THE SOCIAL AETIOLOGY OF FOETAL DAMAGE

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Obstetric research has until recently been more concerned with maternal and foetal survival than with the degrees of foetal damage. With dwindling foetal and infant losses, attention is now shifting towards brain damage, malformations and other abnormalities in the child. For these, a huge variety of social, psychological and obstetric causes have been suggested, ranging from work in pregnancy, through emotional stress to the complications of pregnancy (Mayer & Morin 1959, Stott 1957, 1961, Knobloch & Pasamanick 1960a).

Unfortunately, much socio-medical research in this new and difficult field is likely to be misdirected, for three main reasons. First, we are not nearly so well-informed about the incidence and distribution of " foetal damage " as we are about foetal death. Stillbirths and neonatal and infant deaths are regularly and accurately recorded on a national scale; but information on birth weights, malformations and cerebral lesions or functional defects is much less comprehensive and reliable. Second, we know relatively little about the nature and "natural history" of possible social and psychological factors and about the way they are related to each other and to the various complications of pregnancy and childbirth. Third, it seems certain that these various factors rarely act in isolation; a given type of damage is more likely than not to be the result of many closely interwoven influences, so that the search for a single " cause " is likely to be fruitless.

In this paper, I shall try to summarise some of the sociological-epidemiological lessons that have been learnt in pregnancy research, which are relevant to investigations on the nature and causes of foetal damage.

The existence of social class differences in neonatal and post-neonatal mortality has long been known and accepted; evidence has also been accumulating for many years of similar variations in still-births and premature births. Social classification, however, is a blunt diagnostic tool and the class gradient could be interpreted in many conflicting senses. As ' social class ' is usually based on the occupation of the patient's husband, it is natural to seek the origins of pregnancy complications and foetal loss in the social conditions experienced by the patient during marriage, and particularly during pregnancy and the puerperium. Pregnancy diet, maternal physical activity, living conditions and poor ante-natal care are obvious starting points for investigation. The results of such investigations are often surprising. A detailed and technically meticulous study of the diets of primigravidae in Aberdeen (Thomson, 1959a) revealed no straightforward relationship, within social classes, between maternal diet in pregnancy and birth weight, foetal malformation or perinatal death—although the class differences in average dietary intake were considerable. The author concluded that, under modern British conditions, maternal social class and long-term nutritional experience, with its consequent effect on growth and health, had more effect on the growth and vitality of the foetus than the quantity or quality of the diet taken in pregnancy.

In a study of a random sample of primigravidae, the present author (Illsley, Billewicz and Thompson, 1954) found that women who did paid work during pregnancy had relatively high prematurity rates. Working and non-working primigravidae differed, however, in other relevant respects, e.g., age at delivery, duration of marriage, maternal height and the husband's social class. A matched control study which allowed for these associated factors, suggested that work in pregnancy

had no intrinsic effect on the prematurity rate. Working primigravidae, as a group, had high prematurity rates because they included a disproportionate number of less healthy women from poor social backgrounds. Martin (1954) in a large scale study in Lancashire and London, and Drillien (1957) in Edinburgh, also found no evidence of a causal relationship between work in pregnancy and prematurity. The only contrary evidence was provided by Stewart (1955) in a study of Northamptonshire births. This study, based on matched samples containing only 22 premature births, had certain curious features in that the sample of working women chosen for study had much lower prematurity rates than the total population from which they were drawn, whilst the rates of the matched non-working housewives were lower than those of Social Classes I and II in the Northamptonshire population.

From the studies by Martin, and by Illsley, Billewicz and Thompson cited above, it also emerged that living conditions and the amount of ante-natal care were not significantly related to the rate of prematurity. Indeed there are good sociological reasons for such negative findings. The spread of council housing in modern Britain has complicated the relationship between living conditions and health. Families in poor health often occupy high-standard, though possibly overcrowded accommodation; the families of white collar workers, on the other hand, may not qualify for a council house because they have limited their family and because their health is good. In Aberdeen, the highest rates of prematurity and perinatal death occur in inter-war council estates equipped with bath, running hot water and inside W.C., the rates in the old, decaying areas from which these families came being considerably lower. This suggests that the characteristics of the tenant rather than of the house may be causally significant. Similar complex interrelationships blur the effect of ante-natal care. Among primiparae, least ante-natal care is received by women who conceive pre-maritally and delay attending a clinic until they are married (Illsley, 1956a); such women are at a disadvantage because they are drawn disproportionately from the lower social classes, but they have the great physiological advantage of youth. Among multiparae, the most intensive and prolonged ante-natal care is often received by women with an obstetric history bad enough to require hospital care in pregnancy and labour. A poor outcome in such cases does not warrant the conclusion that ante-natal care has no beneficial effect.

These studies suggest that the events surrounding pregnancy may have importance, not in their own right, but because, however indirectly, they reflect earlier stages in the growth and development of the mother and consequently, the kind of person she is, physically, mentally and socially, at the time of marriage and parenthood. The strong relationship between maternal height and reproductive performance (Thomson, 1959b) gives strong support to this hypothesis, for a mother's height is very largely determined before she marries. Further evidence pointing in the same direction is shown in Table 1 which gives the prematurity rates, for each Husband's Social Class, of women conceiving before and after marriage. The social class gradient is just as wide for those conceiving prenuptially as those conceiving within marriage—yet the pre-nuptially conceiving woman may have lived in the same house as her husband for only a short time before the birth of her baby. In this population, for example, 75% of women conceiving pre-nuptially did not marry until the 2nd trimester of pregnancy or later and two-thirds continued to live in their parental homes after marriage until delivery.

TABLE 1

Prematurity rate by Husband's Social Class and Pre-nuptial Conception

Period of Conception	Husband's Social Class* I & II	III Non-manual	III	IV & V Manual	Total	No. of Cases
	Prematurity rate (per 100 births)					
Pre-nuptial	3.3	7.3	8.2	14.4	9.8	2077
Post-nuptial	5.9	6.1	6.5	9.4	6.9	7072

*Classification according to the method used by the General Register Office (1951).

The implication of these findings seems to be that, among primigravidae at least, the husband's social class, and its associated standard of living, may exert little intrinsic influence on the occurrence of perinatal death or premature birth; and that, whatever the immediate medical cause, the social factors which do influence reproductive morbidity and mortality may date from the period before conception. The mother comes to marriage and childbearing at the end of 20 or 30 years of social and nutritional experience which have inevitably left their mark on her behaviour, health and physique. Table 2 based on all births to Aberdeen women brought up in Social Class III (i.e., daughters of clerical and skilled manual workers) outlines the social processes by which healthy women tend to move into the upper social classes at marriage, whilst women of poor physique (with its consequent obstetric risks) marry into the lower social classes. For example, women who later married husbands in Social Classes I and II (the professional and managerial classes) remained at school longer, on average, than the remainder of their class of origin; many more took professional or other non-manual jobs and at the time of pregnancy their intelligence test scores were relatively high. They were also taller and had low prematurity and perinatal death rates. Women from the same class of origin who married semi-skilled or unskilled workers ranked lowest in all these respects.

TABLE 2

Characteristics associated with inter-class movement at marriage

Class of upbringing	III			No. of Cases
Class at marriage	I & II	III	IV & V	
Left school after minimum age %	49	16	5	1859
Professional, technical or clerical occupation before marriage %	71	38	14	1859
Intelligence test grade above average %	73	47	20	117
Height 5′ 4″ or more %	45	29	19	3364
Prematurity rate (per 100 births)	5.8	6.5	11.4	3364
Perinatal death rate (per 1,000 births)	22	29	46	3364

In this way social class at marriage comes to summarise the social and health experience of the individual over many preceding years. This is not a quality peculiar to the variable " social class at marriage "; any single social index contains within it overtones of other associated social experience, for our lives form a coherent (though not inevitable) pattern. Class and family of origin, educational level, occupation, social milieu, attitudes to work, family, food and health, cluster together in meaningful ways and cannot, without risk of distortion, be regarded as separate, unconnected variables capable of statistical isolation.

Prematurity and foetal damage

Apart from its contribution to the volume of perinatal and neonatal death, low birth weight may impair the physical and intellectual condition of the child who survives. Evidence is accumulating to show that children of low birth weight have relatively low intelligence test scores at later ages and contain a high proportion who are physically handicapped, e.g., Knobloch and Pasamanick (1960b) and Drillien (1958); and that an unusually high proportion of mentally handicapped children have a low birth weight (Fairweather & Illsley, 1960). Precise estimation of the effect of birth weight on intellectual development is several degrees more complex than the research problem described above — for, to the chain of events leading to prematurity, there must be added a further series of interlocking genetic, social, psychological and medical events involving the child as well as the mother.

In the study of this problem three sociological questions must be borne constantly in mind.

(1) What are the social processes and conditions leading to premature birth? And consequently what are the social characteristics of the parents of premature children — their class and family of upbringing, education, intelligence, occupation, environmenthood, etc.

(2) Do sub-categories of under-weight babies (e.g., children delivered before or at full-term) differ from each other in their social aetiology?

(3) What relationships, independent of birth weight, exist between the social factors related to prematurity and the childhood condition being studied, e.g., does the postulated low I.Q. of premature children merely reflect the fact that women with low I.Q., because of their poor social and health experience, have a high prematurity rate?

TABLE 3

Maternal characteristics associated with Prematurity

Maternal characteristics	Infant Birth Weight	
	$5\frac{1}{2}$ lbs. or less	Over $5\frac{1}{2}$ lbs.
% left school at minimum age	88	80
% in semi-skilled and unskilled manual jobs before marriage	32	23
% conceiving before marriage	29	22
% 5′ 0″ in height or less	35	21
% marrying semi-skilled or unskilled workers	31	21

Prematurity, defined in terms of birth weight, is now acknowledged to be more common in the lower social classes (Douglas 1960; Martin 1954; Stewart 1955; Illsley 1956b; Drillien & Richmond 1956). Table 3 shows that the premature children tend to be born to women of minimal education and short stature, manual workers and those who conceive before marriage. On this evidence alone one would expect that the mothers of premature babies would themselves be of low measured I.Q. This suggestion is confirmed, for a smaller population, in Table 4, which shows that women who gave birth to premature babies had a low average I.Q. The relationship holds within broad social classes and is valid for verbal and non-verbal tests of intelligence (for methodological details of this study see Scott and Thomson 1956). The data contain the further implication that birth weights in general, rather than low birth weight, should be the true subject of investigation, for maternal I.Q. varies continuously with baby weight, at least up to $7\frac{1}{2}$ lbs.

TABLE 4

Maternal Intelligence and Infant Birth Weight

Intelligence Test Grade* of Mother	Birth Weight of Infant			
	$5\frac{1}{2}$ lbs. or less	$5\frac{1}{2}$—$7\frac{1}{2}$	$7\frac{1}{2}$ or more	All weights
High	1 (7)	60 (64)	46 (36)	107
Average	11 (10)	79 (85)	53 (48)	133
Low	13 (8)	83 (73)	27 (42)	123

*Wechsler-Bellevue (verbal) intelligence scale; similar results were obtained using Raven's Progressive Matrices 1938 (non-verbal).

( ) expected numbers given in brackets.

It seems unlikely that it is by virtue of their intelligence level that women of low intelligence produce small babies. The correlation must be indirect rather than causal. Women of low I.Q. tend to be drawn from the lower social classes; they are relatively short in stature and of poor physique (Scott, Illsley and Thompson 1956). Because of their poor physical and social condition they are more likely than women of higher I.Q. to bear small babies. The link connecting the psychological variable (maternal I.Q.) and the obstetric outcome (birth weight) is therefore a social one.

What are the implications for the intellectual ability of the child? Without postulating foetal damage, it seems likely on genetic grounds that the average premature child, like its mother, will be below average in intelligence. This tendency will be reinforced by social factors; the premature child, born into an unfavourable environment, continues to be at a disadvantage throughout childhood. Apart from its poor physical surroundings and greater exposure to illness (Douglas and Blomfield 1958) the child's parents will be less able to provide the intellectual and cultural stimulation conducive to high performance in intelligence tests.

Methods of study

The most difficult problem in this field is to isolate the possible effects of physical damage to the foetus from the social and genetic factors with which it is so tightly interwoven. The use of unmatched controls is virtually to ignore the problem; to match for ' social class ' is not enough, for social classes themselves are highly heterogeneous. On the other hand, to match for all relevant social and biological influences requires a wealth of information about the parent population which is rarely available. This problem is well illustrated by a recent study carried out by the present author (Fairweather and Illsley 1960) into the social and obstetric origins of mentally handicapped children. All Aberdeen children with an I.Q. of 70 or less born in 1948 and still surviving and resident in the city in 1958, were traced and interviewed. Information was available, for both this group and for the general child population, on the occupation of the child's grandfather, mother and father, the size of his mother's family of origin, the age of the mother at marriage and delivery and the interval between marriage and first conception. In each of these respects the mentally handicapped group differed markedly from the general population, consisting preponderantly of the children of manual workers from large families, with high rates of extra-marital conception and early marriage. At this stage it might have been possible to choose social controls and compare the obstetric origins of each group. Further study revealed, however, that the mentally handicapped families differed in other social respects highly relevant to the origin of mental handicap. Out of 58 families 30 were recorded as having an unstable history for the following reasons: mother unmarried, 3; parents separated, child illegitimate, 1; parental desertion, 3; heavy drinking, petty larceny, breach of peace, 2; prolonged and/or frequent unemployment and job change, 16; father died, 5. In 27 families siblings or close relatives had attended the special school for mentally handicapped children. An adequately matched control group would be virtually impossible to find. Yet lack of full control would certainly lead to undue weighting in favour of obstetric causes of mental handicap since mothers from socially disorganised families had a high incidence of abnormal pregnancies and labour resulting from their poor health and physique.

These difficulties are real enough in studying the effect of a measurable characteristic, such as birth weight or method of delivery, on the intelligence test score of the child. They are most acute where the influence of such ill-defined conditions as abnormal pregnancy, stress or " pregnancy shock " is under investigation; for example, the work of Stott (1957 and 1961) on the lesions produced in the foetus by the emotional shock sustained by the mother in events ranging from street accidents, the death or illness of a relative to the unfaithfulness of a husband. The accuracy with which such events are reported and evaluated, their social distribution and significance, are virtually unknown and the possibility of ' accidental ' correlations is inevitably high. The chances of error are enhanced by retrospective inquiry.

Some of these difficulties can be overcome by clearer definition. Prematurity for example, is only a convenient expression for a number of clinically different sub-categories, e.g., children of low birth weight delivered at term as well as those expelled prematurely from the uterus, either spontaneously or after induction. Study of such sub-categories may reveal whether low birth weight is **necessarily** associated with low intelligence. The preliminary results of a follow-up of premature children born in 1948 show that at the age of 7 the average I.Q. of single babies delivered spontaneously was 97.7 (116 cases) compared with 106.8 (15 cases) for those in whom labour was induced, and 106.3 for the total child population of the City. This suggests a hypothesis and a potentially fruitful method of study. Here, too, knowledge of the social aetiology of pregnancy complications is essential; women

induced because of pulmonary T.B. for example, will be socially distinct from pre-eclamptic mothers and the I.Q. of their children may differ in consequence.

Sibling studies have the virtue of minimising social and genetic differences between affected cases and controls. We would like to know, for example, whether premature children differ in I.Q. or personality, from their full-term (or full-weight) siblings or whether the premature children of mothers who produce several low-weight babies differ from the first or only premature child of mothers who produce heavier babies at other pregnancies. Even siblings, however, do not have identical intra-uterine, obstetric or social experience. Prematurity, pre-eclampsia and difficult labour are more common in first than in 2nd or 3rd pregnancies; children of different birth rank differ also in I.Q. (Scottish Council for Research in Education 1949) and possibly in personality characteristics. It is at least necessary to ensure that affected cases do not differ in birth order from their controls.

Ultimately, there is no adequate substitute for generalised study of both normal and complicated pregnancies and their outcome. This is partly because processes and their inter-action may be more important than the operation of any single factor; and partly because without a general aetiological framework, it is frequently impossible to assess the meaning of a particular hypothesis or research finding. Since the essential problem is to determine the relative contribution of social, psychological and obstetric influences, it also follows that each should be fully studied. It is inefficient to apply detailed and expensive techniques to one facet of the problem and to dismiss the remainder with a perfunctory ' common sense ' judgment. It is worse than inefficient, in a field where correlations abound, to confuse correlation with causation; because every time a causal factor is postulated on insufficient evidence, useless or even harmful action may be taken; and subsequent research workers have to 'undo' the false evidence before collecting new and more relevant data.

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