Conditions accounting for substantial time spent in hospital in children aged 1–14 years

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Abstract

To identify the clinical conditions associated with substantial time spent in hospital by children aged 1–14 years, records of children admitted to hospital in 1975, 1979, and 1984 were studied. Analysis was by linkage of abstracts of routine records of hospital inpatient care in six districts in southern England covered by the Oxford record linkage study. The total time spend in hospital in the acute specialties each year was calculated by summing the lengths of stay of all episodes of care for each child in each year. First, admissions with long median times in hospital per child admitted were identified. These included, notably, fracture of femur and, in the later years, leukaemia, other malignant neoplasms, and congenital disorders of metabolism. Second, conditions were identified which accounted for large numbers of children with lengths of stay of five days or more. These included, in particular, congenital anomalies, asthma, and appendicitis. Third, conditions were identified which accounted for the largest numbers of bed days used. These included congenital anomalies, hypertrophy of tonsils and adenoids, asthma, otitis media, appendicitis, and head injury. Median time spent in hospital per child admitted declined for most conditions but increased for leukaemia, other malignant neoplasms, and congenital disorders of metabolism. Admission rates for children who spent five days or more in hospital each year declined for all common conditions except asthma which increased. Total numbers of beds used increased for asthma and otitis media but declined for all other common conditions.

The adverse emotional effects that may follow long periods of hospitalisation of children are well documented.[1–3] A great deal has been accomplished in minimising these effects by the introduction of unrestricted visiting by parents to children, the use of day case care, other short stay management, and the use of special teachers and play leaders. Nevertheless, long periods of hospitalisation are unavoidably upsetting for children.

The National Association for the Welfare of Children in Hospital has recommended that children should be admitted to hospital only if treatment at home is not possible, and that lengths of stay should be kept to a minimum.[4] The duration of episodes of hospital inpatient care for children has declined steadily for many years and, despite a considerable increase in rates of admission and readmission,[5] the total amount of time spend in hospital by children has fallen.[6] The aim of the study reported here was to determine (i) which conditions were associated with the lengthiest periods of hospitalisation in children aged 1–14 years and (ii) to investigate the extent of changes over time in the use of hospital care for the treatment of each of these conditions in this age group. We used medical record linkage to calculate the total time spent in hospital each year by each child with each condition.

Methods

The Oxford record linkage study includes brief abstracts of hospital records, birth registrations, and death certificates collected such that it is possible to link together episodes relating to the same individual. The present study included all general hospital admissions between 1975 and 1985 of children aged 1–14 years at admission who were resident and treated in the six districts of the Oxford region covered by record linkage (total population 1·9 million people). The lengths of stay of all episodes of care for each child, excluding those for mental illness and mental handicap, were summed to give a total time in hospital per child per year. Children admitted in 1984 were followed up into 1985 for the full 365 days after their last birthday.

For children who had more than one episode of care in the year, the principal diagnosis of the longest episode was taken as the underlying condition. For example, if a child had diabetes mellitus recorded as the principal diagnosis in the longest episode and other shorter admissions for respiratory infections, the total days in hospital were regarded as those spent by a child with diabetes mellitus. This was done as a means of simplifying the aggregation of episodes in a year under a single disease heading for each child.

Diagnoses were analysed using the three digit categories of the International Classification of Diseases (ICD8 and ICD9).[7 8] Where indicated, closely similar diagnoses were grouped (for example, the three ICD codes for appendicitis). Data are presented on time spent in hospital by children admitted in the calendar years 1975, 1979, and 1984. The terminology in the tables is from ICD8.[7]

Conditions in chapter XVI, which covers symptoms and ill defined conditions, were excluded as main diagnoses from the analysis because of their imprecision and because of difficulty matching ICD8 and ICD9. They are included when they occurred as admissions for

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children with a substantive main diagnosis and counted as the latter.

Results

Conditions which resulted in substantial time in hospital were defined in three ways. Firstly, conditions were identified that resulted in a median time in hospital per child admitted of five days or more: table 1 shows all conditions for which at least 30 children had a median stay of five days or more in at least one of the three years. The longest median stays were recorded for fractured femur, osteomyelitis, osteochondrosis, leukaemia and other malignant neoplasms, the code for congenital disorders of metabolism (which includes cystic fibrosis), certain congenital anomalies, cerebral spastic infantile paralysis (which covers cerebral palsy), and renal failure. In general, median times spent in hospital declined over the years. Median times increased for leukaemia, other malignant neoplasms, and congenital metabolic disorders.

Secondly, conditions were identified where at least 50 children in any one year had spent five days or more in hospital (table 2). This categorisation would, of course, identify conditions with long median stays, as in table 1, providing they were not rare. In addition, it identifies common conditions where, though the median time in hospital may be short, none the less there are substantial numbers of children with long stays. Thus, for example, although the median length of stay for asthma was three days, there were 495 children in the three years shown in table 2 who spent five days or more in hospital per year. In table 2 the number of children who spent five days or more in hospital is also expressed as population based rates per 10 000 children aged 1–14 years and as percentages of children admitted with each condition. The conditions which accounted for the largest groups of children who spent five days or more in hospital included appendicitis and congenital anomalies in which admission rates for such 'long stay' patients declined strikingly and asthma which showed a striking increase in such patients. Other conditions for which rates declined included diabetes mellitus, upper

Table 1 Conditions with median total times in hospital per child admitted of five days or more in at least one year: number of children with each condition and median total days in hospital per child

Diagnosis	ICD8 code	ICD9 code	No of children			Median time in hospital/year		
			1975	1979	1984	1975	1979	1984
Diarrhoeal disease	9		243	26	50	4	5	2
Leukaemia	204–7		29	35	12	7	4	16
Malignant neoplasms	140–203, 208–9		50	36	29	9	8	11
Diabetes mellitus	250		158	131	112	9	7	5
Other congenital diseases of metabolism*	273	277	19	22	30	6	12	11
Purpura	287		55	40	46	7	5	3
Cerebral spastic infantile paralysis	343		40	30	47	11	8	7
Pneumococcal pneumonia	481		54	64	72	5	4	3
Appendicitis	540–2		856	685	509	6	5	4
Renal failure	580–3	580–6	25	31	27	8	10	8
Eczema and dermatitis	692		24	33	14	9	9	6
Osteomyelitis	720	730	36	27	19	19	16	8
Osteochondrosis	722	732	61	63	39	19	15	9
Spina bifida	741		34	26	14	8	8	3
Congenital anomalies:								
Of heart	746		32	6	15	11	4	3
Cleft palate	749		35	23	30	8	5	4
Of musculoskeletal system	754–6		220	190	163	9	6	5
Fracture of femur	820–1		95	81	80	28	32	28
Burns	940–9		91	92	78	8	7	3
Total childhood population (aged 1–14 years)			458 500	429 500	396 400			

*Includes cystic fibrosis.

Table 2 Conditions for which 50 children or more spent five days or more in hospital in at least one year: number of children who spent five days or more in hospital, such children expressed as a rate per 10 000 children in the population aged 1–14 years, and as a percentage of all children admitted to hospital with each condition

Diagnosis	ICD8 code	ICD9 code	No of children			Rate/10 000			%		
			1975	1979	1984	1975	1979	1984	1975	1979	1984
Diarrhoeal disease	9		89	13	6	1·9	0·3	0·1	36·6	50·0	12·0
Diabetes mellitus	250		120	92	63	2·6	2·1	1·6	75·9	70·2	56·2
Other diseases of blood*	289		54	35	12	1·2	0·8	0·3	24·8	20·8	10·3
Epilepsy	345		56	40	40	1·2	0·9	1·0	41·8	34·5	36·7
Otitis media	381–2		64	57	32	1·4	1·3	0·8	9·2	4·7	1·4
Upper respiratory tract infections	460–5		124	63	75	2·7	1·5	1·9	12·8	12·8	10·2
Asthma	493		98	158	239	2·1	3·7	6·0	35·1	33·5	23·0
Hypertrophy of tonsils and adenoids	500	474	115	104	87	2·5	2·4	2·2	6·1	4·5	4·5
Appendicitis	540–2		615	368	194	13·4	8·6	4·9	71·8	53·7	38·1
Osteochondrosis	722	732	52	49	23	1·1	1·1	0·6	85·2	77·8	59·0
Congenital anomalies:	740–59		493	331	246	10·7	7·7	6·2	44·5	32·2	22·6
Of heart	746		23	3	5	0·5	0·1	0·1	71·9	50·0	33·3
Of genital organs	752		155	96	33	3·4	2·2	0·8	32·0	18·5	6·2
Of musculoskeletal system	754–6		156	113	97	3·4	2·6	2·4	70·9	82·1	59·5
Fracture of humerus	812		67	37	16	1·5	0·9	0·4	33·5	25·9	11·6
Fracture of femur	820–1		82	75	71	1·8	1·7	1·8	86·3	92·2	88·8
Head injury	850, 854		73	59	44	1·6	1·4	1·1	3·7	3·4	2·8
Burns	940–9		61	64	29	1·3	1·5	0·7	67·0	69·6	37·2

*The full ICD term is 'other diseases of blood and blood-forming organs' which includes mesenteric adenitis.

Table 3 Diagnoses which accounted for 1000 days or more in hospital in at least one year

Diagnosis	*ICD8 code*	*ICD9 code*	*Total No of days spent in hospital in aggregate each year by children with each diagnosis*		
			1975	*1979*	*1984*
Diarrhoeal disease	9		1113	122	139
Malignant neoplasms	140–203, 208–9		1005	438	211
Diabetes mellitus	250		2256	1242	762
Epilepsy	345		1055	900	818
Strabismus	373	378	1636	895	694
Otitis media	381–2		2069	2519	2679
Deafness	388–9	389	1170	1076	410
Upper respiratory tract infection	460–5		3583	1364	1804
Asthma	493		1535	2237	3956
Hypertrophy of tonsils and adenoids	500	474	5979	6378	5103
Appendicitis	540–2		6038	3975	2444
Redundant prepuce	605		787	894	1091
Osteochondrosis	722	732	1772	1419	447
Congenital anomalies:	740–59		10 055	7157	4604
Of heart	746		534	292	121
Of genital organs	752		2149	1848	1059
Of musculoskeletal system	754–6		4130	2483	1441
Fracture of humerus	812		1012	632	403
Fracture of femur	820–1		3246	2583	2245
Head injury	850, 854		3743	3032	2302
Burns	940–9		1544	969	544
Poisoning	960–89		1189	846	554

respiratory tract infections, hypertrophy of tonsils and adenoids, and head injury.

Thirdly, we calculated the total number of bed days used by patients with each diagnosis. Diagnoses that accounted for 1000 days or more in hospital in at least one year are shown in table 3. In 1975 the conditions that accounted for more than 3000 bed days were, in order of magnitude of use, congenital anomalies, appendicitis, hypertrophy of tonsils and adenoids (the diagnosis associated with tonsillectomy), congenital anomalies of the musculoskeletal system, head injury, upper respiratory tract infections, and fracture of the femur. In 1984 only three conditions accounted for over 3000 bed days: hypertrophy of tonsils and adenoids, congenital anomalies, and asthma. The number of bed days used declined over time for most conditions. As can be inferred from table 1, in some instances the decline partly represented a decline in numbers of children admitted (for example, diarrhoeal disease, malignant neoplasms). In other instances the main component of the decline was a fall in time spent in hospital per child admitted (for example, osteochondrosis, burns). For most conditions both factors contributed to the decline (for example, congenital anomalies of limbs).

Discussion

The data we have presented cover all clinical specialties (except mental handicap and mental illness) and therefore provide a profile of care that may not be readily apparent to doctors working with children in any one clinical specialty. Data are not available to the Oxford record linkage study about residents of the six districts who are treated outside the study area. Our data on population based rates therefore underestimate care received by children to the extent that they are treated elsewhere. Aggregated statistical returns used for financial resource allocation purposes show that about 5% of paediatric admissions for residents of the six district area occur outside it and that this has not changed appreciably over time. Notably, however, there is no regional specialist paediatric oncology centre in Oxford and our data underestimate to some extent numbers of bed days used by children with cancer.

Coding of data for the Oxford record linkage study is undertaken by coding clerks using clinical summaries and case notes completed by clinicians. The coding clerks are specially trained for this purpose and work in teams structured to provide supervision and peer review. In the period covered by this study completeness of coding was routinely checked.[9] Validation studies of the accuracy of coding were not routinely undertaken on a random sample but validation has been undertaken in a number of studies of particular clinical conditions by checking codes against the content of case notes, and coding has been found to be good.[10–12]

The quantification of clinical conditions responsible for substantial periods of time spent in hospital can be undertaken in a number of ways. First, conditions can be identified where the time spent in hospital *per child admitted* is relatively long. Time in hospital may be calculated per episode of admission or, where medical record linkage is available, it may be calculated as time spent in hospital per child per year. The duration of time spent in hospital may be calculated as means, modes, medians, or more detailed measures of the frequency distribution such as centiles. We selected the measure of medians partly for the simplicity of using a single measure and partly because means may be substantially influenced by small numbers of 'outlying' values. As a second main measure, we calculated the *number of 'long stay' children* with each condition. This identified not only conditions where median lengths of stay per child admitted were long but also those where medians were short but where there were none the less appreciable numbers of long stay patients. Third, we identified conditions where large *numbers of bed days* were used which in essence incorporates measures of the commonest reasons for hospital admission. It is reassuring

that, in general, whichever measures were used, the amount of time spent in hospital by children declined over the years. Within this general decline, however, there are areas of increasing activity that reflect changes in prevalence, survival, and medical practice. For example, we have noted increased times spent in hospital by children with leukaemia and other malignant neoplasms: partly, this reflects increase in survival. In 1970, five year survival with Wilms' tumour was 55% but by 1980 was 75%; acute lymphoblastic leukaemia survival increased from 25% to 55% over the timespan.[13] In addition, the pattern of treatment has altered to involve more intensive chemotherapy given over shorter periods but with consequent longer periods of severe neutropenia. A direct result has been longer inpatient stays: at Birmingham Children's Hospital, for instance, bed occupancy for children with cancer increased from a mean of 11·8/day to 17·3/day between 1982 and 1986 with no significant change in the number of new patients treated.[13]

We also found increased time spent in hospital by children with congenital metabolic disorders, by far the commonest of which is cystic fibrosis. Purchasers and providers need to be aware of changes in the management of this condition which may have an impact on the frequency and length of stay for children in hospital. In a clinical budgeting exercise at Booth Hall Children's Hospital in 1983, particular note was made of a treatment policy, novel at the time, involving admissions every three months for a 14 day course of intravenous antibiotic. The effect of this was that an increase in a particular consultant's total number of admissions of just 1·8% in two years included a change in case mix *in favour* of cystic fibrosis leading to an increase in bed days of 27·2%.[14] However, planning is also bedevilled by the pace of change in technological innovation which now permits much of the intravenous treatment to take place at home.[15]

Hospital care for asthma has also increased. This has been widely documented by others.[16 17] There is controversy as to the magnitude of any increase in asthma prevalence. The escalating numbers of such children admitted to hospitals throughout the UK may simply reflect a change in general practitioners' response to this condition. Any such change might be expected only to increase the number of 'short stay' asthmatics. However, our findings show that there was also an appreciable rise in those staying more than five days. This is likely to be related to an increase in severity and/or an increase in prevalence.

In planning how best to purchase and provide care for children, health authorities and provider units need information about volumes of clinical care, such as bed usage, and about changes in them in order to formulate and plan to meet their strategic and operational objectives.

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