

THE CONTRIBUTION OF OBSTETRICAL FACTORS TO SERIOUS PHYSICAL AND MENTAL HANDICAP IN CHILDREN

BY

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THE hazards of maternity which may cause death or damage to the child may be roughly divided into two groups: (a) abnormal intra-uterine conditions before the onset of labour, and (b) damage caused during labour itself. The two groups are not entirely clear-cut since neither is capable of being measured accurately and since a foetus which has been in hazard before the onset of labour may be critically affected by a degree of stress during labour which is of little consequence to a normal foetus.

Naturally, the obstetrician has made more progress in preventing the hazards of labour than of pregnancy, and with competent management birth trauma likely to cause permanent damage should be rare. He usually assesses progress in this respect by a study of perinatal deaths and is not well qualified to discuss remote effects in the survivors.

When I was invited to take part in this Symposium, I thought it might help to clarify my mind if the obstetric antecedents of a group of obviously handicapped children were investigated. Dr. Denys Fairweather and Dr. Raymond Illsley did the work, and I am grateful to them for allowing me to report the following findings.

Out of 3,370 births in a Scottish city during 1948, we were able, in 1959, to identify and investigate 64 children attending the special school for handicapped children. Of these, 7 had a physical handicap only, and 57 were educationally subnormal (I.Q. 70 or less), of whom 4 had a physical as well as a mental handicap.

Of the 11 children with a physical handicap, 4 were deaf, 2 malformed and 2 spastic; the

remaining 3 suffered respectively from eczema and asthma, epilepsy and Perthes disease.

OBSTETRIC FACTORS

Prematurity

In 10 of the 64 cases (15 per cent) the baby weighed 5½ pounds or less at birth. This high incidence of prematurity suggests that low birth weight might be an important causal factor in serious mental and physical handicap. The avoidance of prematurity might thus be of great importance in cutting down the incidence of mental handicap. In practice this has proved very difficult.

Table I gives the incidence of babies of 5½ pounds or less in primigravidae (single pregnancy) arranged in three height groups and three social classes. It shows that the incidence varies from about 2 per cent in tall women married to business and professional men to 15 per cent

TABLE I
Prematurity Rates Per cent in 4,322 Primiparae

Maternal Height	Husbands' Social Class			All Classes
	I and II	III	IV and V	
Tall (5 feet 4 inches +)	1.9	3.5	7.4	4.0
Medium	5.3	6.6	8.5	7.0
Small (— 5 feet 1 inch)	7.7	10.5	14.9	11.7
All heights ..	4.0	6.7	10.1	7.2

TABLE II
Follow-up in 1959 of all City Prematures born in 1948

1948			1948-59		1959	
Birth Weight	Number		Died	Left City	Alive in City	I.Q. 70 or less
-4 pounds	84		50	9	25	1
-4.5 pounds	39		14	2	23	1
-5.0 pounds	61		8	12	41	6
-5.5 pounds	123		12	39	72	3
Unknown	3		3	—	—	—
All prematures	310		87	62	161	11

in short women married to men doing semi-skilled or unskilled work. A uniformly high standard of antenatal care was given to all these women. The conclusion to be drawn is that the type of patient greatly influences the prematurity rate even when a high standard of medical care is available.

Dr. Drillien has found that in babies weighing less than 3 pounds at birth 14 per cent had an I.Q. of 70 or less. Fortunately such babies are few. Out of a total of 3,370 births in the City in 1948 only 6 babies of this weight survived to about 10 years of age. Table II shows that the highest incidence of serious mental handicap

occurred in the weight group $4\frac{1}{2}$ -5 pounds, 6 out of 41. In 48 babies weighing less than $4\frac{1}{2}$ pounds there were only 2 with an I.Q. of 70 or less. This suggests that birth weight by itself is not of prime importance.

Table III gives the results of intelligence tests in 363 primiparae. In the 25 who gave birth to premature babies, there is, on the null hypothesis, a striking excess of women of low intelligence. Also of great interest is the fact that only when the baby is $7\frac{1}{2}$ pounds or more is there a clear excess of mothers of superior intelligence and a deficiency of those of lower intelligence.

TABLE III
Birth Weight and Intelligence of Mothers
 (Expected numbers in each intelligence group in brackets)

Mothers' Intelligence Test Score*	Premature		All Premature	Mature		All Births
	-4½ Pounds	4½-5½ Pounds		5½-7½ Pounds	7½ Pounds-	
Good	0 (2.1)	1 (5.3)	1 (7.4)	60 (63.6)	46 (36.0)	107
Average	4 (2.7)	7 (6.9)	11 (9.6)	79 (85.1)	53 (48.4)	133
Poor	3 (2.3)	10 (5.9)	13 (8.2)	83 (73.2)	27 (41.6)	123
Totals	7 (7.0)	18 (18.0)	25 (25.0)	222 (222.0)	126 (126.0)	363

* Wechsler-Bellevue verbal scale.

TABLE IV

Distribution of Premature Babies by Mothers' Intelligence and Height
(Expected numbers in brackets)

Mothers' Intelligence Test Score*	Mothers' Height			All
	Tall	Medium	Small	
Good ..	— (2·8)	— (3·4)	1 (1·2)	1 (7·4)
Average ..	1 (2·0)	5 (5·6)	5 (2·0)	11 (9·6)
Poor ..	1 (3·0)	6 (4·0)	6 (1·2)	13 (8·2)
All ..	2 (7·8)	11 (12·8)	12 (4·4)	25 (25·0)

* Wechsler-Bellevue verbal scale.

Table IV shows that when the mothers of the 25 premature babies are arranged in three height groups there is a striking deficit in the number of tall women and an excess in the number of small women. In addition it is clear that the excess of women of under average intelligence is greatest in the small women. These findings are supported by some facts about the 10 mothers of premature children born in 1948 who are being educated at the special school for handicapped children in the City. Five of the 9 mothers where the height was known measured 5 feet or less. Five of the pregnancies were full-time by the date; one terminated at 37 weeks, 2 more prematurely and in 2 the duration of the pregnancy was uncertain, but both babies weighed more than 4 pounds.

Intelligence tests performed at the age of 9 in all premature babies born in 1948 in the City and still resident there show that at birth weights between 4 and 5½ pounds the average I.Q. was much lower in those born at or near term than in those where delivery occurred at 36 weeks or less. A foetal weight of 5 pounds at 36-weeks gestation suggests a normal rate of growth, whereas at 40 weeks it may represent a serious disturbance of intra-uterine nutrition and growth.

We can therefore conclude that while extreme prematurity may result frequently in serious mental handicap, there is no clear indication that within wide limits premature expulsion from the uterus does the foetus any serious harm.

Babies weighing between 4½ and 5½ pounds cannot be regarded as very premature; indeed, many of them are born at or near term; yet this weight group contains the highest proportion of babies with a low I.Q. This cannot be explained on a pure weight basis. Probably there is a genetic factor—since many of the parents also have a low I.Q.

Intra-uterine growth is poor and the deleterious effect of these factors on the intelligence test performance at the age of 9 is reinforced by a poor social environment after birth.

Abnormal Pregnancy or Labour

Investigation of the obstetric records showed that in 57 cases the pregnancies and labours were, for practical purposes, perfectly normal. In only 7 out of the total of 64 cases investigated was there any obvious abnormality of pregnancy or labour, and in only one of these was there an undoubted causal relationship with the eventual fate of the child (Table V). One spastic child sustained cerebral damage during a difficult forceps delivery undertaken because of disproportion. One educationally sub-normal child was seriously in hazard during pregnancy; it weighed less than 5 pounds when delivered at 38 weeks because the mother developed severe pre-eclampsia; the delivery itself was short and easy. In 5 cases the abnormalities of pregnancy and labour were not severe or unusual, and there seems no reason to believe that the children were permanently damaged by them.

SOCIAL FACTORS

The association between low birth weight, mental handicap, small stature of the mother and low social status has already been pointed out. Even in the 7 cases in Table V, where there was a possible obstetrical cause for the handicap in the child, adverse social circumstances and poor heredity were also prominent. Five of the fathers were in unskilled occupations and 4 of them had unstable job histories, or prolonged spells of unemployment, or were disabled. In 4 cases also, the child had had relatives at the special school or some of its siblings were described as "backward". Since these findings are very similar to

TABLE V

Seven Educationally Sub-Normal Children Where Possible Obstetric Factors Were Found

Obstetric History	Fathers' Occupation	Relatives at Special School
1. Primigravida, age 25 Admission at 41 weeks, ante-partum haemorrhage Foetal heart rapid in labour Spontaneous delivery, 5 pounds 15 ounces Resuscitation needed	General dealer (Many jobs)	1 uncle 3 cousins
2. Para-1, age 30 Pregnancy normal, 38 weeks Foetal heart rapid, irregular Caesarean after 4 hours, 7 pounds 8 ounces Breathing delayed 10 minutes	Labourer (Many jobs, unemployment)	—
3. Primigravida, age 20 Pregnancy normal, 43 weeks 2nd stage 90 minutes, spontaneous delivery, 6 pounds 9 ounces Cried fairly quickly	Labourer (Many jobs)	2 cousins 1 second cousin (2 siblings "slow")
4. Primigravida, age 19 Pregnancy normal, 40 weeks Foetal heart slow, meconium, 2nd stage Spontaneous delivery, cord round neck, 6 pounds 12 ounces Resuscitation ++	Labourer (Often unemployed)	2nd cousin
5. Primigravida, age 21 Threatened abortion, 5 months Easy normal labour at 41 weeks, 4 pounds 9 ounces	Storekeeper (disabled: unemployed 2 years)	Sister (2 siblings "backward")
6. Para-3, age 28 Severe pre-eclampsia, 38 weeks Very short labour, 4 pounds 14 ounces	Parcel porter	—
7. Primigravida, age 28 Normal pregnancy Contracted pelvis, very difficult, forceps Resuscitation ++, 7 pounds (spastic)	Foreman plater	—

those in which no obvious obstetrical factors existed, all 53 cases of mental handicap will be considered together from the sociological point of view. The majority of the parents are in Social Classes IV and V, the semi-skilled and unskilled working classes. Most of the mothers began their reproductive lives at an early age, an unusually high proportion of them with an illegitimate child.

The parents came from large families which have been unusually prolific. Thus, the 53 mothers have 216 live siblings, 42 per cent of them coming from families of 7 or more children.

Of the 216 siblings, 162 have married and have had a total of 529 live-born children (3.26 children per sibling); many of them have not yet completed their families. Of the mothers with whom we are immediately concerned, 50 are married and have had 242 children (mean family size 4.8), and their reproductive lives are by no means over. To complete this aspect of the story, it has been ascertained that 51 grand-parents, about whom it was possible to get accurate data, have *so far* given rise to 782 grandchildren.

Of the 53 immediate families, 19 seemed to

be more or less "normal", in the sense that the domestic circumstances were not unusual in any way and the fathers were in stable employment (see Table VI). Three of the children were

TABLE VI

Parents of 53 Educationally Sub-Normal Children Born in 1948

Child illegitimate	3
Family: alcoholism, delinquency, marital fights	2
Father died	5
Father deserted family	2
Father unemployed for at least one year ..	13
Father: unstable job history	9
Father in stable employment, family "normal" ..	19
	53

illegitimate. In 2 of the families there was a history of alcoholism, delinquency and marital fighting. Five of the fathers had died, 2 had deserted their families, 13 had had spells of unemployment lasting at least one year, and 9 had notably unstable job histories.

A striking fact, which we have not been able to work out in detail yet, is that many of these families are inter-related.

In 30 out of the 53 cases, the parents had both been born and brought up in the City, so that full information could be obtained about the "extended" families. In 18 of these 30 families, the children with which we are concerned had close relatives who also attended the special school. In every respect, except that of illegitimacy, those with relatives at the special school were socially inferior to those without affected relatives (Table VII).

TABLE VII

*Families of 30 Educationally Sub-Normal Children Born in 1948
(Both parents reared in the City)*

Characteristic	Relatives at Special School	
	Yes	No
All cases	17	13
Long-term unemployment	8	1
Living in slum or clearance areas ..	12	3
At least one child illegitimate	2	4
Unstable marital or occupational history	13	3
Child's I.Q. under 60	10	3
Mother's height under 5 feet 1 inch ..	11	3

The 64 children attending the special school do not constitute all the children with a severe physical handicap and an I.Q. of 70 or less born in that year. A few are being educated at the normal day school, but it is unlikely that their inclusion will make much difference to the general conclusion that obstetric hazards play a small part compared to genetic and environmental factors in causing serious physical and mental handicap.

It is, of course, possible that obstetric hazards can cause minor degrees of damage which, if widespread, would be of great practical importance especially in this scientific age. The practical obstetrician will be particularly interested to hear from Dr. Fraser whether the varying degrees of asphyxia which still occur frequently cause permanent disability. On the answer to this question may depend future trends in management of labour and in methods of resuscitation of the newborn.