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A comparison of psychiatric casemix in the UK and Italy

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Abstract *Background*: The objective of this study was to compare casemix groups in Italy and the UK. Three hypotheses were tested. First, that length of stay would be shorter in Italy. Second, that diagnosis would not be an effective predictor of length of stay. Third, that diagnosis-based groups would be better predictors of length of stay in Italy due to shorter in-patient episodes. *Methods*: In-patient episodes in Pavia (Italy) and Camberwell (UK) for patients with psychosis were allocated to four Healthcare Resource Groups. Average lengths of stay, and coefficients of variation in the two areas were compared. A regression model was constructed to determine the impact of diagnosis groups, gender, age and area on length of stay. *Results*: Length of stay was significantly shorter in Pavia than in Camberwell for three of the four groups. The coefficient of variation was generally above 1, indicating a lack of within-group similarity. With outliers trimmed, the figures were below 1, except for one group in Camberwell. Pavia revealed greater group homogeneity than Camberwell, with one exception. The regression model explained 9% of variation when the two areas were both included, and around 5% when compared separately. Age had a non-linear impact on length of stay in Camberwell. *Conclusions*: We have again shown that diagnosis does not adequately predict length of stay. However, in Italy, where admissions are for shorter periods, diagnosis groups are more homogeneous. This may be because the initial part of a hospital stay is due to clinical factors, whereas prolonged stay is influenced by supply-side issues.

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Introduction

The allocation of psychiatric resources according to Diagnosis Related Groups (DRGs) has been shown to be problematic in the United States [1, 2]. This has been due to violation of the criteria that determine the effectiveness of such groups, particularly the need for homogeneity of length of stay. Results from the UK [3, 4] and France [5] reveal the same difficulties. Healthcare Resource Groups (HRGs) have been suggested for use in the UK to measure hospital activity [6]. In common with DRGs, 15 of the version 2 HRGs relate to psychiatric and substance abuse disorders, but there is greater emphasis given to psychotic conditions (four HRGs compared to one DRG).

However, it is not clear that diagnosis-based casemix, *even if clearly defined*, can effectively predict length of stay for psychiatric patients [7]. This is mainly due to a large number of factors other than diagnosis that may effect in-patient resource use [8]. These include patient characteristics, but also the availability of alternative services. Diagnosis may though be a more effective predictor of length of stay if patients are discharged when clinically appropriate, rather than them having to wait until adequate community services, particularly accommodation, are in place.

In Italy, there has since 1978 been a legislative barrier to *new* admissions to state psychiatric hospitals. From 1982 there have not been *any* admissions allowed to these establishments [9]. Patients are admitted to small units in general hospitals instead, and much emphasis has been given to community alternatives to in-patient care [10]. However, the introduction of community services has been patchy, with marked differences between the north and south [11]. In the UK it is felt that the

length of hospital stay amongst psychiatric patients can be increased beyond that required by clinical circumstances because of limited community services in some areas, especially supported housing [12]. These are reasons to expect length of stay to be shorter in Italy than the UK, and for diagnosis to be a better resource predictor there.

This paper examines the length of stay for patients with psychosis in two areas: Camberwell (UK) and Pavia (Italy), and assesses the effectiveness of diagnosis-based casemix in each setting. Bivariate and multivariate analyses are used to test the following hypotheses:

1. Length of stay is shorter in Pavia than Camberwell
2. Diagnosis-based casemix is a poor predictor of length of stay in both settings, but
3. Diagnosis-based casemix performs better in settings with short lengths of stay, i.e. Pavia.

Subjects and methods

Camberwell is a highly deprived area in south London. The data for this paper were collected from two (of five) geographically defined sectors, each with a population of about 40,000, for use in a wider evaluation of community mental health services [13]. The area is served by a large psychiatric teaching hospital. The two sectors had approximately 40 beds allocated to their catchment areas during the time of this study.

The psychiatric service in Pavia (northern Italy, near Milan) serves an area that contains approximately 180,000 residents. It includes an 18-bed general hospital in-patient ward, an out-patient service, a domiciliary service, and a therapeutic and rehabilitative day centre. This organisation was started after 1978, when the Italian Law 180 stopped new admissions to state psychiatric hospitals.

Length-of-stay data were available for 1 year in Pavia (1996) and 3 years in Camberwell. Patients were allocated to version 2 Healthcare Resource Groups (HRGs) according to ICD diagnosis at discharge in Camberwell and admission in Pavia. Four HRGs (t03 schizophrenia, t04 paranoia and acute psychotic reaction, t05 mania and excited psychoses, and t06 psychotic depression) covered psychotic conditions and were compared. SPSS and Stata were used for data management and analysis.

The proportion of patients in each HRG and setting was compared using cross-tabulations and chi-square tests. The median length of stay for each HRG was compared between Camberwell and Pavia, and differences in the distributions were examined for significance using the Mann-Whitney test. The median length of stay was chosen in preference to the mean, which would be effected by the presence of expected outliers. (Although the Mann-Whitney test is specifically used to compare distributions of data, it does to some extent allow differences in medians to be examined.) The means of the logarithmically transformed data were compared using *t*-tests.

To examine the homogeneity of length of stay in each group, coefficients of variation (the standard deviation divided by the mean) were calculated. The higher this figure, the less group similarity exists. The individual groups were subsequently 'trimmed' of outliers and coefficients of variation re-calculated. There is no consensus as to how outliers should be trimmed. Here we decided to use a formula used by the UK's National Casemix Office. Cases were trimmed if the values exceeded those produced by adding the value of the third quartile to the difference between third and first quartile values multiplied by one and a half.

Finally a multiple regression model was used to analyse variations in length of stay amongst the untrimmed sample using area, HRGs, gender, age and age-squared as independent variables. The age-squared term was used to test for a non-linear relationship with length of stay. The dependent variable was the natural logarithm of the length of stay variable. (One day was added to all lengths of stay. This is because a patient admitted and discharged on the same day would have a zero length of stay recorded, which could not be logarithmically transformed). The sample consisted of individual in-patient episodes, some of which were for the same patients. Such multiple observations were dealt with by using the cluster option in Stata, which incorporates robust standard errors.

Results

The number of in-patient episode records available for use in the analysis was 308 (179 patients) from Pavia and 523 (169 patients) from Camberwell. The median patient age for episodes in Camberwell and Pavia were similar (40 years and 41 years respectively). The gender distributions were also similar, with 215 (41%) of episodes in Camberwell being for male patients, whilst of the episodes in Pavia 137 (45%) were for men. Data were not available on ethnic group.

Proportion of people in psychosis HRGs

The distribution of patients amongst the four relevant HRGs is shown in Table 1. The two areas differed significantly, with higher proportions of schizophrenia, paranoia, and psychotic depression in Pavia, whilst Camberwell had disproportionately more patients diagnosed with mania and excited psychoses.

Length of stay

The median length of stay for Camberwell patients was higher for all HRGs (Table 2). The distributions were significantly different between the areas, except for mania and excited psychoses. The mean length of stay was higher in Camberwell, but significance tests could not be directly undertaken due to the highly skewed nature of the data. However, the means of the logarithmically transformed length of stay were significantly greater in Camberwell, again with the exception of mania and excited psychoses.

Table 1 Number (percentage) of patients in individual Healthcare Resource Groups (HRG): Camberwell and Pavia compared

HRG	Camberwell	Pavia
t03 Schizophrenia	256 (48.9)	182 (59.1)
t04 Paranoia and acute psychotic reaction	44 (8.4)	54 (17.5)
t05 Mania and excited psychoses	187 (35.8)	29 (9.4)
t06 Psychotic depression	36 (6.9)	43 (14.0)

Pearson Chi-square statistic = 79.407, 3 degrees of freedom, two-sided significance $P < 0.001$

Table 2 Length of in-patient stay in Camberwell and Pavia by Healthcare Resource Group (*IQR* inter-quartile range)

Healthcare Resource Group	Camberwell		Pavia		Mann-Whitney test	
	Median	IQR	Median	IQR	*Z* statistic	Significance
t03 Schizophrenia	16	5–46	10	5–17	−4.049	<0.001
t04 Paranoia and acute psychotic reaction	19	6–37	4	2–12	−4.229	<0.001
t05 Mania and excited psychoses	15	5–38	13	5–19	−1.587	0.112
t06 Psychotic depression	33	14–69	9	5–13	−4.836	<0.001

Coefficient of variation

The coefficient of variation was higher than 1 in Camberwell for all four HRGs (Fig. 1), indicating that group homogeneity was limited. Two HRGs in Pavia had coefficients of variation below 1: mania and excited psychoses, and psychotic depression. Camberwell had higher levels of group variability than Pavia except for paranoia and acute psychotic reaction.

The number (percentage) of outlying in-patient episodes trimmed from the samples in Camberwell and Pavia respectively were as follows: schizophrenia 29 (11.3) and 13 (7.1), paranoia and acute psychotic reaction three (6.8) and two (3.7), mania and excited psychoses 15 (8.0) and one (3.4), and psychotic depression four (11.1) and five (11.6). The coefficients of variation for all four trimmed HRGs in Pavia were below 1, and less than those for Camberwell (again with the exception of paranoia and acute psychotic reaction), revealing that patients in trimmed groups are generally more homogeneous in terms of length of stay in Pavia than they are in Camberwell (Fig. 2).

Multiple regression analysis

The results of the multiple regression analysis are shown in Table 3. The coefficients presented in this Table show the impact that the independent variables have on length of stay taking each other into account. The fact that length of stay was transformed using logarithms means that a one unit change in the continuous variables (age and age-squared) has a percentage change on length of stay equal to the coefficient multiplied by 100. For dummy variables the percentage difference between the included category and the reference category is equal to the anti-log of the coefficient minus one, multiplied by 100 [14].

The amount of explained variation in the logarithmically transformed length of stay was low both for the two areas combined (9%) and when they were analysed separately (7% in Camberwell, 4% in Pavia). When only the diagnosis groupings were included, the percentage of variation explained in both areas was 4% (not shown in Table).

For the combined sample, the mean length of stay for patients with paranoia and acute psychotic reaction was 24% less than that for patients with schizophrenia (the reference category). The other two diagnostic categories did not differ significantly ($P < 0.1$) from schizophrenia in explaining variation. A similar finding was repeated for the patients treated in Pavia, where paranoia and acute psychotic reaction patients had a mean length of stay that was 38% less than that for patients with schizophrenia.

Age had a significant relationship with length of stay for the combined sample, and for Camberwell. The

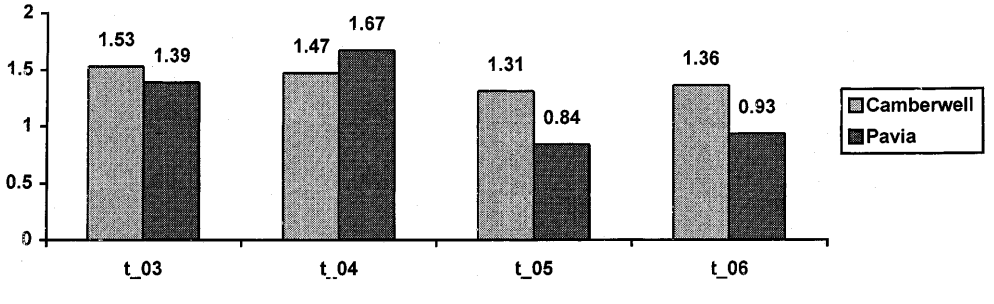

Fig. 1 Coefficient of variation in Camberwell and Pavia (full sample) t_03 schizophrenia, t_04 paranoia and acute psychotic reaction, t_05 mania and excited psychoses, t_06 psychotic depression

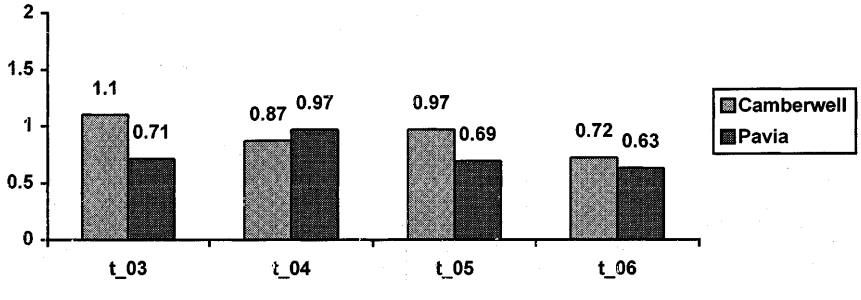

Fig. 2 Coefficient of variation in Camberwell and Pavia (trimmed sample) t_03 schizophrenia,t_04 paranoia and acute psychotic reaction, t_05 mania and excited psychoses, t_06 psychotic depression

Table 3 Regression of length of stay (log transformed) on Healthcare Resource Groups, area, age and gender (*na* not applicable)

Variable	Combined sample			Camberwell			Pavia		
	Coeff.	*T*-statistic	Sig.	Coeff.	*T*-statistic	Sig.	Coeff.	*T*-statistic	Sig.
t04 Paranoia and acute psychotic reaction	−0.273	−1.804	0.072	−0.066	−0.257	0.797	−0.482	−2.623	0.009
t05 Mania and excited psychoses	−0.240	−1.053	0.293	−0.212	−0.782	0.435	−0.023	−0.116	0.908
t06 Psychotic depression	0.017	0.100	0.920	0.319	1.176	0.241	−0.208	−1.191	0.235
Area (0 = Camberwell, 1 = Pavia)	−0.592	−5.464	<0.001	na	na	na	na	na	na
Age	−0.060	−2.729	0.007	−0.088	−2.829	0.005	0.009	0.393	0.695
Age-squared	0.001	3.094	0.002	0.001	3.181	0.002	-4×10^{-5}	−0.187	0.852
Gender (0 = female, 1 = male)	0.129	0.756	0.450	0.174	0.653	0.515	0.072	0.565	0.573
Constant	3.810	9.358	<0.001	4.296	7.650	<0.001	1.953	3.870	<0.001
	$R^2 = 0.088$, $F(7,347) = 10.84$ $N = 831$, Clusters = 348			$R^2 = 0.068$, $F(6,168) = 4.39$ $N = 523$, Clusters = 169			$R^2 = 0.044$, $F(6,178) = 1.45$ $N = 308$, Clusters = 179		

significance of the age-squared variable indicates that this was not a linear relationship. As age rises length of stay falls, but at a decreasing rate until a minimum point is reached, at which point length of stay starts to rise at an increasing rate. Gender was not significantly associated with length of stay.

For the combined sample, the area variable revealed that length of stay was 45% less in Pavia than Camberwell, after taking the other factors into account. This supports the uncontrolled findings from Table 2.

Discussion

There are a number of limitations of this study. First, the two areas are not representative of Italy and the UK as a whole. Camberwell is particularly deprived and the average length of stay in the UK may be closer to that of Pavia. Second, the differences between Pavia and Camberwell in the proportions of patients in particular HRGs suggests that either diagnostic procedures are different or that there are large differences in the true in-patient treated prevalence of these disorders. Furthermore, in Pavia the diagnoses were made at the point of admission, whereas in Camberwell they were made when patients were discharged. Different diagnostic methods used in Pavia and Camberwell could well affect the validity of those diagnoses. Third, whilst the presence of multiple observations was accounted for in the multiple regression analysis, the coefficients of variation and the comparison between the median lengths of stay did not reflect this. The findings from these bivariate tests may, therefore, be biased. Finally, the trimmed groups did result in improved coefficients of variation, but such removal of outliers is contentious. The 9.8% of patients trimmed from the Camberwell sample accounted for 46.3% of all in-patient days, and in Pavia 6.8% of patients were trimmed and these accounted for 28.7% of bed use. Trimming does result in improved homogeneity, but determinants of such disproportionate resource use need to be identified.

Other factors that might effect length of stay were not included in the study. This is not in itself a limitation because the aim was to examine the impact specifically of diagnosis, although we did include age and gender. Potential predictors of variations in length of stay might include family background, physical health, comorbidity with substance misuse and living arrangements. The rate of readmission might also influence length of stay, but this was not tested. A further factor could be the legal status of the admission. Those people compulsory detained might well have increased lengths of stays compared to those admitted voluntarily. Croudace et al. have indicated that differences in service organisation might be more important than patient level characteristics in determining length of stay [15].

We have confirmed that when psychiatric casemix is defined in terms of diagnostic groupings, variation in length of stay is left largely unexplained. Differences in casemix homogeneity do exist in diverse service settings, but these differences are not substantial. The greater diagnosis group homogeneity in Pavia is probably because with a shorter length of stay clinical factors will be more influential than with a prolonged stay, where supply-side issues will be significant.

In the UK, version 3 HRGs have been constructed and these have incorporated a number of socio-demographic factors to improve their predictive capabilities [16]. This process is continuing so that the information and financing needs of the UK National Health Service can be better met. In Italy, DRGs are currently being used to finance psychiatric in-patient care. It is clear that there is a great demand for effective measures of psychiatric casemix, but it is also apparent that development of these measures must continue and generate improved group homogeneity.

Conclusion

Using descriptive statistics and multiple regression analysis with multiple observations accounted for, this paper has confirmed that length of stay is shorter in Pavia than Camberwell. The coefficients of variation for HRGs in Pavia were generally better than in Camberwell. The multiple regression analysis showed that

diagnosis-based casemix, as has been revealed in numerous other studies, was a poor predictor of length of stay in both Camberwell and Pavia. The first two hypotheses were confirmed. The third was partly confirmed in that HRGs were generally more homogeneous in Pavia than Camberwell, but when used in a regression model there was no difference in predictive power.

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