Predicting Length of Stay for Patients with Psychoses

Carleen Stoskopf and Susan Dadakis Horn

The Computerized Psychiatric Severity Index (CPSI) and 22 patient variables were used to predict length of hospitalization for 304 psychiatric patients in DRG 430 who were diagnosed with schizophrenia or affective disorder and had no secondary diagnoses. Length of stay, which correlated .96 with total charges, was used as the dependent variable (measure of resource use). The patient variables and CPSI score explained 32.5 percent of the variation in length of stay for all of DRG 430 (27.5 percent for affective disorder patients and 70.3 percent for schizophrenia patients). Addition of the treatment variable "receipt of ECT" (electroconvulsive therapy) permitted the regression models to explain 40.9 percent of the variation in length of stay (36.24 percent for affective disorder and 71.22 percent for schizophrenia). In each regression model, maximum CPSI score was significant, indicating that much heterogeneity in DRG 430 can be explained by CPSI. Using one payment for such a diverse group places health care institutions at great risk of financial loss. Our study indicates that a continuing need exists for research in the area of case-mix measures for psychiatric inpatients.

In 1983, when Medicare implemented the prospective payment system (PPS) based on diagnosis-related groups (DRGs) (U.S. Congress 1987), psychiatric facilities that applied for a waiver were excluded

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Address correspondence and requests for reprints to Carleen Stoskopf, Sc.D., Assistant Professor, Department of Health Administration, School of Public Health, University of South Carolina, Columbia, South Carolina 29208. Susan Dadakis Horn, Ph.D. is Professor in the Department of Health Policy and Management, School of Hygiene and Public Health, The Johns Hopkins University. This article, submitted to *Health Services Research* on January 5, 1990, was revised and accepted for publication on January 17, 1991.

from the PPS because studies had not yet been completed using appropriate data. The DRG system has been shown to explain only 2 percent to 15 percent of the variation in resource use for psychiatric inpatients (Leff et al. 1985; Blue Cross of Western Pennsylvania 1985; Taube, Lee, and Forthofer 1984; Rockburn Institute and Lewin and Associates 1985; Frieman et al. 1985; American Psychiatric Association 1985; Horn, Horn, and Sharkey 1984; Essock-Vitale 1985). Thus, if DRGs had been used for reimbursement, payments in various facilities might have been poorly correlated with the actual consumption of resources for patient care.

Reacting to the poor predictive ability of DRGs for psychiatric illnesses, several research groups have developed alternative psychiatric case-mix measures. Some of these case-mix measures are based on discharge abstract data only: (a) disease staging (Garg 1978; Gonnella and Goran 1975); (b) patient management categories (Blue Cross of Western Pennsylvania 1985); and (c) clinically related groups (Macro Systems, Inc. 1985).

Other case-mix measures use additional information from patient records: (1) functionally related groups (Leff et al. 1985; Leff and Bradley 1986) use information from the medical record to determine the functional level of a psychiatric patient, from category one (dangerous to self or others) to category seven (system independent); (2) alternate DRGs (Taube, Lee, and Forthofer 1984) modify the original DRG system to include age, marital status, legal status, discharge status, prior mental health care, type of treatment, and referral status; and (3) case mix groupings (Lewin and Associates 1985) use 45 variables available in the patient's medical record to place each patient into 1 of 13 patient categories.

THE COMPUTERIZED PSYCHIATRIC SEVERITY INDEX

The Computerized Psychiatric Severity Index (CPSI) is a second generation of the Psychiatric Severity of Illness Index (PSII) case-mix measure developed by Horn and Pauker at The Johns Hopkins Medical Institutions in the early 1980s. The purpose of the PSII was to determine if additional information on severity of illness could be useful in predicting variation in resource use (Horn 1985; Horn et al. 1989). The PSII was an attempt to quantify the complexity and difficulty of individual case management based on a review of the medical record. The PSII explained 34–50 percent of the variation in length of

stay (LOS) for all psychiatric patients, a significant improvement over the 2–15 percent of the variation explained by DRGs alone. When PSII was placed within DRGs the explained variation increased to 40–54 percent (Horn et al. 1989).

The CPSI uses the patient's ICD-9-CM diagnosis codes to ask disease-specific questions about the patient (Horn 1988, 1989; Stoskopf and Horn 1991). The most important difference between the CPSI and the PSII is the reliance on objective measures of illness in the CPSI, such as recorded signs and symptoms, laboratory values, vital signs, and radiological findings (Horn 1989). The result is a severity score on a scale of 1 to 4 for each of a patient's diagnosis codes as well as an overall severity score on a scale of 1 to 4. The disease-specific CPSI severity score can be determined at various points in time to describe the admission severity of the patient, the maximum (peak) severity over the whole hospital stay, and the discharge severity. The admission severity includes data from the admission day plus the first full hospital day. It is designed to assess the extent of the sickness of the patient on admission to the hospital. The maximum CPSI uses data from the entire hospital stay, including the admission and discharge reviews. It measures the most aberrant findings, regardless of their time of occurrence. For example, a patient may peak on hallucinations one day, withdrawal another day, agitation a third day, and so on, and all of these criteria will be counted in the maximum CPSI. The idea is to measure the worst findings, because when multiple problems occur, it takes longer and is more difficult to bring the patient back to baseline. The discharge review includes data from both the discharge day and the previous hospital day. Reliability of CPSI scoring is assessed with Finn's r (Whitehurst 1984).

PATIENT VARIABLES

Several researchers have addressed the appropriateness of using additional patient variables, either by themselves or in combination with other case-mix measures such as DRGs, to explain variation in resource use or length of stay for psychiatric patients. Patient variables that have been shown to have a statistically significant relationship with LOS or total cost are: age, social support, and history of prior mental illness.

A quadratic relationship between age and LOS has been reported in a number of studies, with children and the elderly experiencing longer periods of hospitalization (Rockburn Institute and Lewin and Associates 1985; Essock-Vitale 1985). Medicare psychiatric patients

under age 65 have been found to have shorter lengths of stay than Medicare psychiatric patients over age 65 (Morrison, Wright, and Frye 1985).

Good social support was found in some cases to be correlated with decreased length of stay (Taube, Lee, and Forthofer 1984). Social support can be measured in several ways, with marital status used most often as a proxy. Leff et al. (1985) used the dichotomous variable of a difference between admission address and discharge address to indicate social support; that is, a person's return to his or her original family indicated good social support and a patient's discharge to another facility or family meant that social support was poor.

Leff's results were positive: good social support correlated with shorter LOS. Other studies, however, failed to find a relationship between social support and length of psychiatric hospitalization (Blue Cross of Western Pennsylvania 1985; Rockburn Institute and Lewin and Associates 1985).

Several studies produced findings relating prior psychiatric hospitalizations and length of subsequent hospitalizations. Blue Cross of Western Pennsylvania (1985), McGuire, Dickey, and Shively (1985), and the study by the National Association of Private Psychiatric Hospitals (NAPPH) (Rockburn Institute and Lewin and Associates 1985) all found that a history of prior psychiatric hospitalization was related to longer LOS, and if a patient's most recent previous hospitalization had been lengthy, then that patient was more likely to have a long LOS in the present hospitalization (Morrison, Wright, and Frye 1985). Morrison reported that as the number of readmissions increased, the LOS decreased (Morrison, Wright, and Frye 1985). McGuire (McGuire, Dickey, and Shively 1985) found a decrease in the readmission rate if the LOS was longer.

As expected, if a patient left against medical advice, the LOS was significantly shorter (Blue Cross of Western Pennsylvania 1985; American Psychiatric Association 1985; Essock-Vitale 1985). Also, the presence of a secondary or tertiary diagnosis, a medical procedure, or a complication due to a psychiatric diagnosis increased the LOS (American Psychiatric Association 1985; Essock-Vitale 1985).

Researchers in psychiatry and psychology were interested in predictors of length of stay for psychiatric patients long before the advent of prospective payment. In 1946, Dunham and Meltzer looked at 30 factors to determine their correlations with LOS in schizophrenic and manic-depressive patients. Dunham found that duration of psychosis, psychiatric prognosis, marital status, insight, and age correlated above .20 with LOS.

In 1959, Lindemann studied 21 demographic characteristics for their ability to predict LOS. Four variables differentiated short-stay patients from long-stay patients: diagnosis, degree of incapacity, legal competence, and alcoholism (Lindemann et al. 1959).

In 1977 Munley, DeVone, Einhorn, et al. (1977) used a multiple regression model with 21 demographic and clinical characteristic variables to predict length of hospitalization and readmission. They found that five of these variables explained 20.3 percent of the variation in LOS: age, history of commitment, number of prior psychiatric hospitalizations, recent employment history, and past history of suicidal behavior.

Cyr and associates used a regression model with 43 demographic and clinical variables to predict LOS (Cyr and Haley 1983). Eleven of the variables were found to be significant at the .05 level: being single, the month of admission, a diagnosis of schizophrenia, admission of the patient for observation in order to make a diagnosis, no one accompanying the patient to admission, the correspondent's address differing from the patient's, employment status, sex, number of psychiatric admissions, age at admission, and the cumulative length of stay in the past five years. The maximum R^2 obtained in this analysis was 30.72 percent, significant at the .001 level.

METHODS

DATA

The CPSI was applied to 304 psychiatric inpatients in DRG 430 from the psychiatric unit of a 1,000 bed tertiary, urban, teaching research hospital. The sample comprised all patient discharges from July 1, 1985 to March 31, 1986, with the principal diagnosis of schizophrenia (ICD-9 codes 295.00–295.99) or affective disorder (ICD-9 codes 296.00–296.99), and with no secondary psychiatric diagnoses. Because this was the initial test of the CPSI criteria, we wanted the sample to be as straightforward as possible. The total sample consisted of 243 cases of affective disorder and 61 cases of schizophrenia. A detailed description of the sample is given elsewhere (Stoskopf and Horn 1991).

Two criteria sets were used, one to cover ICD-9 codes 295.00–295.99 (schizophrenia) and one to cover ICD-9 codes 296.00–296.99 (affective disorder). These criteria sets represented expert clinical opinion regarding the severity of various signs and symptoms of these illnesses in four broad areas: (1) mental status, (2)

psychiatric history, (3) medical complications, and (4) psychosocial factors. After the patient was rated, disease-specific severity levels and an overall severity score were assigned based on rules for weighting the items in the criteria sets. Details of the criteria and weighting rules, along with examples of actual cases are presented elsewhere (Stoskopf and Horn 1991).

Interrater reliability was studied by comparing the ratings of two psychiatrists and a clinical psychologist with the study rater. The Finn's r agreement statistic (Whitehurst 1984), calculated for each combination of raters, ranged from 0.824 to 0.848, indicating a high level of reliability (Stoskopf and Horn 1991).

Each study patient's record was rated twice with the CPSI criteria sets: once based on the information available during the first 48 hours of hospitalization (admission CPSI), and once based on all of the information in the medical record, to obtain a maximum CPSI score. The admission and maximum CPSI scores agreed in 89.5 percent of the cases. The maximum CPSI score alone explained 13.7 percent of the variation in LOS. It performed slightly better for affective disorder than for schizophrenia when the data were sorted by diagnosis (Stoskopf and Horn 1991).

We investigated the utility of collecting CPSI, patient, and treatment variables from the patient's medical record to improve the explained variation in length of psychiatric hospitalization for schizophrenia and affective disorder cases. Forty-five variables were collected from the medical records of the 304 study cases (see Table 1), and another five variables were collected from the hospital discharge abstract data base.

ANALYSES

Multiple regression analyses were performed to determine the extent to which the variables, including the maximum CPSI score, predicted variation in length of stay. A SAS Max R^2 multiple regression analysis was used. Length of stay was the dependent variable because it was highly correlated with total cost ($r = .96$). The variables in Table 1 that are marked with an asterisk are the variables that were entered into the regression models. The basis for inclusion in the regression models was whether or not that particular variable had a statistically significant relationship with the dependent variable, length of stay. To determine this, a one-way analysis of variance (ANOVA) was performed for each nominal variable and a simple linear regression was run for each continuous variable.

Table 1: Variables Collected from 304 Patient Records

Age*	Axis V rating under the DSM-III manual
Sex	DSM-III Axes ratings recorded by physicians in the medical record
Race*	Number of consultations outside of psychiatry*
Marital Status*	Taking major tranquilizers at admission
Nature of admission (emergency, urgent, elective)	Taking minor tranquilizers at admission*
Expected source of payment*	Taking antidepressants at admission*
Number of persons residing in household	Taking sleep inducers at admission
Homelessness	Taking lithium at admission
Occupation*	Taking major tranquilizers at the time of discharge*
Help at home*	Taking minor tranquilizers at the time of discharge
Number of previous hospitalizations	Taking antidepressants at the time of discharge*
Age of first psychiatric admission	Taking sleep inducers at the time of discharge
Age of first psychiatric care	Taking lithium at the time of discharge
Previous outpatient psychiatric care	Admission to rule out a previous diagnosis*
Previous admission to this particular hospital*	Payer*
Negative reference to alcohol use in record	Unit number*
Use of illicit drugs*	Special cases code*
History of arrest*	Severity rating*
Family history of mental illness	Disposition of patient*
Learning disability*	Religion
Episodes of life-threatening or chronic illness	Education
Conduct problem	Head of household
Use of electroconvulsive therapy (ECT) at least once*	Unemployment referral*
Number of ECT treatments	
Mini-mental examination score	
Seclusion or restraints used	
Axis IV rating under the DSM-III manual	

*Variable entered into the regression models.

Because age, age of first psychiatric admission, and age of first psychiatric care were so highly correlated, only age was used in the regression model. It was quantified in three age categories: <25 years, 25–64 years, and ≥ 65 years. The maximum CPSI and admission CPSI scores were also highly correlated (Spearman $r_s = .90$); thus, only the maximum CPSI score was used in the regression models.

The variable "use of ECT" was used in the multiple regression model in place of the variable "number of ECT treatments," since there was a high Spearman rank correlation between the two variables ($r_s =$

.98). The "use of ECT" was treated as a dichotomous variable, with "yes" meaning that at least one treatment was given, and "no" meaning that no treatments were given.

Eight nominal variables were collapsed into fewer categories to reduce the number of dummy variables entering the regression equations. These are: (1) marital status, collapsed into "married" or "not married"; (2) help at home, either "yes" or "no"; (3) occupation, collapsed into "white collar," "blue collar," and "unemployed"; (4) referral, either "emergency" or "other"; (5) number of consultations, reduced to "at least one" or "no consultations"; (6) race, reduced to "white" or "other"; (7) disposition, collapsed into three categories—"to home," "left against medical advice," and "to other care"; and (8) special cases codes, reduced to either having a special cases code or not.

Variables treated as dichotomous were use of illicit drugs, arrest history, learning disability, admission for differential diagnosis, minor tranquilizers at admission, antidepressants at admission, major tranquilizers at discharge, and antidepressants at discharge.

Six regression analyses were performed in two sets of three each. The first set of three regression runs excluded the treatment variable "use of ECT" (electroconvulsive therapy). The second set of three regression runs included the "use of ECT" variable. In each set, three models were tested: one for all patients in DRG 430, one for all patients with a principal diagnosis of affective disorder, and one for all patients with a principal diagnosis of schizophrenia. In the regression models for all patients in DRG 430, diagnosis was entered as an additional independent variable.

RESULTS

STUDY SAMPLE CHARACTERISTICS

The study sample characteristics are described in detail elsewhere (Stoskopf and Horn 1991). Briefly, most of the patients were female (68 percent) and between the ages of 25–64 (59 percent). The schizophrenia patients were younger on average, with 97 percent of the cases less than 65 years of age, while 69 percent of the affective disorder patients were less than 65. Race differed in the two disease groups: the affective disorder patients were mostly white (70 percent), whereas the schizophrenia patients were mostly black (72 percent).

Table 2: Severity and Patient Variables Predicting Length of Stay for DRG 430

R^2 = *0.3255*		F *15.76*	*Prob > F* *0.0001*
Variable	*B Value*		
Intercept	11.4478		
Maximum CPSI 2	5.6256	6.49	0.0113
Maximum CPSI 3	8.8209	14.86	0.0001
Maximum CPSI 4	20.3373	26.60	0.0001
Age 25-64	-3.3849	3.81	0.0519*
Medicare	7.2540	12.70	0.0004
Blue Cross	6.0837	10.95	0.0011
Disposition to home	6.5345	10.06	0.0017
Antidepressants at admission	4.5173	6.74	0.0099
Major tranquilizers at discharge	-5.6597	13.41	0.0003

Order in which variables entered into the model:

Variable	R^2
Major tranquilizers at discharge	0.1212
Medicare	0.1828
Blue Cross	0.2168
Maximum CPSI 4	0.2450
Disposition to home	0.2687
Maximum CPSI 3	0.2888
Antidepressants at admission	0.3043
Maximum CPSI 2	0.3167
Age 25-64	0.3255

*The age group 25-64 is marginally significant.

SEVERITY AND PATIENT VARIABLES AS PREDICTORS OF LENGTH OF STAY

Three regression models were studied. The first model entered the patient variables, the diagnosis, and the maximum CPSI score, regressing them on LOS (in days) for all patients in DRG 430. This regression resulted in nine significant variables explaining 32.55 percent of the variation in length of stay. Table 2 shows the regression coefficients, *F*-statistics, probability $\geq F$, R^2, and the order in which the variables entered into the regression equation.

The second model included the patient variables and the maximum CPSI score, regressing them on length of stay for all patients who were diagnosed with affective disorders (ICD-9 296.00-296.99). More than 27 percent of the variation in LOS was explained with six significant variables. Table 3 displays these results.

Table 3: Severity and Patient Variables Predicting Length of Stay for Affective Disorder

R^2 = 0.2750		F	*Prob* > F
		14.92	*0.0001*
Variable	*B Value*		
Intercept	11.9051		
Maximum CPSI 3	6.4997	12.73	0.0004
Maximum CPSI 4	15.4923	16.46	0.0001
Medicare	10.2869	22.66	0.0001
Blue Cross	6.0876	7.69	0.0060
Disposition to home	7.8446	9.93	0.0018
Major tranquilizers at discharge	-4.9932	7.09	0.0083

Order in which variables entered into the model:

Variable	R^2
Medicare	0.1049
Maximum CPSI 3	0.1491
Maximum CPSI 4	0.1931
Major tranquilizers at discharge	0.2238
Disposition to home	0.2514
Blue Cross replaces major tranquilizers at discharge	0.2532
Major tranquilizers at discharge	0.2750

The third regression model regressed the patient and severity variables on those patients diagnosed with schizophrenia, resulting in 70.3 percent explained variation in LOS with eight significant variables. These results are presented in Table 4.

SEVERITY, PATIENT VARIABLES, AND ECT AS PREDICTORS OF LENGTH OF STAY

The first of this set of regression models for all of DRG 430 resulted in an R^2 of 40.88 percent. Nine variables entered significantly into the model. The results (regression coefficients, *F*-statistics, and probability $\geq F$) of the regression model are shown in Table 5.

The second model of this set looked at the ability of the patient variables, ECT, and CPSI to predict length of stay for affective disorder patients only. The R^2 for this model is 36.24 percent, with seven variables entering the model significantly. These results are shown in Table 6.

The third model, predicting length of stay for patients with schizophrenia, explained 71.22 percent of the variation in length of stay.

Table 4: Severity and Patient Variables Predicting Length of Stay for Schizophrenia

R^2 = *0.7030*		F	*Prob* > F
		15.39	*0.0001*
Variable	*B Value*		
Intercept	6.3260		
Maximum CPSI 2	7.8813	16.74	0.0001
Maximum CPSI 3	5.1282	5.80	0.0196
Medicare	5.3477	7.81	0.0072
Unit 4	-12.0745	7.10	0.0102
Emergency referral	3.9246	6.04	0.0173
Learning disability	9.5197	10.32	0.0023
Rule out previous diagnosis	20.9690	32.60	0.0001
Antidepressants at admission	13.8328	14.63	0.0004

Order in which variables entered into the model:

Variable	R^2
Rule out previous diagnosis	0.3065
Antidepressants at admission	0.4400
Maximum CPSI 2	0.4939
Medicare	0.5696
Maximum CPSI 3	0.6147
Learning disability	0.6413
Unit 4	0.6685
Emergency referral replaces Maximum CPSI 3	0.6699
Maximum CPSI 3	0.7030

Eight variables entered the regression model significantly. These results are presented in Table 7.

DISCUSSION

SEVERITY AND PATIENT VARIABLES PREDICTING LOS FOR DRG 430

The maximum CPSI scores entered the regression with monotone-increasing coefficients; maximum CPSI level 2 added 5.6 days to the LOS, maximum CPSI level 3 added 8.8 days, and maximum CPSI level 4 added 20.3 days. This is consistent with the expectation that increased CPSI severity usually results in increased length of stay (Table 2).

Medicare and Blue Cross were two payer variables that were significant in the model, adding 7.25 and 6.08 days, respectively. This

Table 5: Severity, Patient Variables, and Electroconvulsive Therapy Predicting Length of Stay for DRG 430

R^2 = 0.4088		F 22.59	Prob > F 0.0001
Variable	*B Value*		
Intercept	7.8696		
Maximum CPSI 2	4.5367	4.89	0.0279
Maximum CPSI 3	6.0589	7.86	0.0054
Maximum CPSI 4	13.5775	13.01	0.0004
Medicare	7.4524	19.42	0.0001
Blue Cross	5.2466	9.24	0.0026
Electronconvulsive therapy (ECT)	11.5817	45.82	0.0001
Disposition to home	5.7053	8.94	0.0030
Antidepressants at admission	4.0810	6.30	0.0126
Major tranquilizers at discharge	-3.0125	4.04	0.0454

Order in which variables entered into the model:

Variable	R^2
ECT	0.2642
Medicaid	0.3118
Antidepressants at admission	0.3310
Medicare	0.3483
Blue Cross replaces Medicaid	0.3528
Disposition to home replaces antidepressants at admission	0.3545
Antidepressants at admission	0.3712
Maximum CPSI 4	0.3842
Major tranquilizers at discharge	0.3929
Maximum CPSI 3	0.3990
Maximum CPSI 2 replaces major tranquilizers at discharge	0.4007
Major tranquilizers at discharge	0.4088

result is not surprising as elderly people have been found to have longer lengths of stay. In this study sample, 72 percent of the patients on Medicare were over age 65. Blue Cross/Blue Shield policies vary greatly and it is difficult to determine if a cap exists on some policies. It may be assumed, however, that the Blue Cross/Blue Shield policies have more generous reimbursement for psychiatry than Medicaid, for example. Medicare patients had more consultations outside psychiatry (58 percent), compared to 45 percent for Blue Cross and 31 percent for Medicaid patients. The frequency distribution and average LOS by payer are found in Table 8, where Medicare and Blue Cross/Blue Shield patients are shown to have longer average LOS. In this table, the 44 patients under "other" payer refer to patients with either com-

Table 6: Severity, Patient Variables, and Electroconvulsive Therapy Predicting Length of Stay for Affective Disorder

R^2 = *0.3624*		F *19.08*	*Prob* > F *0.0001*
Variable	*B Value*		
Intercept	7.3034		
Maximum CPSI 3	4.3208	6.06	0.0145
Maximum CPSI 4	10.8118	8.56	0.0038
Medicare	9.2733	21.72	0.0001
Blue Cross	5.8589	8.13	0.0047
Electronconvulsive therapy (ECT)	11.1725	35.74	0.0001
Disposition to home	7.4747	10.19	0.0016
Antidepressants at admission	3.6623	4.12	0.0434

Order in which variables entered into the model:

Variable	R^2
ECT	0.2261
Medicare	0.2689
Disposition to home	0.2953
Blue Cross	0.3202
Maximum CPSI 4	0.3335
Maximum CPSI 3	0.3512
Antidepressants at admission	0.3624

mercial insurance, self-pay, or no pay. This is the way the data were coded in the discharge abstract data available.

Disposition to home increased the length of stay by 6.5 days (Table 2). The mean LOS for the 260 patients being discharged home was 24.9 days, while those discharged to other facilities (another psychiatric institution or a nursing home, $N = 26$) or an organized care situation (home health care, $N = 4$) had a mean LOS of 22.4 days. It appears that those individuals who are going home may be kept slightly longer since no formal, organized care is available once the patient leaves the hospital. Patients going to a more structured environment may be released earlier.

Patients who were recorded as taking antidepressants at the time of admission are found to have longer lengths of stay. In order for a patient to have been classified as being on a medication at the time of admission, the patient had to report that he or she was actually taking the medication, and this information had to be verified by another person, such as a friend, spouse, other family member, health professional, or social worker. The mean LOS for patients on antidepressants at the time of admission was 29.6 days, whereas those not on antide-

Table 7: Severity, Patient Variables, and Electroconvulsive Therapy Predicting Length of Stay for Schizophrenia

R^2 = 0.7122		F	Prob > F
		16.09	0.0001
Variable	*B Value*		
Intercept	14.3416		
Maximum CPSI 2	7.3016	13.77	0.0005
Maximum CPSI 3	4.8040	5.16	0.0273
Medicaid	-6.3191	15.98	0.0005
Unit 4	-8.9123	4.09	0.0482
Learning disability	7.9757	7.66	0.0078
Electroconvulsive Therapy (ECT)	19.1635	17.21	0.0001
Self-pay expected source of payment	-10.3114	8.74	0.0047
Antidepressants at admission	10.4110	7.76	0.0074

Order in which variables entered into the model:

Variable	R^2
ECT	0.4015
Antidepressants at admission	0.4876
Medicare	0.5416
Maximum CPSI 2	0.5892
Medicaid replaces Medicare	0.5907
Self-pay expected source of payment	0.6309
Maximum CPSI 3	0.6610
Learning disability	0.6896
Unit 4	0.7122

Table 8: Frequency Distribution and Average Length of Stay for DRG 430, Affective Disorder, and Schizophrenia

	Payer			
	Blue Cross	*Medicare*	*Medicaid*	*Other*
DRG 430	77 (23%)	103 (34%)	80 (26%)	44 (14%)
Affective disorder	68 (28%)	91 (38%)	47 (19%)	37 (15%)
Schizophrenia	9 (15%)	12 (20%)	33 (54%)	7 (11%)
Average Length of Stay (in days)	25.75	30.97	19.93	19.77

pressants at admission had a mean LOS of 22.4 days. The results of the regression analysis indicate that being on antidepressants adds 4.5 days to the LOS. It may be that patients who are actually taking prescribed medication and who still require hospitalization may be showing some

Table 9: Frequency Distribution and Average Length of Stay by Age Groups for DRG 430, Affective Disorder, and Schizophrenia

	Age		
	≤24 Years	*25-64 Years*	*≥65 Years*
DRG 430	47 (16%)	180 (59%)	77 (25%)
Affective Disorder	30 (12%)	138 (57%)	75 (31%)
Schizophrenia	17 (28%)	42 (69%)	2 (3%)
Average length of stay (in days)	21.87	21.58	31.22

treatment resistance, making treatment in the hospital more difficult, and consequently of longer duration.

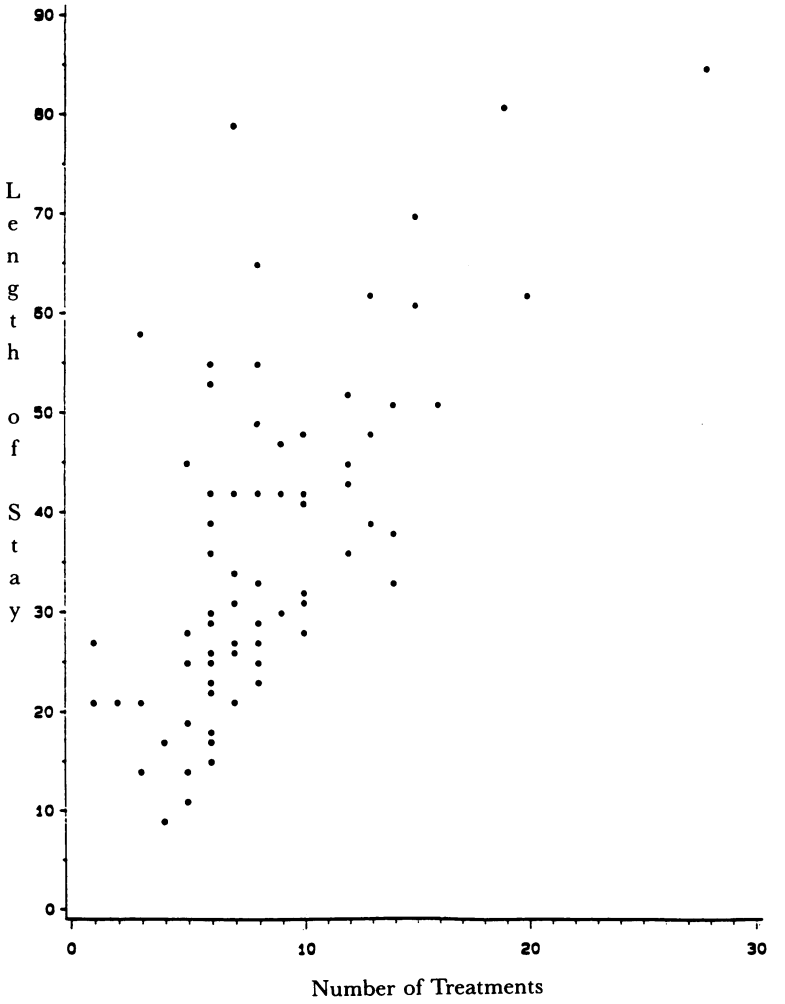
Patients who received discharge prescriptions for major tranquilizers reduced their LOS by 5.7 days. The mean LOS for patients receiving a major tranquilizer at discharge was 18.7 days, and for those not receiving a major tranquilizer on discharge, it was 29.0 days. Since major tranquilizers are antipsychotic medications used in reducing psychoses, the use of such medication, it would appear, stabilizes the patient more quickly and permits earlier discharge of the patient.

The age of a patient is marginally significant in this model. Being in the middle age category (25–64) reduced the LOS by 3.4 days. This finding is consistent with results of previous studies showing that children and the elderly had longer lengths of stay (Essock-Vitale 1985). Table 9 contains the frequency distribution and average LOS by age group.

SEVERITY, PATIENT VARIABLES, AND ECT PREDICTING LOS FOR DRG 430

There is much controversy over the use of treatment variables in case-mix systems and/or payment systems because of potential incentives for the care provider to alter treatment in order to obtain higher payments. Clearly, the use of ECT adds to the length of stay. The mean LOS of patients receiving ECT was 36.7 days; those not receiving ECT had mean LOS of 19.5 days. The strong relationship between LOS and the number of ECT treatments can be seen in Figure 1. This is not unexpected once ECT treatment commences. General clinical practice dictates two to three days between treatments. The multiple regression model for DRG 430 shows that receiving ECT adds 11.58 days to the LOS (Table 5). Furthermore, when included among the

Figure 1: Length of Stay versus Number of Electroconvulsive Therapy Treatments



independent variables, ECT enters the model first and accounts for more than 26 percent of the variation in LOS by itself. A comparison can be made by contrasting the results reported in Tables 2 and 5.

When ECT is added to the regression equation, the categorical age variable is no longer significant. The other patient variables and maximum CPSI score are still significant in the model, and although

the number of days added or subtracted to the LOS by each of these variables is altered somewhat, each variable continues to exert influence in the same direction. With the exception of Medicare, all of the variables have somewhat less influence on the LOS (i.e., have smaller magnitude in Table 5) than they did when ECT was not in the model (see Table 2).

SEVERITY AND PATIENT VARIABLES PREDICTING LOS FOR AFFECTIVE DISORDER

Seven variables explained 27.5 percent of the variation in length of stay for affective disorder patients. Maximum CPSI level 2 was not significant in this model, but maximum CPSI levels 3 and 4 added 6.5 and 15.5 days to the LOS, respectively. The results of this regression are reported in Table 3.

Medicare, Blue Cross, and disposition to home enter the equation much as they did for all of DRG 430. Medicare has a greater impact in this model, however, adding more than ten days to the LOS. The explanations for the significance of the variables in this model (affective disorder only) are the same as for all of DRG 430.

Antidepressants at admission is not a significant variable in this model. Only 26 percent of patients admitted with a diagnosis of affective disorder were actually taking antidepressants at admission. The variable major tranquilizer given at the time of discharge remains significant in this model and decreases the LOS by five days. Some affective disorder patients (37 percent) were given antipsychotic medications at the time of discharge; these are probably the manic-depressive patients.

SEVERITY, PATIENT VARIABLES, AND ECT PREDICTING LOS FOR AFFECTIVE DISORDER

When ECT is added to the regression model for affective disorder patients, the explained variation increases from 27.5 percent to 36.2 percent, and mean LOS increases by 11.2 days (Table 6). As in the model that excludes the treatment variable ECT, maximum CPSI levels 3 and 4, Medicare, Blue Cross, and disposition to home are significant, continuing to influence LOS in the same direction with only some minor differences in the number of days these variables add to the LOS.

In contrast to the model that excludes ECT, this model no longer has major tranquilizers given at discharge as significant; instead, the model now includes the variable major antidepressants at admission,

which adds 3.7 days to the LOS. Patients who are on antidepressants at the time of admission are severely depressed and therefore are more likely to receive ECT or are more likely to be difficult to manage. On the other hand, patients who receive major tranquilizers on discharge may have psychotic symptoms such as hallucinations.

SEVERITY AND PATIENT VARIABLES PREDICTING LOS FOR SCHIZOPHRENIA

The 61 schizophrenia patients are a very different population from the 243 affective disorder patients. The schizophrenia patients in this study are predominately black, young, reside in a local inner-city neighborhood, and receive Medicaid, which has a cap of 16 days for each inpatient admission in the study hospital's state (Stoskopf and Horn 1991). Eight variables account for 70 percent of the variation in resource use (Table 4).

In this model, admission to the hospital for purposes of diagnosis differentiation (ruling out a previous diagnosis) explained greater than 30 percent of the variation in LOS alone. The regression coefficient indicates that if a patient is admitted for this reason, nearly 21 days are added to the LOS. The mean LOS for schizophrenia patients admitted for this purpose is 40.33 days, where those not admitted for ruling out a diagnosis have a mean LOS of 15.76 days.

As with differential diagnosis, a patient admitted on antidepressants added 13.8 days to the LOS. Only one patient was both a differential diagnosis admission and admitted on antidepressants; that patient was hospitalized 63 days.

Maximum CPSI levels 2 and 3 entered the regression model as significant. There were no maximum CPSI level 4 schizophrenia cases in the sample. Unexpectedly, maximum CPSI level 2 added 7.88 days to the LOS while maximum CPSI level 3 added only 5.1 days. This reflects the fact that schizophrenia patients at maximum CPSI level 2 have a mean LOS of 19.7 days, compared to maximum CPSI level 3, with mean LOS of 15.7 days (Stoskopf and Horn 1991). There are several possible reasons for this aberration in schizophrenia. The study hospital has several programs aimed at reducing LOS for its psychiatric patients. There is a day hospital providing supervision for patients who otherwise might be left alone for many hours out of each day. Second, there is an outreach program designed to assist the patient, especially schizophrenia patients, to continue on medication, a problem commonly cited as a reason for readmission. Hospital personnel go out into the community to locate their clients, administer the medica-

tion, and ensure that the patient has money, shelter, and access to food. The programs are funded on a fee-for-service basis. The structure of these programs provides contact with and organization of the patient's environment. Third, the hospital is part of a hospital system that can provide a continuum of care, is a major provider in the area, and maintains good relationships with the community.

The schizophrenia population in this study is unique in many respects. The schizophrenia patients tend to be local, with 61 percent coming from the immediate community surrounding the hospital. This area is generally economically depressed in comparison to other areas of the city and its suburbs. The population of schizophrenics tends to be young (28 percent under age 24 and 69 percent between the ages of 24 and 64), represents a greater portion of blacks (72 percent), is largely unemployed (89 percent), and is on Medicaid (54 percent).

The mean length of stay for schizophrenia is 16.97 days, whereas for affective disorder the mean LOS is 25.6 days. Since the state cap on Medicaid reimbursement for psychiatric inpatient days is 16 days, it is difficult to ascertain what factors are actually driving this schizophrenia model. Medicare increases the LOS by 5.3 days, consistent with other models for all of DRG 430 and affective disorder.

Each of the variables—being on unit 4, having a learning disability, and emergency referral—entered the model significantly. A patient residing on unit 4 reduces the LOS by 12.1 days. This unit treats affective or eating disorders. The mean LOS for those patients on unit 4 in this study is only 5.5 days, whereas the mean LOS for the other units ranges from 15.8 to 20.3 days. Only two schizophrenic patients were assigned to unit 4 in this study. After an inquiry was made, the nursing staff suggested that these two patients might have been transferred to another unit when a bed became available, and that change would have been considered as a discharge in the medical record. This result appears to be an aberration in the data, and under normal circumstances residence on unit 4 would not be associated with a shorter LOS.

The presence of a learning disability adds 9.5 days to the LOS. The mean LOS for a schizophrenic with a learning disability is 28 days; those without a learning disability have a mean LOS of 16 days. A learning disability makes treatment more difficult, since the patient is less likely to have insight into his or her illness or is less likely to be able to conform to treatment regimens.

If a patient is admitted through the emergency room (emergency referral), nearly four days are added to the LOS. More than 50 percent of the schizophrenic admissions are through the emergency room,

whereas emergency referrals make up only 25 percent of the affective disorder cases. This finding may be explained by the existence of a psychotic episode severe enough to precipitate an emergency admission.

SEVERITY, PATIENT VARIABLES, AND ECT PREDICTING LOS FOR SCHIZOPHRENIA

When treatment with ECT is added to the regression model, the $R2$ increases by only 1 percent to 71 percent. ECT does, however, enter the model first and explains 40 percent of the variation in LOS alone (Table 7). Since only two schizophrenia patients in our study received ECT, and since ECT is not a common treatment for schizophrenia, the appropriateness of including this variable in a model to predict LOS for schizophrenia is questionable. It should be noted, however, that in this model, maximum CPSI levels 2 and 3, learning disability, and taking antidepressants at admission remain significant and continue to influence LOS in the same direction.

Medicaid became significant in this model, while Medicare was dropped from it. Medicaid reduces the LOS 6.3 days, a result that would be expected because of its cap. If the expected source of payment was self-pay, the LOS is reduced by more than ten days. This is the only time this particular variable entered any of the models studied. It is not unexpected that an institution might try to reduce inpatient hospitalization days dramatically for persons without insurance coverage. Being on unit 4 again entered this regression model, as in the previous model.

The models for schizophrenia are possibly weak due to a small sample size and a unique population. The affective disorder patients in this study appear to be more diversified and perhaps represent a better cross section of the affective disorder population.

CONCLUSION

A major finding of the study is that the diagnosis variable (affective disorder versus schizophrenia), when added to the regression models for all of DRG 430 (304 cases), was not significant. This clearly indicates that the two diagnostic categories are fairly homogeneous and that including them together in a case-mix grouping system may be appropriate.

There is a controversy among case-mix researchers regarding the use of treatment variables as factors in assigning cases to case-mix

categories. Philosophically, one is inclined to say that treatment regimens should not be used to classify cases for reimbursement, as the treatment of an individual case should be determined solely through the professional judgment of the attending health care provider. Clearly, to allow different payments for different treatments invites the possibility of altering treatment to maximize payment regardless of the characteristics of the individual case. On the other hand, when the use of a specific treatment regimen such as initiating electroconvulsive therapy influences the consumption of resources dramatically, as found in this study, it may be appropriate to include it. This is not without precedent, since the existence of operating room procedures influences DRG designation outside of psychiatry.

Psychiatric hospitals using DRGs for reimbursement are not now paid more for providing ECT. Our findings suggest that perhaps ECT should be treated as a procedure. There is a separate DRG for psychiatric patients who have a "procedure"; however, ECT is not considered to be such a procedure. ECT might also be used as a stratifying variable in the CPSI. Severity ratings would then be given on two groups, one group that does not receive ECT, and another group that does receive ECT. In either case, this significant variable should not be ignored by researchers developing psychiatric case-mix measures.

The CPSI addresses the issue of treatment complexity by imbedding this concept into the medical complications section of the severity criteria. There, a higher severity rating is given to patients who experience changes in medication due to treatment failure or due to medical complications. Likewise, a history of receiving ECT treatment is given consideration in the psychiatric history section. By imbedding these factors into the CPSI, one is measuring the difficulty in case management without specifying treatment or passing judgment on a particular treatment regimen (Stoskopf and Horn 1991).

In the various regression models studied, several variables repeatedly come to our attention. The three major payer groups, Medicare, Medicaid, and Blue Cross, are clearly important predictors of length of stay in this study sample. Medicare and Blue Cross consistently increase LOS, while Medicaid as a payer consistently decreases LOS. Medicare may be a proxy for age, and may represent a group of patients that have more comorbidities. Blue Cross may be expected to have a more liberal inpatient mental health benefit than either Medicare or Medicaid, which results in longer lengths of stay. Finally, Medicaid has a cap of 16 days for inpatient psychiatric care, a limit that profoundly decreases length of stay for these patients.

Discharge to home consistently added to the length of stay in the

regression models for all of DRG 430 and affective disorders. This finding was surprising, as we expected that patients returning directly to their homes might be less ill and that these patients would not incur any administrative waiting days. In retrospect, however, it appears that these patients are going to unsupervised and unstructured environments and therefore must be stabilized completely before discharge, whereas a patient going to another health care setting or to a structured environment (home health care, halfway house, day hospital, or other psychiatric facility) may be discharged in a less stable condition.

The use of two types of medication appears to influence length of stay: antidepressants being taken at the time of admission and major tranquilizers administered at the time of discharge. Antidepressants at admission increase LOS and may indicate a treatment-resistant patient who needs hospitalization in spite of compliance with medication. Receiving major tranquilizers at discharge appears to have a stabilizing effect and allows patients to be discharged earlier than one might otherwise expect. Since use of psychotropic medications is now common, the effect of drugs on LOS is an area that deserves further analysis.

In each regression model, the maximum CPSI score was significant. This clearly indicates that there is much heterogeneity in DRG 430 due to severity differences, despite the fact that the current reimbursement system makes the same payment for each patient in DRG 430. Using one payment for such a diverse group places health care institutions at risk for large financial losses. Great care should be used in implementing a payment mechanism for psychiatric care to avoid serious consequences for both the medical institutions and the patients they serve. Our study indicates a continuing need for research in the area of case-mix measures for psychiatric inpatients and, in particular, a need to consider disease-specific severity measures, such as the CPSI, rather than generic severity measures, such as those used historically by the Health Care Financing Administration and the Peer Review Organizations.

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