

Variations in the costs of child and adolescent psychiatric in-patient units[†]

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Background Child and adolescent in-patient care is a highly specialised service, ideally requiring planning at a national level, but there are no routine data collections specifically for these services.

Aims To estimate unit costs for child and adolescent psychiatric in-patient units and to analyse the variations in costs between units.

Method Data collection alongside a national survey with cost estimations guided by principles drawn from economic theory. Bivariate and multivariate analyses are employed to identify cost influences.

Results Fifty-eight units could provide sufficient data to allow calculation of the cost per in-patient day; mean=£197 (s.d.=71.6; 1999–2000 prices). The management sector, type of provision, number of rooms, capacity and location explained nearly half of the cost variation.

Conclusions Child and adolescent psychiatric in-patient units are an expensive resource, with personnel absorbing two-thirds of the total costs. Costs per in-patient day vary fourfold and the exploration of cost variations can inform commissioning strategies.

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Commissioners and providers alike need good-quality cost data to inform their contracting and pricing strategies for child and adolescent psychiatric in-patient care, yet there are no national data collections describing these services and, commonly, commissioning budgets are not identified separately (Audit Commission, 1999). To help fill this information shortfall, the Department of Health commissioned a study to explore the costs of these in-patient services. The study was to run in parallel with the National In-patient Child and Adolescent Psychiatry Study (NICAPS). The main aims of the cost study were:

- (a) to estimate total and unit costs for child and adolescent psychiatric in-patient units; and
- (b) to analyse the variations in the costs of child and adolescent psychiatric in-patient units.

METHOD

Estimation of total and unit costs for child and adolescent psychiatric in-patient units

To estimate unit costs accurately, information on the total costs of each service unit is required. A clear description of the resource mix (staff and capital) employed can facilitate this. The description also should provide sufficient information about the activities of the service to identify a sensible unit of measurement. Combining the activity and total cost information allows an estimation of service-level cost, which here is the cost per in-patient day (Beecham, 1995, 2000).

In this study our aim was to estimate a cost for each child and adolescent psychiatric in-patient service that would include staffing costs, other revenue and overhead costs and capital costs. The cost estimate then would be appropriate for use in research that takes an economic perspective. However, by collecting data

in a way that fitted the routine hospital accounting procedures (such as those laid out in *The NHS Costing Manual*; Department of Health, 2000) the results would be useful also to service providers and commissioners.

Financial data were obtained through two questions added to the NICAPS Unit Survey Questionnaire, with their scope, format and content based on previous research (Chisholm *et al.*, 1997a). First, data were requested on the whole-time-equivalent number (by grade) of education, nursing, medical and other staff usually working on the in-patient unit, and their salaries and on-costs (expenditures associated with salaries, e.g. employers' National Insurance and superannuation contributions). Time spent providing support in other parts of the hospital was to be excluded, and any staff costs allocated to other parts of the hospital or other organisations (such as the education authority) were to be included. Second, a standardised format was devised for hospital personnel to record the other costs associated with maintaining the child and adolescent psychiatric unit in the previous financial year. Data were requested on revenue costs (such as clinical support, utilities, cleaning and maintenance), the actual or apportioned expenditure on hospital overheads (personnel, administration, accounts, etc.) and capital charges for land, buildings and equipment.

Twenty-nine child and adolescent psychiatric units provided a full set of costs-related information. A further 11 units provided information on nursing costs and 18 provided whole-time-equivalent staffing data. To estimate costs for those units providing staffing information but no expenditure data, the mean cost (by grade) provided by other units was used. Forty-eight units provided information on other revenue, overhead and capital costs. Where these non-staffing costs were missing, the median cost for the 48 child and adolescent psychiatric units providing the data was employed (see also Beecham *et al.*, 2002).

The number of in-patient bed-days each year was also calculated, adjusted for the number of days the unit was open each year and the number of places available for day patients. Data on bed availability were missing for two units. Across the 58 units for which costs could be estimated, the mean number of 'in-patient-equivalent' places was 14.2 (range 6–32, s.d.=4.9; median 13.3). The mean number of in-patient-equivalent days per annum was 4863 (range

[†]See invited commentary, pp. 226–227, this issue.

2184–11 680, s.d.=1754; median 4600). These data were used to calculate the cost per in-patient day.

Analysis of variations in the unit costs of child and adolescent psychiatric in-patient units

Child and adolescent psychiatric in-patient units serve different client groups, have different staff mixes and are located in different areas. We should therefore expect the unit costs to vary, but to what extent do these types of factors influence costs? A statistical cost function was estimated to determine the potential influence of user or provider characteristics on service costs. A cost function can be estimated for cross-sectional data where cases have broadly similar objectives and employ broadly similar resources to meet those objectives. (It is important to note, however, that we are not exploring relative efficiency or trying to identify 'best performing' units.) Ordinary least-squares multiple regression analysis was employed, using the cost per in-patient day as the dependent variable (Knapp, 1998). The hypothesised influences on costs and the final set of measures used in this study are described below (Table 1 summarises the characteristics of the continuous variables).

(a) The influence on costs of resource prices, which refer to the amounts that child and adolescent psychiatric unit providers must pay for staff and other resources employed, was assessed via two survey variables, namely the proportion of unit cost absorbed by salary-related costs and whether the unit is based in the London region ($n=22$). London prices have been shown consistently to be higher than in other areas of the country (Chisholm *et al.*, 1997b). An urban/rural identifier

was not included as a potential cost predictor. Even though many of the units are located in urban areas, they all serve far wider catchment areas so it would be difficult to say quite what influences such a variable reflected. Staffing levels and staff/patient ratios also have been excluded, because these are undoubtedly highly correlated with the cost per in-patient day. To include them would mean that one type of resource input (staff) was being used to predict total inputs (cost).

- (b) The potential cost influence of service outputs was addressed via the following survey variables: the number of in-patient beds available on the census day and the number of day care places, whether out-patient or outreach care is provided within the unit ($n=44$ and $n=33$, respectively) and whether the unit has its own school ($n=38$). Information also was available on whether the unit will admit children and adolescents who are at high risk to others ($n=33$) or those who do not want to be admitted ($n=49$). This last group of variables could be seen as measures of user characteristics or need, but note that they record what the service does rather than whether such children (and how many) were actually admitted.
- (c) Patients' characteristics should have an impact on unit costs through the numbers and types of staff employed (and therefore costs). Two measures taken from the survey data were included: the proportion of patients who require one-to-one teaching and whether adolescents are treated on the unit ($n=41$). These young people might be more difficult to engage in treatment. In addition, by using data from the Residential Census Day

Form, average scores for each unit were calculated for residents' age, gender, ethnicity (White/non-White) and whether the referral came from a child and adolescent mental health service. Indicator variables were created for presence of mood disorder, conduct disorder, schizophrenia, eating disorder, self-harm and learning disability. The total Health of the Nation Outcome Scale – Child and Adolescent (HoNOS-CA) score, duration and severity of condition and the total treatments received completed these measures.

- (d) Occupancy and throughput are measures of the 'rate' of service delivery. Measures were selected or created for whether the unit was open seven days a week ($n=39$) and for the total number of in-patients on the unit's list. The NICAPS also investigated pressure of work and we included two variables: whether the unit had experienced a reduction in the number of beds in the past 2 years ($n=6$) and whether there were any plans to increase the number of beds ($n=10$).
- (e) Whether services should be managed within public- or independent-sector services remains an important health and social care policy issue, with cost and quality questions pertinent to both. Commonly, the independent sector child and adolescent psychiatric units have a specialist role (eating disorder units, forensic psychiatry and secure units) with the National Health Service (NHS) as the main purchaser. The variable employed here identifies NHS-managed units ($n=45$) but no distinction is made between non-profit or for-profit organisations because the numbers are too small.

- (f) Finally, it is likely that the quality of the care environment will influence unit costs. In this study we included measures identifying whether referral and admission criteria are available in written form ($n=38$), and the total number of treatments available (e.g. drug, cognitive, problem-solving or creative therapies). Data were collected also on the number of rooms available on site that are not bedrooms, such as recreational, interview or therapy rooms.

Table 1 Characteristics of potential cost-influencing factors (continuous variables)

Variable	Cost sample ($n=58$)				
	Missing cases	Range	Median	Mean	s.d.
% Total cost absorbed by salaries	0	42–91	69	70	9.0
No. in-patient beds available for use	0	4–32	11.5	11.6	4.7
No. day care places	0	0–25	3	3.9	4.8
No. treatments provided	0	6–15	12	11.8	1.9
Total no. on in-patient list	1	2–21	9.0	9.4	3.4
% In-patients requiring 1:1 teaching	4	0–100	17	28	32
No. rooms (not bedrooms) per available bed	3	0.17–3.42	0.55	0.84	0.66

RESULTS

Total and unit costs for child and adolescent psychiatric in-patient units

The NICAPS research team identified 80 child and adolescent psychiatric in-patient units in England and Wales. A unit was defined as a ward or unit within an NHS or independent-sector service that has a specialist child and adolescent psychiatric function, with the focus on health facilities. For full details of this study, see O'Herlihy *et al* (2001).

A considerable effort went into chasing the cost-related data but, by December 2000, six units were still unable to provide data on staffing patterns and two units had not reported bed availability. The remaining 58 units were similar in composition to the

full NICAPS ($n=66$) sample in terms of the managing agency, the type of psychiatric care and the age group supported (Table 2).

The mean cost per in-patient day for these 58 units is £197. The NHS Reference Costs 2001 show a wider range (£67–2237), possibly suggesting less standardisation in their estimation methodology. Personnel absorb around 70% of the total costs, with nurses accounting for just over half of that amount (Table 3). Bivariate analyses were employed to begin to explore some of the considerable variations in the unit costs, with significant differences found in the following dimensions:

(a) London-based units ($n=13$) have a higher mean unit cost than other locations: £234 compared with £187 (t -test, $P=0.035$).

(b) Units managed within the NHS ($n=45$) have a higher mean unit cost than those managed by independent sector organisations: £211 compared with £151 ($P=0.001$).

(c) Units that are open seven days a week ($n=39$) have a lower mean unit cost than those always open only five days a week ($n=6$): £188 compared with £253 ($P=0.032$). However, the small sample size may have influenced this result.

Fifty-three units reported the fee charged to placing agencies per in-patient day, including 14 returning a zero figure. For the remaining 39 units the range of fees charged was £93–510 around a mean of £225 (s.d.=161; median £262). The mean cost per in-patient day remained at £197 for these 39 units and the median was slightly lower at £163. The difference of £28 between the average fee charged and the estimated cost per in-patient day reached statistical significance (t -test, $P<0.001$).

Table 2 Characteristics of units in the National In-patient Child and Adolescent Psychiatry Study (NICAPS) and cost samples

Indicator	All units identified by NICAPS ($n=80$)	Units in NICAPS sample ($n=66$)	Units in cost sample ($n=58$) ¹
Located in the south-east	26% (21)	26% (17)	24% (14)
Located in London	19% (15)	20% (13)	22% (13)
Adolescent units ²	68% (54)	76% (50)	78% (45)
Managed within NHS	74% (59)	77% (51)	77% (45)
Total	80	66	58

NHS, National Health Service.

1. Includes units for which a cost could be estimated.

2. Units predominantly admitting young people between the ages of 12 and 18 years.

Table 3 Unit cost (in £) per in-patient day for 58 child and adolescent psychiatric in-patient units (1999–2000 prices)

Unit cost component	Range	Median	Mean	s.d.
Nursing ¹	6.22–220.38	73.07	75.70	33.60
Doctors ²	0–91.06	20.50	25.03	15.81
Psychologists ³	0–15.13	3.12	4.07	4.45
Psychotherapists ⁴	0–39.81	5.16	6.96	7.23
Therapists ⁵	0–14.61	1.85	3.16	3.46
Administrative/other staff	0–33.72	8.30	10.28	7.72
Teaching staff	1.26–45.72	10.91	12.54	8.98
<i>Total cost of all personnel</i>	<i>53.57–303.40</i>	<i>119.66</i>	<i>137.81</i>	<i>52.65</i>
Overheads and capital costs	17.17–167.94	48.42	59.14	30.05
Total unit cost	91.23–380.15	171.61	197.32	71.61

1. All grades of nursing staff.

2. Consultants, senior registrars and senior house officers. No cost is recorded for doctors for one unit, but in the 'other staff' category an adult psychiatrist is listed as working 0.3 whole-time-equivalent in the unit.

3. Grades A and B clinical psychologists and psychology assistants.

4. Psychotherapists, family therapists and social workers.

5. Occupational therapists and play and music/art therapists.

Variations in the costs of child and adolescent psychiatric in-patient units

Table 4 reports the 'best' equations resulting from the analyses, with the second equation (Equation II) adding the measures of children's needs to the service-level measures included in Equation I. The conventional criteria of performance were employed. The cost function performs well statistically (in particular, the individual estimated coefficients attain statistical significance) and the overall goodness-of-fit (F statistic) is high. The equation is parsimonious, explaining as much of the observed cost variation (as measured by R^2) as possible and with as few included variables as possible. Finally, it is important that the equation can be interpreted because results that do not make sense are of limited value to decision-makers. The standardised residual from the final equation was normally distributed, ensuring that the technique was appropriate for making inferences about the mean. Moreover, it is the within-sample influences that are of interest in this study because, as noted above, data have been captured on around three-quarters of the total population.

In Equation I nearly half of the variation in costs has been explained statistically using only the service-level measures (adjusted $R^2=0.464$). Units managed within the NHS are found to be more

Table 4 Estimated cost functions for child and adolescent psychiatric in-patient units

Explanatory variable	Equation I			Equation II		
	Coefficient	s.e.	P	Coefficient	s.e.	P
Constant	157.37	34.68	<0.001	93.72	38.54	0.019
Unit managed within NHS	93.85	26.16	0.001	107.47	24.42	<0.001
No. day care places available	-9.24	1.92	<0.001	-8.28	1.88	<0.001
No. rooms per available bed	29.06	11.47	0.015	32.59	10.89	0.005
Unit located in London region	49.57	18.64	0.011	43.55	18.16	0.021
No. beds available for use	-4.14	1.63	0.014	-4.26	1.50	0.007
Specialist treatment unit	54.36	25.72	0.040	82.60	25.59	0.002
Presence of mood disorder				83.59	39.00	0.038
Presence of schizophrenia				96.34	47.74	0.050
Presence of learning disability				66.46	27.60	0.020
	N=55; R ² =0.52; adjusted R ² =0.46; F=8.81 (P<0.001)			N=55; R ² =0.62; adjusted R ² =0.55; F=8.31 (P<0.001)		

NHS, National Health Service.

expensive, all other factors considered, as are those providing a specialist service. There is a strong correlation between the managing agency and specialisation variables (Table 5), yet a single variable combining these two indicators did not improve the explanatory power of the equation, either when added to this equation or when used as a replacement for the two separate variables. A higher proportion of therapy and other rooms per available bed are also associated with higher costs, but the absolute numbers of available beds and day care places are negatively associated with costs. Finally, if the unit is located in London the direction of the coefficient is as expected, with higher costs resulting. The first three variables listed in Equation I account for 35% of the variation in cost per in-patient day.

Although none of the throughput measures reached conventional statistical significance, whether the unit was open seven days each week was close (it was positively associated with costs). Of the measures of user characteristics, whether

the unit provided a service for only adolescents was again on the borders of statistical acceptability but the indicator variable for specialist services was a stronger cost predictor. However, 10 of the 14 specialist units provide a service only to adolescents.

Equation II allowed the influences of the average ward scores for the patients' mental health problems to be assessed. This resulted in an increased proportion of cost variation explained (adjusted R²=0.55) without changing the direction of influence of the previously included variables or causing too much change in the size of their impact on unit costs. Each of the measures has a positive association with costs; units that support children and adolescents who have mood disorders, schizophrenia or learning disabilities have relatively higher unit costs.

DISCUSSION

Strengths and limitations of the study

The cost estimation methodology devised for this study drew upon economic theory,

thus making the results useful in research, and best accounting practice, which ensures that the results are useful to purchasers and providers. The overall response rate to the cost-related questions was good, despite the perceived commercial sensitivity of some data and the time constraints of busy ward-based and finance personnel. The advantage of such a comprehensive survey is that cost elements not supplied for one unit can be estimated using data from other units with a reasonable degree of accuracy. However, unless data are provided on the whole-time-equivalent staffing mix, the margin of error for any particular unit could be wide.

There are limitations to the study. First, although these costs are as accurate as possible, given the data received, some of the cost variation could be due to measurement error or different accounting conventions in use. Although we could not visit the finance departments to check the data that they provided, our standardised methodology ensured that the scope of the data was the same across all units; costs devolved to wards and those falling to wider hospital functions were included in our final estimates. In addition, staffing costs were confirmed against nationally applicable salary scales (plus allowances and on-costs). Generally, mean and median observed staff costs were found to lie at the top of the relevant range. However, both this and a cautionary reminder about the sample size ($n=58$) mean that the findings should be used with some care.

The second limitation stems from the fact that the cost predictors, although taken from a wide-ranging national survey, are unlikely to reflect the full complexity of the system in which child and adolescent psychiatric in-patient units must operate. It is unsurprising, therefore, that the equations provide only a partial explanation of the cost variation. For example, we have no data describing the service model or

Table 5 Bivariate correlation coefficients for variables used in the cost function

Variable	Variable	No. of units	Coefficient ¹	P
No. beds available for use	Total number on in-patient list	57	0.85	<0.001
Unit admits adolescents and other age groups	Unit admits only adolescents	58	-0.67	<0.001
Increase in beds planned for the future	Reduction in beds in past 2 years	57	0.87	<0.001
Unit is a specialist service	Unit managed within NHS	58	-0.76	0.004
No. rooms (not bedrooms) per available bed	Unit admits only adolescents	55	0.45	0.001

NHS, National Health Service.

1. Pearson's correlation coefficient: all results above 0.4 are shown.

treatment philosophy operating in each unit, nor do we have full data on the relationship between each unit and the wider organisation. Of course, the direction of causality cannot be gauged from these results. It may be the case, for example, that costs exert an influence on service factors, perhaps where financial cut-backs force services to change quickly. (Longer-term pressures of increases or reductions in capacity were not associated with in-patient day costs, however.) Finally, it is important to note the boundaries of this study. Here we focus on cost variations between the units themselves and not variations between the children and adolescents using those units (Christ *et al*, 1989; Chadbra *et al*, 1999). Nor do we compare child and adolescent psychiatric in-patient units with other programmes (e.g. Grizenko & Papineau, 1992). Moreover, this is not a study of cost-effectiveness because we have no longitudinal measures of final outcome (changes in patients' welfare resulting from child and adolescent psychiatric treatment).

Resource implications of child and adolescent psychiatric in-patient units

The overall goal of this study was to provide some improved information on the costs of child and adolescent psychiatric in-patient units to aid central and local service planning. Too often, costs are provided for a whole hospital or for a clinical speciality that do not take into account the factors that make particular wards relatively more expensive. One hospital's pricing strategy was found to underestimate the true in-patient day costs for children with HIV-related disorders by 20%, contributing to a hospital deficit of around £5.9 million (Beck *et al*, 1999). There is little cost research into child and adolescent psychiatric in-patient or, indeed, community-based services (Beecham *et al*, 1996; Knapp, 1997) but some recent UK studies have focused on individual-level support costs for various disorders (Knapp *et al*, 1999; Harrington *et al*, 2000).

We found that the costs of child and adolescent psychiatric in-patient care are high, at around £130 000 per day in England and Wales. If the number of in-patients on the NICAPS census day ($n=663$) were typical of the whole year, the total annual cost would be £47.7 million. Personnel absorb a high proportion of these costs. Both nurses and clinical

CLINICAL IMPLICATIONS

- Per diem cost information for specific child and adolescent psychiatric in-patient units can be generated.
- Reported charges/fees were found to be significantly higher than costs.
- Per diem costs vary according to the management sector and the type of service provided.

LIMITATIONS

- Although representing three-quarters of the existing child and adolescent psychiatric units, cost data on only 58 units were available.
- Data on many service context factors could not be incorporated.
- More information is needed on the quality of care provided and the outcomes for residents.

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staff working on these units tend to be employed on the higher scale points of their grades, probably reflecting the high care needs of the patient population. However, assessing the costs of child and adolescent psychiatric in-patient units using just these direct care costs would underestimate the full costs by around one-third. Overhead costs reflect the wider support functions undertaken by the organisations managing the child and adolescent psychiatric units and are essential for the units' functioning.

Implications for commissioners and providers

There are a number of implications to take from the findings. The higher costs associated with child and adolescent psychiatric units in London should come as no surprise and are likely to reflect the higher prices paid by providers for staff and other inputs. Many of the large teaching hospitals are in London and generate a sizeable body of skills and experience, as well as opportunities for training.

Two measures of capacity have important influences on costs, with increases in

the number of available in-patient beds and number of day care places having a small but negative influence on costs. Of course, it should not be inferred from this that more patients should be squeezed into existing units or that increasingly larger units should be provided to save money. This finding needs to be balanced against the provision of good-quality care. Overcrowded units with low staff/patient ratios and poor-quality care led to the closure of many of the old 'water tower' hospitals (Davigde *et al*, 1993). Although only one of our limited measures of care quality appears to influence the cost of child and adolescent psychiatric in-patient units – the number of rooms other than bedrooms – its impact on costs is sizeable.

The two remaining variables present a rather complex story. Specialist units are £54 more expensive per in-patient day than those providing a general psychiatry service, yet 11 of the 14 specialist units in the study were run by independent-sector organisations. Conversely, 42 of the 45 NHS units provide general rather than specialist psychiatric services and yet the

analysis also shows that management within the NHS is associated with higher costs. Of course, NHS units often provide teaching and training, which may influence costs. Once the measures of young people's mental health needs are taken into account, it is factors that relate to the provision of general psychiatry services rather than, say, eating disorders that add to the proportion of cost variation explained and have a cost-raising influence.

Child and adolescent psychiatric inpatient services are high-cost, low-volume services for which specific facility-based costs are rarely estimated. The work undertaken here shows that cost estimation for units within a hospital can be achieved using economic principles and practices set out in the *NHS Costing Manual*. In turn, this should encourage both central and local decision-makers to request these data on a routine basis. The finding that the costs per in-patient day vary by a factor of four and that some of this variation is associated with service characteristics can help to inform commissioners and providers as they develop contracting and pricing strategies.

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