

## PAPERS AND SHORT REPORTS

# Reversal of changes in distribution of gestational age and birth weight among firstborn infants of Cardiff residents

R G NEWCOMBE

## Abstract

Firstborn singleton infants born to primiparous Cardiff residents during the decade 1970-9 were studied. Both mean birth weight and gestational age at delivery rose during the period. Changes in maternal age, height, smoking habits, and history of spontaneous or induced abortion did not explain these findings.

The decreased proportion of infants weighing less than 2500 g may be explained by the overall increase in gestational age, which in turn may have resulted from decreased use of induction of labour during 1975-9.

## Introduction

A study of firstborn singleton infants delivered to Cardiff residents in the decade 1965-74 showed a small but significant reduction in gestational age and birth weight between the two five year periods 1965-9 and 1970-4.<sup>1</sup> These changes did not disappear when adjustment was made for changes that occurred in the distributions of maternal age, height, smoking habits, and history of spontaneous or induced abortion, and it was hypothesised that the increased recourse to elective delivery during 1970-4 might have led to these findings.

Accordingly, similar analyses were performed to compare the periods 1970-4 and 1975-9. As the rate of elective delivery among primiparas in Cardiff reached a peak in 1972 with a sharp fall in the latter half of the decade the hypothesis would predict a reversal of the pattern seen earlier.

## Subjects and methods

The Cardiff Births Survey was used to compare liveborn singleton infants of primiparous Cardiff residents delivered during the five year periods 1970-4 and 1975-9.<sup>2</sup> Cases were included if the date of the last menstrual period was certain and the birth weight, maternal age, height, smoking habit, and history of abortion were known. (The survey data did not distinguish between induced and spontaneous abortions.) Thus the study comprised 11 296 births, of which 5146 (45.6%) occurred during the second quinquennium.

Birth weight and gestational age were analysed in terms of mean and SD, and *t* tests were performed using pooled variances from within the five year periods. Characteristics of the parturient population in the two five year periods were compared using the  $\chi^2$  test on one degree of freedom with Yates's correction (table I). To analyse further the increase in mean birth weight and gestational age adjustment was made for each of the "explanatory" variables individually as in the earlier study, and a summary variable taking 16 values representing all possible combinations of the dichotomies indicated in table I was used (table II). The effects of changes in the distribution of the social class of the parturients were also examined. Five groups were used—namely, social classes I and II, III, and IV and V (defined according to the husband's occupation); the unmarried; and a residual group consisting of others and those for whom information was missing. The latter were not excluded, to ensure comparability with the earlier study. Mean changes adjusted for this variable indicating sociomaterial state are also given in table II.

## Results

During the decade two changes occurred in the parturient population that would be expected to improve the incidence of low birth weight and preterm delivery—namely, a fall in the proportion of women aged under 20 at their first delivery, and an increase in the proportion of women who had never smoked (table I). On the other

TABLE I—Changes in characteristics of primiparas resident in Cardiff 1970-9. (Figures are numbers (%) of women)

Characteristics	1970-4 (n = 6150)	1975-9 (n = 5146)	$\chi^2$	Significance
Previous abortion	721 (11.7)	793 (15.4)	32.49	p < 0.001
Maternal age under 20	1728 (28.1)	1144 (22.2)	50.55	p < 0.001
Never smoked	3446 (56.0)	3157 (61.3)	32.38	p < 0.001
Height < 1.57 m	1798 (29.2)	1505 (29.2)	0.00	NS

Department of Medical Computing and Statistics, Welsh National School of Medicine, Cardiff CF4 4XN

R G NEWCOMBE, PHD, lecturer

hand, the proportion of women with a history of abortion increased. There was no change in the distribution of height between the two periods. The changes in sociomaterial state were of equivocal benefit: the proportion in social classes I and II rose from 17.0% to 21.2% while the proportion unmarried also rose, from 12.3% to 15.4%.

The increases in mean gestational age and birth weight shown in table II showed high statistical significance and were not altered greatly by adjustment for the above changes in the parturient population. As in the previous study, examination of the change in weight within single week categories of gestational age suggested that it was probably secondary to the change in gestational age.

The incidence of all elective delivery fell from 36.4% in 1970-4 to 15.4% in 1975-9, a lower figure than that in 1965-9 (25.6%). The incidence of induction of labour fell from 34.6% to 12.6%.

TABLE II—Crude and adjusted changes in mean gestational age and birth weight of firstborn singleton infants of Cardiff residents between 1970-4 and 1975-9. (Figures for 1965-9 given for comparison)

	Gestational age (weeks)	Birth weight (g)
Mean (SD) 1965-9	39.813 (1.724)	3207.6 (509.1)
Mean (SD) 1970-4	39.575 (1.667)	3175.5 (514.1)
Mean (SD) 1975-9	39.739 (1.718)	3206.2 (512.6)
Rise in mean from 1970-4 to 1975-9	0.164	30.7
<i>t</i>	5.14	3.17
Rise in mean value adjusted for:		
History of abortion	0.171	32.4
Maternal age	0.160	27.9
Smoking habits	0.162	23.8
Height	0.164	30.7
All of the above simultaneously	0.170	25.4
Gestational age		9.1
Sociomaterial state	0.163	28.1

Table III compares characteristics of induced and non-induced births in the two five year periods. In both periods the mothers in whom birth was induced were more often of high social class and were less often unmarried, under 20 years old, smokers, or of short stature. Birth weight and gestational age tended to be higher for induced babies.

Table IV contrasts deliveries in the two five year periods. Primiparous and multiparous deliveries were included, and missing information did not lead to exclusion. The proportions of deliveries at the extremes of maternal age and at high parity fell. Use of caesarean section increased considerably. The incidence of antepartum haemorrhage increased, but mortality fell.

## Discussion

The changes in mean gestational age and birth weight between the periods 1970-4 and 1975-9 were nearly equal and opposite to those reported in the earlier study, suggesting that during 1975-9 the distributions of gestational age and birth weight had returned to roughly what they were in 1965-9. The changes in population means appear to have been small and of doubtful clinical importance but correspond to about five days

TABLE IV—Characteristics of singleton births (any parity) among Cardiff residents in 1970-4 and 1975-9

Characteristics	1970-74 (n = 19 776)	1975-79 (n = 16 186)
Maternal age under 20	3122 (15.8)	2174 (13.4)
Maternal age 35 or over	1318 (6.7)	830 (5.1)
No previous deliveries	7923 (40.1)	6651 (41.1)
Four or more previous deliveries	1139 (5.8)	648 (4.0)
Any antepartum haemorrhage	2833 (14.3)	2643 (16.3)
Any elective delivery	6237 (31.5)	2371 (14.6)
Caesarean section	1219 (6.2)	1595 (9.9)
Induced labour	5731 (29.0)	1823 (11.3)
Stillbirth or neonatal death	461 (2.3)	293 (1.8)

and 140 g in each infant born after induced labour in 1970-4 for whom induction would not have been used had the pregnancy occurred five years later.

The proportions of infants born before 36 complete weeks' gestation and weighing less than 2500 g are more adequate markers of perinatal and infant morbidity, and these fell by only 2% (from 3.93% to 3.87%) and 6% (from 7.12% to 6.70%) respectively. These changes were not significant by the  $\chi^2$  test, which is less sensitive than the *t* test used in table II. They were smaller than the corresponding changes of 10% and 12% in the earlier study, the discrepancy being particularly pronounced for gestational age. In view of improvements in fetal monitoring before labour during the study period it would be expected that selection for elective delivery during the later years was more appropriately based.

Mean birth weight and gestational age were higher in induced than in non-induced births because postmaturity is a major reason for induction and, conversely, any prior intention to induce labour may be forestalled by spontaneous onset of labour. Notwithstanding this, induction reduces gestational age and sometimes birth weight in the individual cases in which it is used and reduces both mean birth weight and gestational age in a birth population to which it is applied, to a degree that depends on the frequency of use.

In each five year period there were consistent differences between induced and non-induced births (table III). The rate of induction decreased drastically, and the basis of selection for induction in 1975-9 must have been different from that in 1970-4. Under these circumstances, examination of secular changes in outcome in induced and non-induced "groups" is misleading if membership of the group is treated as if it were a predetermined variable such as maternal age.<sup>3</sup>

The increase in mean gestational age of 0.164 weeks shown in table II is lower than that for either the induced or the non-induced deliveries (0.277 and 0.293 weeks, respectively; table III); thus even if no change had occurred in the whole population there would have been a rise in mean gestational age in induced and non-induced groups as the rate of induction decreased and induction was increasingly reserved for post-maturity.

Analysis using perinatal mortality as the end point would not have provided extra information as mortality specific for

TABLE III—Comparison of induced and non-induced births, 1970-4 and 1975-9, among firstborn singletons delivered to Cardiff residents

Characteristics	1970-4		1975-9	
	Not induced (n = 4025)	Induced (n = 2125)	Not induced (n = 4498)	Induced (n = 648)
Mean (SD) birth weight (g)	3152 (526)	3220 (487)	3193 (517)	3301 (471)
No (%) with birth weight under 2500 g	324 (8.0)	114 (5.4)	320 (7.1)	25 (3.9)
Mean (SD) gestational age (weeks)	39.38 (1.80)	39.95 (1.29)	39.67 (1.75)	40.23 (1.34)
No (%) with gestational age:				
Under 36 completed weeks	219 (5.4)	23 (1.1)	194 (4.3)	5 (0.8)
Over 41 completed weeks	170 (4.2)	176 (8.3)	426 (9.5)	111 (17.1)
No (%) of mothers:				
Social class I or II	641 (15.9)	404 (19.0)	938 (20.9)	151 (23.3)
Unmarried	549 (13.6)	206 (9.7)	719 (16.0)	75 (11.6)
Previous abortion	455 (11.3)	266 (12.5)	693 (15.4)	100 (15.4)
Maternal age under 20	1206 (30.0)	522 (24.6)	1030 (22.9)	114 (17.6)
Never smoked	2183 (54.2)	1263 (59.4)	2728 (60.6)	429 (66.2)
Height < 1.57 m	1225 (30.4)	573 (27.0)	1322 (29.4)	183 (28.2)

maturity has decreased for several other reasons. These include many changes in obstetric practice, and it is not possible to summarise the effect that all of these would be expected to exert on perinatal mortality, gestational age, and birth weight. Nevertheless, the broadly parallel trends in elective delivery and the incidence of preterm delivery or low birth weight tend to confirm the hypothesis put forward previously that the high rate of induction of labour during 1970-4 was the major reason for the high incidences of low birth weight and preterm delivery during that period.

## References

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# Excess mortality among children discharged from hospital after treatment for diarrhoea in rural Bangladesh

S K ROY, A K M A CHOWDHURY, M M RAHAMAN

## Abstract

Five hundred and fifty one children aged between 3 months and 3 years were followed up at home for 12 months after treatment of diarrhoea in a rural treatment centre of the International Centre for Diarrhoeal Disease Research, Bangladesh. During follow up the children were found to have a significantly higher mortality than generally observed in the community. The first three months after discharge appeared to be crucial, some 70% of the deaths occurring in that period. Severely malnourished children (nutritional state below 56% of the American National Center for Health Statistics (NCHS) standard of weight for age ratio) had a risk of death 14 times that of their well nourished counterparts (nutritional state 66% or more of the NCHS standard). The highest mortality occurred in 2 year olds, one in three of the severely malnourished children dying compared with one in 10 of the moderately malnourished. This pattern was not seen in children aged under 2 years.

Immediate priority should be given to providing nutritional rehabilitation for malnourished children who contract diarrhoea.

## Introduction

Diarrhoea and malnutrition continue to be the two most important factors associated with high mortality among children in developing countries.<sup>1</sup> Several studies, based mostly on lay reporting, have shown a gross association between malnutrition and mortality.<sup>2-3</sup> To our knowledge there has been no longitudinal study to establish the role of malnutrition and its severity as a risk factor for increased fatality rates. Death, however, is a comparatively infrequent event in any community, and it is difficult to keep a large number of children under surveillance for nutritional state.

In Matlab, a rural area in Bangladesh, demographic surveillance has been continued since 1966. This offered an opportunity to determine the nutritional state of children discharged from

hospital after treatment for diarrhoea and to monitor this during follow up. We report such a study, which was designed to discover whether the nutritional state of children recently recovered from diarrhoea and sent back to their unprotected home environment plays a part in subsequent mortality due to reinfection during 12 months after discharge.

## Patients and methods

The study was carried out in the rural area of Matlab, Bangladesh. In 1966 a longitudinal mandatory registration system was begun, which since 1978 has covered 177 000 people living in the surrounding 149 villages. Detailed field techniques of demographic surveillance and the role of the diarrhoeal health service have been reported.<sup>4</sup> A small fleet of speedboats is used to transport patients from their villages for treatment of diarrhoea.

We studied 551 children aged between 3 months and 3 years who in 1979 were admitted to Matlab treatment centre with the complaint of diarrhoea. Each child was weighed on admission and at discharge using an accurate balance (Toledo, USA). The children with diarrhoea were rehydrated with oral and intravenous solutions. Accurate age of the population was known from the special birth registration system in the area,<sup>4</sup> so that estimation of nutritional state was expected to be free of the age related bias commonly encountered in developing countries. Nutritional state was determined by comparing actual weight at the time of discharge with the National Center for Health Statistics (NCHS) standard of median weight for age.<sup>5</sup>

The children were classified into three categories of nutritional state: normally nourished—those whose weight was 66% and above of the NCHS standard; moderately malnourished—children whose weight was 56-65% of the standard; and severely malnourished—children whose weight was below 56% of standard. Classification was based on a study of subsequent risk of mortality in children assessed for these anthropometric values in a rural community of Bangladesh.<sup>3</sup> Data from that study (fig 1) showed that there was a threshold of about 65% of standard weight for age above which mortality was low and constant but below which mortality increased sharply. Use of the classification in this study was expected to have more functional value for Bangladesh than the traditional approach.

TABLE 1—Distribution of children by age and nutritional state

Nutritional state (% NCHS standard)	Age (months)				Total
	1-11	12-23	24-35	36-47	
≤55	10	27	25	2	64
56-65	39	85	29	7	160
≥66	142	135	39	8	324
Not known	2			1	3
Total	193	247	93	18	551

NCHS = National Center for Health Statistics.

International Centre for Diarrhoeal Disease Research, Bangladesh,  
GPO Box 128, Dhaka-2, Bangladesh

S K ROY, MB, BS, senior medical officer

A K M A CHOWDHURY, D SC, scientist

M M RAHAMAN, MSC, PHD, senior scientist and deputy director

Correspondence to: Dr A K M A Chowdhury.