Cost of care for a geographically determined population of low birthweight infants to age 8–9 years. I. Children without disability

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Abstract

Aim—To determine the extra cost of healthcare associated with low birthweight, in a cohort study of a geographically defined population in five health districts that comprise Merseyside.

Methods—The study comprised all children of birthweight ≤ 1500 g and a 10% random sample of those weighing 1501–2000 g, without clinical disability, born in 1980 and 1981 to mothers resident in Merseyside, and their controls, matched by age, sex, and school class, followed up to age 8–9 years.

Results—The cost of care associated with the initial admission to the neonatal special/intensive care unit and subsequent use of hospital and family practitioner services was assessed. There were 641 survivors without disability and 227 non-survivors who weighed ≤ 2000 g at birth. The mean cost of neonatal care per low birthweight child was 13 times greater than for a control child. For children weighing ≤ 1000 g at birth, neonatal costs were 55 times greater than for the control children. Low birthweight children continue to use hospital and family practitioner services more intensively than controls to age 8–9 years.

Conclusion—Low birthweight children used hospital and family practitioner services more intensively throughout the follow up period. Whether the increased use of health services persists into adolescence and adulthood is yet to be determined.

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resident in five Merseyside health districts. The children were assessed at age 3–4,⁴ and again at age 8–9. Compared with control children, the low birthweight group performed significantly worse in tests of motor skills, IQ, and reading ability.⁵ The prevalence of behavioural disorders was also greater among the low birthweight children.⁶

Methods

The derivation of the study group is shown in fig 1. In 1980–1, 40 321 children were born to mothers resident on Merseyside. Nine hundred and forty four babies weighed ≤ 2000 g at birth. Of these, 719 (76%) survived to assessment at age 3–4 years; 220 weighed 1500 g or less, and 499 1501–2000 g. The costing sample consisted of all 227 non-survivors and 219 of the 719 low birthweight children who survived to age 3–4 years. Included were all 173 children who weighed 1500 g at birth and a 10% random sample ($n=46$) of the 468 children weighing 1501–2000 g at birth. Excluded from the sample were the remaining 90% of children weighing 1501–2000 g; 52 children with clinical disabilities; and 26 children lost to follow up.

Each low birthweight index child with no disability was paired with a child of the same sex, closest in birth date and attending the same class in the same school. School was used as a matching variable to provide a proxy matching for a variety of social indices. Subsequent analysis showed very few significant differences between the families of index and control children over a range of socioeconomic variables which included social class, housing status, parental income, parental education and the number of children in the family.⁵

COSTS

Costs were deflated by the Department of Health Prices and Pay Index to 1979. Episodes of care were also discounted to 1979 at 6% (the rate recommended by the Department of Health) to give a consistent measure of costs incurred at different times. The estimates may be interpreted as the capital sum which, invested at 6% in 1979, would produce a stream of income sufficient to pay for the whole cost of the cohort up to age 8–9. Costs were aggregated in two categories:

Neonatal period – birth to first discharge to home
The cost of neonatal care for the index children was estimated from a detailed study of the

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Developments in neonatal special and intensive care for low birthweight infants have been accompanied by an improvement in mortality, but at a cost which gives cause for concern in many countries. The economics of neonatal intensive care have been examined in the United Kingdom^{1–3} and elsewhere, but far less is known about medium and long term costs of care for low birthweight children and adults.

This report estimates the extra cost of healthcare for a cohort of low birthweight children without clinical disability, compared with a control group, to age 8–9 years. The cohort is geographically determined and consists of all children born in 1980–1 to mothers

Figure 1 Derivation of costing sample.

Mersey Region Neonatal Intensive Care Unit, conducted in 1984.⁷ Three well defined levels of care – namely intensive, special, and nursery care – were costed at £297, £138, and £71 per day at 1983–4 pay and prices. No significant changes in resourcing or management occurred between 1980 and 1984, so the 1983–4 prices were considered applicable to the earlier period.

No direct information was available on the cost of neonatal care for the control children, but mothers and infants would normally be discharged from hospital at the same time. A sample of 70 (32%) of the mothers of control children was asked how many days they spent in hospital when the child was born. Inpatient days were then costed in 1979 prices.

Account was also taken of the cost of neonatal care for non-survivors. The treatment of non-survivors was regarded as an unavoidable cost incurred in the treatment of survivors. No information was available as to whether the non-survivors were likely to have been disabled had they survived. Therefore, their entire cost was added to the cost of those survivors with no disability.

Hospital and family practitioner care

A search of hospital records for all index and control children provided data on total hospital service use from first discharge to home until age 8–9. The 219 matched pairs received

attention in 91 hospitals, all of which were visited, or contacted by letter. Hospital care was priced from hospital costing returns, which, over the period of the study, may have varied with changes in accounting procedure, but there was no reason to suppose that this would introduce bias between the control and index groups.

Family practitioners provided information on the number of contacts and prescriptions issued. Most replied to a postal questionnaire. Visits and telephone enquiries were made to achieve 100% ascertainment. Family practitioner services were indexed and discounted from their cost in 1990 pay and prices: £8.50 per consultation and £4.85 per prescription.

Results

COSTS IN THE NEONATAL PERIOD

Index low birthweight children

Total and mean costs for neonatal care are shown in table 1 by birthweight group for the 641 children who survived without disability. For the three birthweight groups, mean neonatal costs of survivors are in the rough proportion of 3.5:2:1 which gives the appearance of a strong inverse relation between cost and birthweight. The mean cost per survivor was £1648. Of the 227 non-survivors, 35% died on the first day and 77% died within seven days. One child survived for 182 days. In two cases birthweight was not recorded. The mean cost

Table 1 Cost of neonatal care for 641 low birthweight children with no disability and 227 non-survivors (£1979 discounted at 6%)

Birthweight group (g)	Survivors			Non-survivors		
	No	£ Total	£ Mean	No	£ Total	£ Mean
Not weighed	0			2	678	339
≤1000	20	87 905	4395	108	72 470	671
1001–1500	153	372 535	2435	69	67 889	984
1501–2000*	468	595 764	1273	48	16 750	349
All children	641	1 056 204	1648	227	157 787	695

*Estimated from 10% sample.

of care for a non-survivor was £695. The mean cost of producing a survivor without disability was calculated as total cost (survivors without disability plus non-survivors) divided by the number of survivors without disability which equalled £1893.

Control children

The sample of 70 mothers of control children reported hospital stays from one to 21 days with a mean of 3.58 days. Mean neonatal cost per control child was estimated at £146.52 at 1979 prices.

Specific data on mortality in the control group were not available, but if national neonatal mortalities are applied, less than one death would be expected in a sample of this size. The adjustment is quantitatively unimportant, but for consistency it is assumed that 220 births would be needed to provide a live cohort of 219 control children for the study. The mean cost per survivor was £147.

COST OF HOSPITAL AND FAMILY PRACTITIONER CARE

The cost of medical services from first discharge to home for low birthweight and control children is shown in table 2. In the index group those children in the two lower birthweight categories made more than twice as much use of hospital services as did children weighing 1501–2000 g. Family practitioner costs were very similar across all birthweight groups. Control children made far less use of NHS services.

COMPARISON BETWEEN INDEX AND CONTROL CHILDREN

The summary findings from the case control comparisons are shown in table 3 which gives mean values for the cost of all medical services. Neonatal care for 641 low birthweight

survivors was nearly 13 times more expensive per child than for control children. The cost for survivors in the lowest birthweight group was 55 times greater than for controls. Table 3 also shows that low birthweight children continued to use more than twice the amount of medical services as controls up to the age of 8–9. The difference is explained by greater use of hospital rather than family practitioner services, and birthweight continues to exert a positive influence on medical expenditure beyond the neonatal period.

The mean total costs per child were £9349 (range £4974–18 881) for children weighing ≤1000 g at birth; £4104 (range £1029–18 888) for children weighing 1001–1500 g; £2008 (range £771–11 599) for children weighing 1501–2000 g. The mean total cost for all index low birthweight children was £2737 (range £771–18 888) compared with £578 (range £147–3248) for control children.

Discussion

The strength of this study lies in the nature of the sample (geographically determined rather than hospital based) and the high follow up rate (96%). In the costing most data were highly specific to individual children and the estimates are likely to be as accurate and complete as is possible in a study which required retrospective costing. The costs, discounted at 6% and expressed in 1979 prices, are directly comparable for different groups of children. It would be misleading to present the results in current prices, but as a rough guide, 1995 health service prices are slightly more than three times greater than 1979 prices. The discount rate of 6% is that suggested by the Department of Health. A case might be made for the use of a lower discount rate but sensitivity analysis showed the findings to be highly unresponsive to the choice of discount rate.

The main conclusion was that the mean cost of medical care for low birthweight children with no disability (£2737) was 4.7 times greater than the cost of care for control children (£578). Large differences were found within the sample of low birthweight children, and these seem to be related to birthweight. Mean costs for children in the lowest birthweight group were more than 16 times greater than for control children.

The study also showed the extent to which low birthweight children without clinical disability continue to use health services much

Table 2 Cost of hospital and family practitioner services for 219 low birthweight and control children (£1979 discounted at 6%)

Low birthweight children (g)	No	Hospital care				Family practitioner services	
		Outpatients	Inpatients	Total	Mean	Total	Mean
≤1000	20	12 775	8 419	21 194	1060	4 736	237
1001–1500	153	85 939	66 217	152 156	995	35 290	231
1501–2000*	468	78 981	126 268	205 249	438	122 006	261
All low birthweights	641	177 695	200 904	378 599	591	162 032	253
Controls	219	24 924	29 844	54 768	250	39 675	181

*Estimated from 10% sample.

Table 3 Mean cost of care for low birthweight and control children (£1979 discounted 6%)

Low birthweight children (g)	No	£ Neonatal*		£ Hospital		£ Family practitioner	
		£	£	£	£	£	£ Total
≤1000†	20	8052	1060	237	9349		
1001–1500	153	2878	995	231	4104		
1501–2000	468	1309	438	261	2008		
All low birthweight	641	1893	591	253	2737		
Controls	219	147	250	181	578		

*Includes cost of non-survivors.

more intensively than the control children in early childhood. It will not be known for several years whether the low birthweight children will continue to require more care than control beyond the age of 8–9 years. However, learning and behavioural problems^{5 6} may have implications for long term health, social adjustment, and employment prospects.

More certainly, it can be predicted that improvements in neonatal medicine since 1980, which have reduced mortality rates especially in the lower birthweight ranges, will increase the demand for medical services for children to at least the age of 8–9 years. However, of greater quantitative importance will be the cost of special education and long term care for disabled low birthweight children.

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