MATERNAL, INFANT AND SOCIAL FACTORS ASSOCIATED WITH BIRTHWEIGHT

K. W. HARPER, B.Sc., M.B., B.Ch., B.A.O.*

Department of Social and Preventive Medicine
Queen's University of Belfast

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IN 1900, the Infant Mortality Rate (I.M.R.) in Belfast was 153 per 1000 livebirths (Elwood, 1973). By 1971, the rate had fallen to 26 per 1000 (Registrar General's Report, 1973). This figure is, however, one of the highest in any city of comparable size in the United Kingdom. The I.M.R. in Birmingham in that year was 20 per 1000, in Bristol it was 17 and in Stoke on Trent 16, while even Teeside recorded 19.8.

Elwood and Pemberton (1971) examined possible reasons why the I.M.R. in Belfast was higher than in Birmingham and concluded that 40 per cent of the excess infant mortality in Belfast was accounted for by differences between the two livebirth distributions by birthweight. Low birthweight is known to be associated with increased neonatal mortality, and also with relative mental and physical impairment of surviving infants (Weiner and Milton, 1970), so any diminution in the number of infants of low birthweight would hopefully improve the situation with regard to both mortality and morbidity.

This study was undertaken in order to examine the relationship between birthweight and certain biosocial factors, and to identify some of the characteristics of mothers likely to have infants of low birthweight, and hopefully, to suggest means of reducing the incidence of low birthweight infants. Some characteristics of low birthweight infants were also studied.

METHOD

The records of the 867 live single births which occurred in the Royal Maternity Hospital, Belfast, between 1st January, 1974, and 31st May, 1974, were examined. Information concerning the selected biosocial factors was recorded on a prepared register, and then transferred to punch cards for analysis.

Tables of the distribution of infants by birthweight and a selected variable were prepared, and the chi square test applied in order to assess the significance of observed differences in the distributions. A difference was judged to be significant if the probability value 'p' was less than 0.05, i.e. if such a difference was likely to be reached or exceeded by chance alone less than once in 20 such comparisons.

A random sample of 50 records was extracted from the total of 867 records and used to calculate linear correlation coefficients on suitable parameters.

Each infant was allocated to one of the Registrar General's Social Classes based upon the occupation of the father. Social Classes I and II, and Social Classes IV, V and unemployed were combined for convenience of tabulation.

Copies of tables of results may be obtained on application to the Department of Social and Preventive Medicine, Queen's University of Belfast.

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RESULTS

Number of previous pregnancies
Mothers having a fourth or subsequent pregnancy significantly more commonly had babies at the extremes of the birthweight range (p<0.02). Also low birthweight was found more often than expected among first born infants.

Maternal Age
Older mothers were significantly much more likely to have infants in the very low or very high birthweight groups (p<0.001).

Maturity of fetus
Low birthweight babies were, not surprisingly, significantly more common among babies born before 38 weeks maturity (p<0.001).

Apgar score
An infant of low birthweight was significantly more likely to have a low Apgar score (p<0.001).

Religion of Mother
There was a significant difference (p<0.01) in the distribution of birthweights in Roman Catholic and non-Roman Catholic groups. The latter had a higher proportion of babies in the higher birthweight groups, i.e. over 3500g. There was little difference in the proportion in the low birthweight groups.

Height of Mother
The shorter mothers were significantly more likely to give birth to infants of low birthweight (p<0.001, r=0.33).

Social Class
Table 1 shows that mothers in social classes I and II were significantly more likely to have babies of heavier birthweight. Those in social classes IV, V and unemployed had more in the under 2500g. group (p<0.01).

| Birthweight (g) | I, II No. | % | III No. | % | IV, V, Unemployed No. | % | Total No. | % |
|----------------|----------|---|---------|---|----------------------|---|-----------|---|
| <2500          | 8        | 5.0| 26      | 6.3| 27                   | 10.9| 61        | 7.4|
| 2500—          | 39       | 24.4| 71      | 17.2| 55                   | 22.2| 165       | 20.1|
| 3000—          | 51       | 31.8| 155     | 37.7| 101                  | 40.7| 307       | 37.4|
| 3500—          | 52       | 32.5| 138     | 33.5| 52                   | 21.0| 242       | 29.6|
| >4000          | 10       | 6.3| 22      | 5.3| 13                   | 5.2| 45        | 5.5|
|                | 160      | 100.0| 412     | 100.0| 248                  | 100.0| 820       | 100.0|

P<0.01
Placenta weight and diameter

Birthweight was strongly correlated with placenta weight \((r=0.56)\) and to a lesser degree with placenta diameter \((r=0.23)\).

Hypoxia

Low birthweight infants had significantly more hypoxia \((p<0.001)\).

Congenital defect

There was no significant relationship between live birthweight and the presence or absence of congenital defect.

Social Class and height of mother

Table 2 shows that social class is significantly associated with height of mother. The small mothers tended to be in social classes IV, V and unemployed, while the taller mothers tended to be in social classes I, II and III \((p<0.001)\).

| Social Class | Height of Mother (cm.) | Total |
|--------------|------------------------|-------|
|              | <149 | 150— | >160— | No. | % | No. | % | No. | % | No. | % |
| I, II        |       |       |       | 139 | 18.3|
| III          | 10    | 59    | 70    |     |     |     |     |     |     |     |     |
|              | 11.2  | 13.4  | 30.3  |     |     |     |     |     |     |     |     |
| IV, V        | 35    | 233   | 122   | 390 | 51.4|
| Unemployed   | 44    | 147   | 39    | 230 | 30.3|
|              | 49.5  | 33.5  | 16.9  |     |     |     |     |     |     |     |     |
|              | 89    | 439   | 231   | 759 | 100.0|
|              | 100.0 | 100.0 | 100.0 |     |     |     |     |     |     |     |     |

\(P<0.001\)

Discussion

From the results it can be seen why birthweight is closely related to infant mortality. Low birthweight infants, as has been shown before (Reid, 1961; Nelligan, 1966), were of lower gestational age. They also had more hypoxia and had a lower Apgar score at birth. Placenta weight and diameter were lower in low birthweight infants, and perhaps placental insufficiency is an important factor in causing low birthweight, even in the absence of disease such as pre-eclampsia. On the other hand a small mother having a small baby may naturally have a small placenta with no insufficiency. Others have concluded that weight is a poor indicator of placental adequacy, and that placental insufficiency, on the basis of small placental size is probably rare (Thompson, Billewicz and Hytten, 1969). Congenital defect, a major cause of infant mortality in Northern Ireland was not associated with live birthweight in this study.
These factors arise as a result of pregnancy. Of interest are the environmental factors which exist before pregnancy begins. Older mothers and those having their fourth or subsequent pregnancy had more infants at the extremes of the birthweight range. The association of birthweight has already been shown with maternal age (Karn and Penrose, 1951) and parity (Jayant, 1966). High parity mothers are more likely to suffer from diabetes, rhesus iso-immunization and pre-eclampsia. Religion of the parents was associated with birthweight, but this factor was probably confounded with social class. Social class was associated with birthweight, the lower birthweight infants tending to be in the lower social classes.

Low maternal height was also associated with low birthweight and with lower social class. In Aberdeen, Thompson and Billewicz, (1963) have shown a relationship between maternal height and the nutritional status of the mother, concluding that tall women eat more, and on the whole eat better diets than short women, even when differences of body weight are allowed for. In Massachussets U.S.A., it has been shown that nutrition of pregnant women and the birthweight of the baby are strongly associated with her socio-economic status (Sacho, 1975) and in Montreal, with the addition of milk, eggs and oranges to the diet of pregnant women, the incidence of low birthweight was reduced from 9.0 per cent to 6.7 per cent (Higgins, 1973). A study of infants born to mothers in the Dutch Famine (1944-45) showed that deprivation of nutritional factors led to lower birthweight infants being born (Stein and Susser, 1975).

It can be concluded from this that low social class, low maternal height and low birthweight are all interrelated, and postulated that poor nutrition is the underlying cause of both low maternal height and low birthweight. Improving maternal height by better previous nutrition may subsequently improve infant birthweight. The preparation for pregnancy therefore begins in early childhood and it is not just sufficient to take care of the diet of women after pregnancy has begun.

When considering the association of maternal height and social class in the aetiology of low birthweight, it is interesting to note that relative to the rest of the United Kingdom incomes in Northern Ireland on average are lower (Commissioners of H.M. Inland Revenue 1967) and there is also a higher proportion of families in Social Class V. In Northern Ireland and Scotland there is also much more overcrowding than in England and Wales (Census Reports, 1961). This may partly account for the higher infant mortality in Belfast relative to other cities in the United Kingdom.

In retrospective study it was not possible to ascertain the smoking status of the mother. Russell, Taylor and Madison (1966) showed that the smoking of five or more cigarettes per day resulted in lower birthweight infants than in mothers who smoked less or were non-smokers. The finding that smoking is associated with a lower weight gain in the mother during pregnancy (Rush, 1975), and that maternal weight gain during gestation is strongly associated with birthweight (Rush, Davis and Susser, 1972), would further suggest that nutrition during pregnancy has an effect on birthweight.
CONCLUSION

Some 98 per cent of mothers in Belfast now have their babies in hospital where the obstetric and paediatric services are highly efficient. The causes of the high infant mortality rate associated with a high proportion of low birthweight babies are therefore likely to lie outside the hospital. Poor social conditions in general, perhaps a poor diet in the antenatal period and even in the mother’s childhood causing reduced stature, appear to be of aetiological importance for low birthweight. The continued improvement in the diet of children and of social conditions in general can be expected to have a beneficial effect eventually on the I.M.R. In addition the extension of the use of family planning in Social Classes IV and V and among the unemployed by reducing the number of high parity babies should help to reduce the number of babies at special risk.

At present the Department of Health and Social Services is monitoring the nutritional status of the population, including the nutritional health of women during pregnancy, and financing further research into family planning (D.H.S.S. Annual Report, 1973).

SUMMARY

Data on all singleton livebirths in the Royal Maternity Hospital, Belfast from 1st January, 1974 until 31st May, 1974 were analysed to identify maternal, infant and social factors associated with birthweight. Age, height, parity, religion and social class of the mother, maturity of the fetus, Apgar score, placenta weight and diameter and hypoxia in the infant were all significantly associated with birthweight. Social class was also significantly associated with maternal height.

It is suggested that an improvement in general social conditions and an increase in the average height of future mothers brought about by better nutrition in childhood and an extension of family planning in Social Classes IV and V and the unemployed, would reduce the numbers of low birthweight babies and, as a consequence, reduce the rather high infant Mortality Rate in Belfast.

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