Predictors of mental health service costs for representative cases of psychosis in south London

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ABSTRACT

Background. Increasingly, evaluations of mental health services include an economic component, although often only summary statistics such as the mean or median are reported. Measures of variation are often limited to the standard error or standard deviation, though costs are rarely normally distributed and vary substantially between patients. The aim of this study is to identify factors that can explain variations in the cost of mental health services for epidemiologically representative cases of psychosis.

Methods. Cases with ICD-10 diagnoses of functional psychosis were drawn from a sample that included all identified cases of psychosis in two geographically defined sectors in Camberwell, south London. Mental health service use was measured and costed. A predictive model was developed using multiple regression analyses, in which patient characteristics and previous service use indicators were used as predictor variables. Services were measured using the Client Service Receipt Interview.

Results. Among the 147 cases included, the amount of cost variation explained by the model was 31·5%. The most significant predictive factor was social functioning, which was highly negatively associated with cost.

Conclusions. Current mental health service use can be predicted to a reasonable extent by previous service use and patient characteristics, especially the degree of social disability. Identification of such factors can aid the effective allocation of scarce resources. In particular, subgroups of patients who use most resources can be identified and targeted by mental health services.

INTRODUCTION

Mental illness causes relatively high levels of service utilization (Davies & Drummond, 1990), and at a time of resource scarcity, it is important that evaluations of new services include an economic component (Goldberg, 1991; O'Donnell *et al.* 1992). The economic cost of providing mental health services can vary substantially between patients. Typically, service costs are reported as average figures, and while this is important it does not provide information about which patients cost more and why. An understanding of the causes of such variations has important resource allocation implications. This paper examines the impact of patient characteristics on mental health service costs for representative cases of psychosis in south London. Previous work has examined ethnic differences in compulsory admission risk (Davies *et al.* 1996).

A range of patient factors are examined in relation to cost, using a 'cost function' technique. Knapp *et al.* (1990) used this methodology in an examination of cost variations for groups of patients leaving long-stay hospital wards to live in the community. They found that variations were linked with gender, number of social

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contacts, length and proportion of time spent in hospital, age, social behaviour and negative symptoms. Using these factors 33% of cost variation was explained. Further research (Beecham *et al.* 1991) discovered that marital status, everyday living skills, physical health and patient attitudes were also related to cost and increased the amount of variation explained to 50%. With the addition of variables related to the type of agency managing accommodation, this proportion was further increased to 59%.

Another study (Salize & Rossler, 1996) revealed that service costs for people with schizophrenia were significantly associated with the number of social and rehabilitative problems, gender and risk associated with accommodation situation. The cost-function in that study could explain 45% of cost variation.

METHOD

The PRiSM Psychosis Study is evaluating the introduction of sectorized community mental health services for people with functional psychosis who live in a deprived part of south London. The Camberwell area, served by the Bethlem and Maudsley NHS Trust, was divided into five geographically defined sectors in 1991 for the purposes of mental health service delivery. Community-based services have recently been developed in the sectors. Two of these (Nunhead and Norwood) provide the sites for this study. The data presented here were collected at the baseline stage of the study, when the mental health services were largely hospital based.

A case identification exercise was carried out to establish the total annual period prevalence rate for ICD-10 psychosis. All people with a diagnosis of functional psychosis living in either sector during an index year were included. Background data on each case was collected from casenotes, including sociodemographic factors, living arrangements, physical health problems, psychiatric history and diagnosis. Some of the variables collected related to the entire life of the patient up to the end of the index year (such as whether the patient had ever been detained under the Mental Health Act), while others related to the index year only (such as whether the patient had had community psychiatric nurse (CPN) contact during that time). A Global

Assessment of Functioning (GAF) (American Psychiatric Association, 1987) score was made based on casenote information. The GAF can range from 0 (seriously impaired functioning) to 90 (absence of functioning problems).

From the case identification stage a random sample was selected for interview. Patients, formal carers, and informal carers were interviewed using 13 instruments prior to the establishment of community mental health services and subsequently after they had been using such services for approximately $2\frac{1}{2}$ years. The patient interview instruments used were the Client Service Receipt Interview (Beecham & Knapp, 1992), the user version of the Camberwell Assessment of Need (Phelan *et al.* 1995), the Verona Service Satisfaction Scale (Ruggeri & Dall'Agnola, 1993), the PRiSM Socio-Demographic Rating Scale, the Lancashire Quality of Life Profile (Oliver, 1991), the Social Network Scale (Leff *et al.* 1990) and the Physical Health Index. The clinical staff were interviewed using the Brief Psychiatric Rating Scale (Overall & Gorham, 1962), the staff version of the Camberwell Assessment of Need (Phelan *et al.* 1995), the Social Behaviour Schedule (Wykes & Sturt, 1986), and the Global Assessment of Functioning Scale (American Psychiatric Association, 1987). Informal carer interviews at baseline used the General Health Questionnaire-28 (Goldberg, 1972) and the Burden on Carers Schedule. This paper draws particularly on data generated from the case identification exercise and the Client Service Receipt Interview (CSRI).

Service use and cost measurement

Services were measured using the CSRI and costed following the methodology that was developed by Knapp & Beecham (1990). The methodology employed is discussed further by Allen & Beecham (1993). A number of other studies have employed this approach (Knapp *et al.* 1990, 1994; McCrone *et al.* 1994).

All services that were considered part of a package of community care were recorded. Individuals were asked how often they had used a particular service during the previous 6 months and for what duration. Total contact time with individual services was combined with the unit cost for that service to arrive at a service cost for each patient for the 6 months prior to interview. This paper examines the cost variations relating

to core mental health services (in-patient episodes, day-hospital care, other contacts with mental health staff and medication).

Cost function

A cost function describes cost as being determined by a number of predictive factors and quantifies the impact that each factor has on cost with all the others taken into account. If such a function explains cost variations well then it should be robust enough to aid the prediction of care costs. An ordinary least squares linear regression model was used here to explore cost variations. The distribution of the untransformed cost residuals was skewed, but by taking natural logarithms of cost the results were normalized, as required by linear regression models. Therefore, the dependent variable was the natural logarithm of core service cost.

Patient characteristics were used as explanatory factors. The majority of these took the form of indicator variables – scoring one if a condition was met and zero if not (or if it was unknown), while the remainder were continuous variables. All the eligible variables were initially entered into the model. Non-significant variables were then removed by backward elimination.

RESULTS

A total of 535 patients were identified from the initial case identification exercise; 320 were then randomly selected for interview. Oversampling was conducted to increase the overall sample size so as to improve the statistical power of the study. CSRI data was collected for 211 patients. There was an overlap between the index year (from which information was used as predictors) and the 6 month cost period in 19 of these cases. These had to be excluded due to service use information used as independent variables also being part of the cost measure. GAF scores were available for 154 of the remaining 192 patients and 147 of these used core mental health services. Comparisons of 23 patients characteristics collected during the case identification stage were conducted between these 147 and the remaining identified clients ($N = 392$) to test for their representativeness. Of these 19 showed no significance difference at the 90 % level of significance. Those in the final sample had a higher number of admissions up to the end of

Table 1. *Psychiatric characteristics of epidemiologically representative cases of psychosis, obtained from case identification exercise* (N = 147)

Psychiatric service characteristic	N	%
ICD-10 diagnosis of bipolar disorder	31	21·1
ICD-10 diagnosis of schizophrenia	82	55·8
Alcohol and/or drug problems	28	19·0
Living in supported accommodation in index year	23	15·6
Day-patient in index year	34	23·1
Domiciliary visit in index year	34	23·1
CPN contact in index year	26	17·7
Out-patient in index year	114	77·6
Emergency clinic in index year	35	23·8
Ever detained under Mental Health Act	79	53·7

Table 2. *Sociodemographic characteristics for epidemiologically representative cases of psychosis* (N = 147)

Sociodemographic characteristic	N	%
Married	24	16·3
Cohabiting	6	4·1
Divorced	19	12·9
Separated	8	5·4
Widowed	10	6·8
Black Caribbean ethnicity	40	27·2
Black African ethnicity	9	6·1
Patient has children	67	45·6
Convicted of crime in lifetime	43	29·3
Born in UK	102	69·4
Other family member with any psychiatric history	60	40·8
Living on own in index year	63	42·9
Female	70	47·6
Never known to be suicide risk	65	44·2
History of any violence	60	40·8
Staff concern regarding violence in lifetime	18	12·2
Ever in prison	22	15·0
Living in Norwood sector (others in Nunhead)	82	55·8

the index year than the remaining clients ($P = 0·0012$) and had been in contact with services longer ($P = 0·0075$). A greater proportion of final sample clients had had contact with out-patient services during the index year ($P = 0·0151$) than the remaining clients, whereas a smaller proportion had had CPN contact ($P = 0·0816$).

Variables that were entered into the cost function equation are described in Tables 1 and 2. Table 1 shows that most of the cases had an ICD-10 diagnosis of schizophrenia. The majority had also been detained at some time under the Mental Health Act. Out-patient services had

Table 3. *Use of services, mean cost among users and contribution to total* (N = 147)

Service	N (%) using service in previous 6 months	Mean (median) cost among users (1995/96 £s)	Inter-quartile range of cost (1995/96 £s)	Contribution to total cost (%)
Medication	116 (78·9)	76 (64)	64–64	3·2
Psychiatrist	115 (78·2)	172 (129)	86–216	8·9
CPN	55 (37·4)	383 (208)	63–504	7·8
In-patient	31 (21·1)	5661 (3733)	1841–6458	64·8
Day-patient	25 (17·0)	1515 (1242)	349–2207	12·3
Emergency clinic	24 (16·3)	77 (43)	43–86	0·7
Psychologist	9 (6·1)	341 (309)	155–580	1·8
Occupational therapist	9 (6·1)	133 (116)	29–302	0·6
All core services	147 (100·0)	1842 (442)	172–2022	100·0

Table 4. *Cost function derived from ordinary least squares linear regression model. Dependent variable = log of core cost* (N = 147)

Explanatory variables	Type	B	Impact factor	95% CI	P
GAF score in index year	C	−0·0319	0·9686	−0·0483 to −0·0154	0·0002
Born in UK	D	0·7511	2·1192	0·2950 to 1·2071	0·0014
Day-patient in index year	D	0·7527	2·1227	0·2510 to 1·2543	0·0035
Age	C	−0·0141	0·9860	−0·0280 to −0·0003	0·0460
Lived alone in index year	D	0·4686	1·5978	0·0441 to 0·8932	0·0308
No suicide risk	D	−0·4299	1·6506	−0·8563 to −0·0036	0·0481
Index year length of stay	C	0·0044	1·0044	0·0002 to 0·0085	0·0395
Constant		8·0301		6·8682 to 9·1919	0·0000

$R^2 = 0.3478$, adjusted $R^2 = 0.3150$.
D, dummy variable (scores 1 if condition is known to be met, 0 otherwise); C, continuous variable; B, coefficient; P, significance of coefficient.

been received by three-quarters of the sample during the index year prior to the cost period. Mean (standard deviation) length of stay during the index year was 22·5 (53·2) days. This was also entered into the model. Table 2 reveals that most people had never been married and a large minority of patients were born outside of the United Kingdom. The mean (standard deviation) GAF score was 58·3 (13·7) representing a level of functioning described in the DSM-III-R manual as: 'Moderate symptoms…OR any serious impairment in social, occupational, or school functioning…' (American Psychiatric Association, 1987). Other variables entered into the model were age (mean = 44·0, s.d. = 43·5), and the number of physical health problems (mean = 0·5, s.d. = 0·7).

The number of people using core mental health services during the preceding 6 months is shown in Table 3 along with details of costs. It can be seen that the majority of patients had contact with psychiatrists and were using medication for their psychotic symptoms. Over one-

fifth of clients had been in-patients. Not surprisingly in-patient and day-hospital care were the most expensive services, and these also contributed the most to total core cost (77%).

The mean (standard deviation) cost, measured at 1995/96 prices, was £1842 (£3736) for the 6-month period. As expected this was skewed, justifying logarithmic transformation. Those patients (N = 51) who used core services but who do not appear in these analyses (because of missing data on background characteristics or being overlappers) had a mean (s.d.) core cost of £2992 (£4799). Using a Mann–Whitney U non-parametric test it was shown that this difference had a P value of 0·0708. Using a t test of log-transformed costs this finding is repeated (P = 0·063).

Cost function

Using log-transformed values for the dependent variables means that the anti-log of the coefficients needs to be examined to see the impact on core cost when the relevant independent

variable changes by one unit, with all other variables in the equation held constant. In Table 4 the impact factor shows the multiplier effect on costs of changing each independent variable by one unit. An impact factor of below one indicates a negative relationship and above one a positive relationship.

The most significant variable was the GAF score which had a significant and negative impact on core service costs (Table 4). Being born in the UK, index year use of day-hospital services and length of in-patient stay and living alone during the index year were also significantly related to higher costs. Costs were significantly lower if the patient had never being considered a suicide risk. There was an inverse relationship between age and cost. This equation could explain 31·5% of core cost variation. The model met the assumptions of normally distributed residuals, linearity, and constant residual variance.

DISCUSSION

This study has examined variations in the costs of mental health services for epidemiologically representative cases of psychosis in south London. Factors related to such variations are patient characteristics, and psychiatric service history. About one-third of variation in cost can be explained in this way. Dummy variables scored one if the characteristics were known to be met and zero if not or if the information was not known. Therefore, this model attempts to explain variations only with information that is available.

High levels of social functioning were associated with lower core service costs. This indicates that resources are being successfully targeted towards those who are more disabled, i.e. people with more severe forms of mental illness. It was expected that patients with poorer social functioning would attract higher resource utilization, however, this had not previously been demonstrated. The model also reveals that more resources are used in the care of younger people, and for those who live on their own. A finding of some concern is that patients born in the UK are associated with higher service costs. This may reflect a problem of access to services by people who have recently moved to the UK. This warrants further investigation.

Nearly two-thirds of the variation in cost could not be explained by the model. However, the factors included here only relate to patient sociodemographic characteristics and past service history. Patients are generally in current contact with services because of current service requirements. This paper has attempted to identify predictive factors other than current clinical requirements. By doing so various issues of access and equity could be raised. It is important to note that while a high amount of explained variation is pleasing it is perhaps more important to identify significant predictive factors. If measures of casemix which are based on diagnosis are to be refined (McCrone & Phelan, 1994), then results from studies such as this can make a substantial contribution in future to an understanding of how best to link service inputs to patients' needs and to improved outcomes. This paper has dealt with data from a sample of clients using hospital based out-patient and day-patient services. Future work will examine the cost variations of community based psychiatric care, and will link care costs to measures of outcome.

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