged within 21 days would have been 45·2.

†Compared with their controls the mean ratings of LBW children for nervousness are significantly higher ($0{\cdot}1 > P > 0{\cdot}05$ at both 13 and 15). No other LBW/control comparisons based on the figures given in the table reached this level of statistical significance.

(Douglas, 1960) could only exaggerate the differences between the LBW and controls and the resulting picture is certainly considerably more realistic than the statistically significant and highly misleading result that would have been obtained if the LBW group had been compared either with the whole population or a randomly selected sample of 'controls'.

This study of a complete population of LBW children provides little evidence of increased physical, mental, or behavioural handicap, at any rate up to the age of 18. This is in contrast to two major studies in this country (Drillien, 1964; MacDonald, 1967). The major difference from MacDonald's study lies in the small proportion of 1964 LBW children with defects, and from Drillien's in the generally more favourable outcome of the 1946 LBW group whether judged by level of defect or by the general level of behavioural or mental disturbance. Both these previous studies were based on children born in the 1950s and cared for in teaching hospitals or hospitals with special preterm baby units. Drillien's study was limited to one city and MacDonald's covered 14 cities in different parts of Great Britain. The national survey in contrast included home as well as hospital deliveries in all parts of England, Wales, and Scotland. It was also undertaken at an earlier date. In 1946, though the mortality among babies weighing 1500 g or less at birth was high, conditions were relatively favourable for the survivors. Few hospitals attempted to provide special care for LBW babies but they were kept warm, fed soon after birth, seldom given oxygen, and ran little danger of excess dosage of vitamin K. The succeeding years, in which both MacDonald's and Drillien's sample populations were born, covered a period of innovation in the medical care of LBW children which is now known to have been associated with considerable iatrogenic hazards. The 1946 sample is important because it antedates these innovations and therefore provides a good base for judging the outcome of present day care. Current reports (Stewart and Reynolds, 1973; Francis-Williams and Davies, 1974; Davies and Tizard, 1975) of a low level of neurological damage among LBW children may reflect not only the excellence of modern paediatric care but also the removal of the artificial hazards imposed in the 1950s and early 60s.

Some further comment is needed on the lack of association found in this study between the length of initial hospital stay and later disturbance of behaviour. As Leifer *et al.* (1972) have pointed out the LBW situation is an unsuual one which is likely in any event to distort mother/child relationships. In 1946 the situation was perhaps less unusual than today because a substantial proportion were reared at home or nursed by their mother's side in hospital rather than being isolated in intensive care units. The high rate of nervous behaviour among children born and reared at home, which at both 13 and 15 years exceeded the rates of the controls at a level of $0 \cdot 1 > P > 0 \cdot 05$, might be a residual effect of the strain born by a mother who has to look after a very small baby without adequate support. Even long periods of separation may be less likely to generate long-term disturbances than the feelings of incompetence and anxiety aroused in a mother who has a very small baby entirely in her care. This may explain why the most favourably assessed LBW children were those kept longest in hospital who were also the heaviest when they returned home.

This study was mounted at a time when babies weighing 1750 g or less were unlikely to survive. In succeeding years the survival of these small babies has improved and there have been many important advances in neonatal care. The results of these changes should be evident in the subsequent longitudinal studies of cohorts born in 1958 and 1970.

References

Davies, P. A., and Tizard, J. P. M. (1975). Very low birthweight and subsequent neurological defect. *Developmental Medicine and Child Neurology*, **17**, 3.

Douglas, J. W. B. (1950). Some factors associated with prematurity. *Journal of Obstetrics and Gynaecology of the British Empire*, **57**, 143.

Douglas, J. W. B. (1956). Mental ability and school achievement of premature children at 8 years of age. *British Medical Journal*, **1**, 1210.

Douglas, J. W. B. (1960). 'Premature' children at primary schools. *British Medical Journal*, **1**, 1008.

Douglas, J. W. B. (1975). Early hospital admissions and later disturbances of behaviour and learning. *Developmental Medicine and Child Neurology*, **17**, 456.

Douglas, J. W. B., and Mogford, C. (1953a). Health of premature children from birth to four years. *British Medical Journal*, **1**, 748.

Douglas, J. W. B., and Mogford, C. (1953b). The results of a national inquiry into the growth of premature children from birth to 4 years. *Archives of Disease in Childhood*, **28**, 436.

Douglas, J. W. B., Ross, J. M., and Simpson, H. R. (1968). *All Our Future*. Davies, London.

Drillien, C. M. (1964). *The Growth and Development of the Prematurely Born Infant*. Livingstone, Edinburgh.

Francis-Williams, J., and Davies, P. A. (1974). Very low birthweight and later intelligence. *Developmental Medicine and Child Neurology*, **16**, 709.

Klaus, M. H., Jerauld, R., Kreger, N. C., McAlpine, W., Steffa, M., and Kennell, J. H. (1972). Maternal attachment—importance of first post-partum days. *New England Journal of Medicine*, **286**, 460.

Leifer, A. D., Liederman, P. H., Barnett, C. R., and Williams, J. A. (1972). Effect of mother-infant separation on maternal attachment behavior. *Child Development*, **43**, 1203.

MacDonald, A. (1967). *Children of Very Low Birth Weight*. Heinemann Medical, London.

Pidgeon, D. A. (1964). Tests used in 1954 and 1957 surveys. (Appendix 1.) *The Home and the School.* Ed. by J. W. B. Douglas. McGibbon and Kee, London.

Pidgeon, D. A. (1968). Details of the fifteen years tests. (Appendix 1.) *All Our Future.* Ed. by J. W. B. Douglas, J. M. Ross, and H. R. Simpson. Davies, London.

Royal College of Obstetricians and Gynaecologists and Population Investigation Committee (1948). *Maternity in Great Britain.* Oxford University Press, London.

Stewart, A. L., and Reynolds, O. R. (1974). Improved prognosis for infants of very low birthweight. *Pediatrics*, **54**, 724.

Correspondence to Dr. J. W. B. Douglas, MRC Unit on Environmental Factors in Mental and Physical Illness, London School of Economics, 20 Hanway Place, London W1P 0AJ.