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The Impact of Psychiatric Diagnosis on Length of Stay in a University Medical Center in the Managed Care Era

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Inpatient use data were examined for fiscal years 1999–2001. Patients with and without psychiatric diagnoses were compared for length of hospital stay and complexity of illness. Patients with psychiatric disorders represented 33%–35% of total cases. Substance use (9,824 cases), mood disorders (2,524 cases), and cognitive disorders (2,362 cases) were the most common psychiatric illnesses. Patients with substance use disorders or no psychiatric diagnosis had the shortest adjusted length of stay, whereas the small number with adjustment disorders (N = 147) had the longest. Other psychiatric patients had lengths of stay between these extremes. Excepting substance use disorders, increased lengths of stay with psychiatric comorbidity have persisted into the managed care era. (Psychosomatics 2005; 46:431–439)

Comorbid psychiatric illness increases the challenges for delivering cost-effective medical and surgical care.[1] In the era of managed care, delivery of medical and surgical care in a resource-sensitive manner is a survival imperative for medical institutions, particularly inpatient medical centers, which are the most costly model of care. Most university medical centers face additional special challenges because of their responsibility to provide definitive care to a large community without regard to insurance status or ability to pay. In particular, university medical centers must be sensitive and responsive to the resource implications of psychiatric illness in medical/surgical inpatients.

Comorbid psychiatric illness in medical/surgical inpatients is common. Nearly 30 years ago, Maguire et al.,[2] using screening instruments on 230 medical inpatients, identified psychiatric illness in 23%. Silverstone,[3] in work published two decades later, performed semistructured psychiatric interviews on 313 consecutively admitted medical inpatients and found that 85 patients (27.2%) met DSM-IV criteria for a psychiatric disorder. Even higher rates were reported by Fulop et al.,[4] who prospectively interviewed 467 geriatric medical and surgical admissions and found 208 patients (44.5%) to have met DSM-III-R criteria for a psychiatric disorder.

Previous studies, employing various methods, have shown an effect of psychiatric comorbidity on medical/surgical length of stay (LOS). Ackerman et al.[5] studied 92 medical and surgical inpatients with comorbid DSM-III depressive disorders and found that the depressed patients had a mean LOS of 24.8 days, 2.5 days longer than their control subjects. Fulop et al.[4] found that patients with cognitive impairment had a 4-day excess LOS compared to patients without cognitive impairment (14.6 versus 10.6 days, respectively); anxiety and depressive disorders were not associated with an increased LOS. In another study, Fulop et al.[6] found that psychiatric comorbidity increased

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medical/surgical LOS from 9.2 to 19.8 days at one medical center and from 8.3 to 13.7 days at another. Their groups had 5.1% and 3.7% rates of psychiatric comorbidity, respectively. Levenson et al.[7] assessed 455 consecutively admitted medical inpatients with the Medical Inpatient Screening Test and found 51% of the patients to have a high degree of psychopathology or pain. This group had a 40% increased LOS (11.5 versus 8.7 days, respectively).

Lyons et al.[8] studied patients with head and spinal cord trauma and found the patients with comorbid psychiatric illness to have had a longer acute hospital LOS (39.0 versus 26.5 days) and a longer rehabilitation hospital LOS (52.8 versus 29.9 days). Morris and Goldberg[9] found an increased LOS for patients with peptic ulcer disease with psychiatric comorbidity (9.6 versus 7.5 days). Wancata et al.[10] prospectively interviewed 933 medical, surgical, gynecological, and rehabilitation inpatients in Austria and found a 32% prevalence of psychiatric comorbidity. Overall, the presence of psychiatric illness predicted an increased LOS, but further analysis indicated that only two specific psychiatric illness groups—with dementia and substance-related disorders—showed an increased LOS (the mean LOS for dementia was 23.5 days; for substance-related disorders, it was 15.4 to 16.0 days; and for no comorbid psychiatric illness, 11.5 days). Strain et al.[11] found a decreased LOS among elderly patients with hip fracture at two hospitals (20.7 to 18.5 days and 15.5 to 13.8 days, respectively) with proactive involvement of psychiatric consultation-liaison service. Furlanetto et al.,[12] in a Brazilian study, found an increase in hospital LOS from 12.1 days with no psychiatric comorbidity to 14.7 days with psychiatric comorbidity. Among psychiatric illnesses, only cognitive disorders were associated with increased LOS, whereas depressive, anxiety, and substance abuse disorders were not. A major 1994 review by Saravay and Lavin[13] of 26 prior studies of psychiatric comorbidity and LOS concluded that cognitive impairment, depressed mood, and other personality variables contributed to increased LOS.

Most prior studies examining psychiatric comorbidity and LOS were completed well before the impact of managed care significantly decreased inpatient hospital LOS. In addition, only Fulop et al. addressed the impact of psychiatric illness on all patients discharged from a medical/surgical hospital in a given year. We sought to explore whether psychiatric illness still had a significant impact on medical/surgical LOS in the managed care era, where typical LOS are dramatically shortened. Our hypothesis was that medical/surgical inpatients with a psychiatric diagnosis would continue to have a significantly increased LOS, even in the era of managed care, when overall LOS had been dramatically reduced by aggressive use of management practices. We were also interested to determine if some DSM-IV diagnosis groups would affect LOS more than others.

METHOD

The University of California, Davis Medical Center (UCDMC), located in Sacramento, is a 528-bed inpatient facility with a level-I trauma center that serves a large region of inland northern California. UCDMC maintains an active adult psychiatric consultation-liaison service, with services provided by three faculty psychiatrists (one full-time and two part-time), first- and fourth-year psychiatry residents, a clinical nurse specialist, and two to four third-year medical students. Only a small percentage of adult inpatients are referred for formal psychiatric consultation (1,042 inpatient consultations in 2001). UCDMC does not operate a psychiatric inpatient unit; patients who require inpatient psychiatric care and do not also require medical/surgical admission are admitted directly to several local psychiatric inpatient facilities and not to UCDMC itself. Thus, the data reviewed are not affected by cases of excessive LOS due to inpatient hospitalization exclusively for psychiatric illness.

Utilization data were obtained from the UCDMC Utilization Management Office for July 1998 through June 2001; this period represents the three fiscal years 1999, 2000, and 2001. Data for all patients ages 18 or older discharged during the study period were analyzed. Discharge billing data (which were coded with one primary diagnosis and up to 14 secondary diagnoses) were examined. Each discharge record was searched for ICD-9 codes, whether or not a psychiatry consultation had been obtained.[14] V-code conditions were excluded. Psychiatric ICD-9 codes were segregated into diagnosis groups, according to DSM-IV. Each record was assigned to one of the following eight groups: no psychiatric diagnosis, conditions related to substance use, anxiety disorders, cognitive disorders, mood disorders, schizophrenia and other psychotic disorders, adjustment disorders, or other psychiatric illnesses.

In the case of multiple psychiatric diagnoses, the case was assigned to the DSM-IV group with the psychiatric code of greater clinical significance among the discharge diagnosis codes. If a patient with two psychiatric diagnoses had one of the psychiatric codes as the "primary" diagnosis and the other psychiatric code as a "secondary" diagnosis (14 secondary diagnoses were allowed, in de-

creasing order of clinical significance), the case would have been assigned to the DSM-IV group containing the "primary" code. If two or more psychiatric diagnoses were coded but neither was the "primary" diagnosis, then the higher/highest ranked of the psychiatric diagnoses was used to sort the case into DSM-IV groups. For example, a case with pneumonia as the primary diagnosis, delirium as the secondary diagnosis, and mood disorder as the fifth diagnosis would be classified as a "cognitive disorder" case based on the higher ranking of delirium. The LOS (in days) was compared between these groups for each of the three fiscal years. To eliminate possible sources of bias due to more than one admission for a particular patient in a given fiscal year, only the first admission of a fiscal year was included.

The Medicare mean LOS and the average diagnosis-related group (DRG) weight were included in statistical models to compensate for the possibility that an increased LOS in patients with psychiatric illness could be solely due to their being more "medically/surgically ill" than patients without psychiatric illness. The average DRG weight is an index number for medical complexity that is derived from an algorithm that considers and assigns a "weight" to all of the patient's discharge diagnoses for overall medical/surgical complexity. Higher numbers indicate more complex and thus more resource-intensive cases. The Medicare mean LOS is a measure of the expected LOS for a case. These values are redefined annually in a table published in the Federal Register and on the Internet.[15]

LOS, Medicare mean LOS, and DRG weight are positive and skewed toward large values. Accordingly, geometric means of LOS are reported, rather than arithmetic means, and the natural logarithm (log) of DRG weight and Medicare mean LOS was used in all modeling. Generalized linear models were fit with the "glm" function in R 7.0 for Windows[16] with a log link. Since LOS values start at 1, not 0, the response variable was chosen to be the number of days a patient stayed beyond the first day, resulting in a variable that could equal 0. Consequently, a Poisson-like model could be applied. Exploratory analysis revealed, however, that the variance was proportional—not to the mean, as would occur in a pure Poisson model—but to the square of the mean, indicating a more complex variance structure known as "overdispersion." Consequently, a quasi-likelihood approach was used.[17] A single model that included all three datasets (1999, 2000, and 2001) would have required the assumption that all cases (or records) in the data were independent. The fact that some patients probably appeared in more than one of the three datasets would have violated this assumption. Consequently, analyses were performed separately for each year.

Analysis of deviance was employed to compare sequences of nested models. Deviance is a measure, analogous to the sum of squares in classical regression or analysis of variance, of the degree to which a generalized linear model fails to fit the data. Consider two models, the second more complex because it includes all of the variables of the first plus one or more additional variables. The difference in deviance between the models measures the degree to which the more complex model fits the data better than the simpler model. If the simpler model is adequate, the difference in deviance has an approximate chi-square distribution with an expectation equal to the difference in the number of variables (or degrees of freedom) between the models.

In the simplest or null model, the DRG weight, Medicare mean LOS, and diagnostic group of a patient had no relationship to the patient's LOS, whereas the full model allowed the LOS to differ for each of the eight diagnostic groups and for each level of DRG weight and Medicare mean LOS. Since the DRG weight and Medicare mean LOS were significant for all 3 years ($\chi^2 > 200$, $df = 1$, $p < 0.0001$), these variables were included in all intermediate models. Within the context of a model, the adjusted average LOS for a group was defined as the value for patients whose DRG weight was equal to 1 and whose Medicare mean LOS was equal to 3.6, the approximate medians of these variables. Chi-square tests were employed at each step to determine whether there was sufficient evidence to add a variable or factor.[16–19] The order in which intermediate models were tested differed for each year, depending on the pattern of adjusted average LOS values for the year that was observed in the full model.

RESULTS

Table 1 summarizes the data before the models were fit, showing the number of cases and the (raw, unadjusted) geometric means of LOS, DRG weight, and Medicare mean LOS for each diagnostic group. Medicare mean LOS and DRG weight were found to be correlated but not equivalent. This may be seen in the scatterplot of these variables for 2001 in Figure 1. Scatterplots for the other years were similar. Correlations between log Medicare mean LOS and log DRG weight were 0.87, 0.85, and 0.86 for 1999, 2000, and 2001, respectively. In spite of these correlations, Medicare mean LOS improved the prediction of LOS, even after

adjustment for DRG weight ($\chi^2>365$, df = 1, $p<0.0001$), and vice versa ($\chi^2>220$, df = 1, $p<0.0001$).

Analysis of deviance may be seen in Table 2. In each row, a simpler model is contrasted with a more complex model. The more complex model was created by adding a variable or by allowing an additional diagnosis or group of diagnoses to differ from the others in their modeled LOS values. Thus, the "model" column labeled "More Complex" identifies the additional variable or additional group distinction(s). In the first two rows for each year, we see that DRG weight was significant after adjustment for Medicare mean LOS and that Medicare mean LOS was even more significant after adjustment for DRG weight. Next, we add indicators for additional diagnostic groups, one group at a time, resulting in a sequence of tests with one degree of freedom. Finally, we performed a composite test for each year, contrasting the model with only DRG weight and Medicare mean LOS with the model in which all statistically significant distinctions between diagnostic groups were allowed. No additional group distinctions attained

TABLE 1. Geometric Mean Hospital Length of Stay (LOS), Diagnosis-Related Group (DRG)[a] Weight, and Medicare Mean LOS[b] by Psychiatric Diagnosis Group

Diagnostic Group	1999	2000	2001	Total
No psychiatric diagnosis				
Cases	10,448	10,451	10,947	31,846
LOS (days)	2.88	2.89	2.90	2.89
DRG weight	1.08	1.08	1.08	1.08
Medicare mean LOS	3.75	3.62	3.57	3.64
Cognitive disorders				
Cases	692	818	852	2,362
LOS (days)	3.28	3.64	3.66	3.54
DRG weight	1.03	1.05	1.06	1.05
Medicare mean LOS	4.18	4.05	3.89	4.03
Substance use disorders				
Cases	3,456	3,360	3,008	9,824
LOS (days)	2.92	2.94	3.09	2.98
DRG weight	1.16	1.14	1.20	1.17
Medicare mean LOS	4.18	3.99	4.07	4.08
Psychotic disorders				
Cases	267	244	234	745
LOS (days)	3.31	3.88	3.92	3.68
DRG weight	1.16	1.24	1.23	1.21
Medicare mean LOS	4.47	4.49	4.31	4.43
Mood disorders				
Cases	757	877	890	2,524
LOS (days)	3.02	3.33	3.56	3.31
DRG weight	1.04	1.06	1.14	1.08
Medicare mean LOS	3.82	3.67	3.82	3.77
Anxiety disorders				
Cases	228	271	278	777
LOS (days)	2.51	3.02	2.80	2.78
DRG weight	1.00	1.09	1.10	1.06
Medicare mean LOS	3.53	3.81	3.63	3.66
Adjustment disorders				
Cases	50	49	48	147
LOS (days)	4.98	7.66	8.80	6.92
DRG weight	1.18	1.49	1.63	1.42
Medicare mean LOS	4.30	4.82	4.94	4.68
Other psychiatric disorders				
Cases	134	116	126	376
LOS (days)	3.64	3.92	4.22	3.91
DRG weight	1.16	1.14	1.41	1.23
Medicare mean LOS	4.42	4.22	4.69	4.44

[a]An index number for medical complexity that is derived from an algorithm that considers and assigns a ''weight'' to all of the patient's discharge diagnoses for overall medical/surgical complexity. Higher numbers indicate more complex and thus more resource-intensive cases.

[b]A measure of the expected LOS for a case.

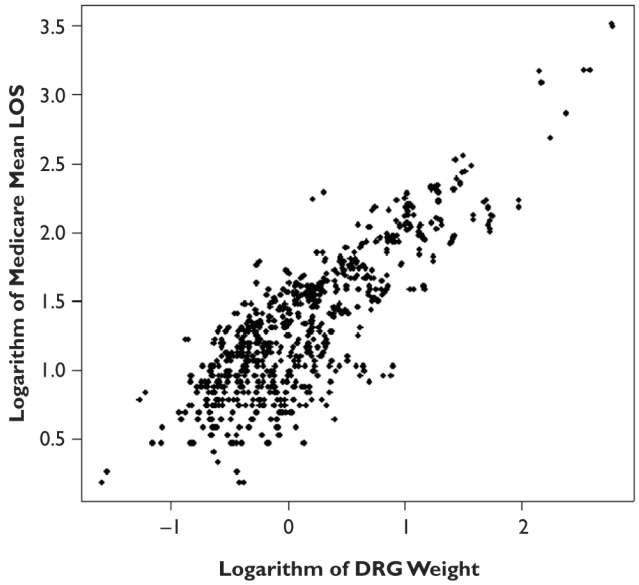
statistical significance at the $p = 0.05$ level, beyond those displayed in Table 2.

Table 3 displays the characteristics of the groups that were derived through analysis of deviance. For each year, the groups are displayed for which the difference in LOS was statistically significant. For these groups, the average adjusted LOS is also displayed—that is, after adjustment for DRG weight and Medicare mean LOS.

The data for the 3 years had much in common. The group composed of no psychiatric diagnosis and substance use disorders was by far the largest (85% to 87% of the records for each year) and fell at or near the bottom of the average adjusted LOS: 3.29, 3.43, and 3.51 days for 1999, 2000, and 2001, respectively. Adjustment disorders had dramatically greater average adjusted LOS than any other group, i.e., 5.68, 7.96, and 8.85 days, respectively ($\chi^2 > 25$, $df = 1$, $p < 0.0001$). Mood and cognitive disorders, schizophrenia, and other psychiatric disorders fell between these extremes, and the division by adjusted LOS into at least three levels was statistically significant ($\chi^2 > 100$, $df = 4$, 2, or 3, $p < 0.0001$, for 1999, 2000, and 2001, respectively).

The 3 years differed in some respects. The adjusted LOS associated with anxiety disorders was unstable over time. In 1999, anxiety disorders had a shorter average adjusted LOS than any other group (2.77 days; $\chi^2 = 6.8$, $df = 1$, $p < 0.01$); in 2000, anxiety disorders fell in the middle-range adjusted LOS group (at 4.24 days) and could not be distinguished statistically from the other four diagnostic groups in the middle; and in 2001, anxiety disorders fell in the shortest adjusted LOS group, along with no psychiatric diagnosis and substance disorders (adjusted LOS = 3.51 days) and could not be distinguished from them statistically. Furthermore, although mood disorders always fell between this lowest group and the adjustment disorders group, in 2001, the mood disorders group (at 4.17 days of adjusted LOS) could be distinguished from the shortest LOS group (no psychiatric diagnosis, substance use disorders, and anxiety disorders, at 3.51 days of adjusted LOS) and the longer adjusted LOS group immediately above it (cognitive disorders, schizophrenia, and other psychiatric disorders, at 4.7 days) ($\chi^2 = 6.9$, $df = 1$, $p < 0.01$). In the other years, adjusted LOS for the mood disorders group was indistinguishable statistically from the other diagnoses in the middle-range adjusted LOS group.

FIGURE 1. Diagnosis-Related Group (DRG)[a] Weight and Medicare Mean Hospital Length of Stay (LOS) in Days[b] Predicting LOS for 2001 in Patients With a Psychiatric Diagnosis



[a]An index number for medical complexity that is derived from an algorithm that considers and assigns a "weight" to all of the patient's discharge diagnoses for overall medical/surgical complexity. Higher numbers indicate more complex and thus more resource-intensive cases.

[b]A measure of the expected LOS for a case.

DISCUSSION

This study examined the impact of comorbid psychiatric illness on the LOS of medical and surgical inpatients at a major university medical center for a 3-year period (fiscal years 1999–2001) in a heavily penetrated managed care environment. The percentage of cases with comorbid psychiatric diagnoses ranged from 33% to 35%. Because the diagnostic data were derived from discharge documents, the discharging physicians (typically house officers from medical and surgical departments) were ultimately responsible for listing the psychiatric diagnoses. In the majority of instances, these were rendered without formal psychiatric consultation. Thus, the psychiatric diagnoses used in the current study are, by their nature, somewhat imprecise. This represents a major limitation.

The sources of diagnostic bias when we rely on nonpsychiatric physicians to recognize psychopathology are potentially two-sided. On one hand, nonpsychiatric physicians may be less sensitive to the more subtle presentations of psychiatric illness, may not render a diagnosis in an obscure case, and diagnose only an "obvious" case (resulting in "false negatives"). Several studies have suggested that nonpsychiatric physicians may underdiagnose psychiatric illness.[20–27] Thus, the 33% rate of psychiatric

comorbidity in our group might represent an *underestimation* of comorbid psychiatric illness.

On the other hand, one study found that nonpsychiatric physicians overdiagnosed psychiatric illness compared to standardized research diagnoses with structured interviews.[28] Thus, the nonpsychiatric physicians whose diagnostic work was used in the current study might have overestimated the prevalence of psychiatric illness. For instance, they might have diagnosed a case of major depression when the only manifest symptom was depressed mood or have misattributed a "physical" symptom to a "psychiatric" cause. This type of overdiagnosis would lead to an overestimation of psychiatric comorbidity, or "false positives."

Elimination of bias of these types is not possible when we use retrospective data, such as were available for this study. Clearly, the gold standard for diagnostic precision would be a routine psychiatric interview of every patient with standardized interview instruments, such as the Structured Clinical Interview for DSM-IV, with each interview completed by an experienced psychiatrist. Given the scale reported here of 16,000 cases per year, this would be an excessively expensive study design.

It can be argued that since all diagnoses were derived from discharge documents, some cases might reflect the development of psychiatric illness as a *consequence* of excessive time in the hospital, a possibility that makes causal inferences between psychiatric comorbidity and LOS problematic. In addition, other factors, such as social isolation, inability to care for oneself, older age, and other factors, may also have effects on LOS, independent of the effect of psychiatric illness. These social factors were not directly addressed in the database available for this study. Future studies would ideally include assessment of these factors.

The advantages of our study include rigorous data

TABLE 2. Analysis-of-Deviance Models for Hospital Length of Stay (LOS) Versus Diagnosis-Related Group (DRG) Weight[a] for Patients With a Psychiatric Diagnosis

	Model		Difference		
Year	Simple	More Complex	df	Deviance	p
1999	DRG weight	Plus mean LOS (days)	1	379.4	<0.0001
1999	Mean LOS (days)	Plus DRG weight	1	228.9	<0.0001
1999	DRG weight, mean LOS	Plus ''anxiety, no psychiatric illness or substance use'' (low group), ''adjustment disorders'' (high group)	2	104.4	<0.0001
1999	DRG weight, mean LOS	Plus adjustment disorders	1	25.8	<0.0001
1999	Complex model of previous row	Plus ''no psychiatric illness or substance use disorders'' group	1	66.1	<0.0001
1999	Complex model of previous row	Plus anxiety disorders	1	6.8	<0.01
1999	Complex model of previous row	Plus ''cognitive and other psychiatric disorders'' group	1	8.5	<0.004
1999	DRG weight, mean LOS	Plus groups in previous four rows	4	107.2	<0.0001
2000	DRG weight	Plus mean LOS	1	367.8	<0.0001
2000	Mean LOS	Plus DRG weight	1	275.5	<0.0001
2000	DRG weight, mean LOS	Plus ''no psychiatric illness or substance use'' (low group), ''adjustment disorders'' (high group)	2	195.3	<0.0001
2000	DRG weight, mean LOS	Plus adjustment disorders	1	58.2	<0.0001
2000	Complex model of previous row	Plus ''no psychiatric illness or substance use disorders'' group	1	137.1	<0.0001
2000	DRG weight, mean LOS	Plus groups in previous two rows	2	195.3	<0.0001
2001	DRG weight	Plus mean LOS	1	441.2	<0.0001
2001	Mean LOS	Plus DRG weight	1	260.3	<0.0001
2001	DRG weight, mean LOS	Plus ''no psychiatric illness or substance use'' (low group), ''adjustment disorders'' (high group)	2	232.6	<0.0001
2001	DRG weight, mean LOS	Plus adjustment disorders	1	66.0	<0.0001
2001	Complex model of previous row	Plus ''no psychiatric illness, substance use, or anxiety'' group	1	171.0	<0.0001
2001	Complex model of previous row	Plus mood disorders	1	6.9	<0.009
2001	DRG weight, mean LOS	Plus groups in previous three rows	3	243.9	<0.0001

[a]An index number for medical complexity that is derived from an algorithm that considers and assigns a ''weight'' to all of the patient's discharge diagnoses for overall medical/surgical complexity. Higher numbers indicate more complex and thus more resource-intensive cases.

capture for a 3-year period and simultaneous assessment of DRG weight data for relative medical/surgical complexity. Therefore, we had a large and representative sample. This offset, in part, the limitations inherent in a design without structured diagnostic interviews or independent assessment of other variables that may also influence LOS.

Consistently over the 3-year period of study, comorbid psychiatric illness—except for substance use disorders

TABLE 3. Hospital Length of Stay (LOS) for Medical/Surgical Patients by Psychiatric Diagnosis Group for Fiscal Years 1999–2001

Diagnostic Group	1999	2000	2001
No psychiatric diagnosis or substance use disorders			
Cases	13,904	13,811	14,233
LOS (days)	2.89	2.90	2.94
Adjusted LOS	3.29	3.43	3.51
DRG weight[a]	1.10	1.09	1.10
Medicare mean LOS[b]	3.85	3.71	3.67
Mood disorders and psychotic disorders			
Cases	1,024		
LOS (days)	3.09		
Adjusted LOS	3.59		
DRG weight[a]	1.07		
Medicare mean LOS[b]	3.98		
Cognitive disorders and other psychiatric disorders			
Cases	826		
LOS (days)	3.34		
Adjusted LOS	4.24		
DRG weight[a]	1.05		
Medicare mean LOS[b]	4.22		
Anxiety disorders			
Cases	228		
LOS (days)	2.51		
Adjusted LOS	2.77		
DRG weight[a]	1.00		
Medicare mean LOS[b]	3.53		
Adjustment disorders			
Cases	50	49	48
LOS (days)	4.98	7.66	8.80
Adjusted LOS	5.68	7.96	8.85
DRG weight[a]	1.18	1.49	1.63
Medicare mean LOS[b]	4.30	4.82	4.94
Cognitive disorders, psychotic disorders, mood disorders, anxiety disorders, and other psychiatric disorders			
Cases		2,326	
LOS (days)		3.48	
Adjusted LOS		4.24	
DRG weight[a]		1.08	
Medicare mean LOS[b]		3.92	
Cognitive disorders, psychotic disorders, and other psychiatric disorders			
Cases			1,212
LOS (days)			3.76
Adjusted LOS			4.70
DRG weight[a]			1.13
Medicare mean LOS[b]			4.05
Mood disorders			
Cases			890
LOS (days)			3.56
Adjusted LOS			4.17
DRG weight[a]			1.14
Medicare mean LOS[b]			3.82

[a]An index number for medical complexity that is derived from an algorithm that considers and assigns a ''weight'' to all of the patient's discharge diagnoses for overall medical/surgical complexity. Higher numbers indicate more complex and thus more resource-intensive cases.

[b]A measure of the expected LOS for a case.

(and except for anxiety disorders in 1999)—was associated with an increased LOS for medical/surgical patients. This pattern persisted even after adjustment for medical complexity (DRG weight) and the LOS projected by the Medicare system (Medicare mean LOS). This is a compelling finding in a managed care environment, with the attendant concern for efficiency in the use of inpatient resources. Even though the overall LOS in the present study was dramatically shorter than in prior studies examining psychiatric comorbidity and LOS, comorbid psychiatric illnesses other than substance-related disorders were still associated with a significantly increased LOS.

For example, in 2000, the adjusted LOS for no psychiatric illness and substance abuse cases was 3.43 days (2.90 days before adjustment), whereas the adjusted LOS for cases with psychiatric comorbidity (other than substance use and adjustment disorders) was 4.24 days (3.48 days before adjustment)—a difference of eight of 10 per hospital day (six of 10 before adjustment), or approximately a 20% increase. This 0.8-day increased adjusted LOS in 2,326 cases represents 14% of UCDMC's cases for fiscal year 2000. UCDMC financial analysts have estimated that an increase in average LOS by 0.1 day for the total patient population at UCDMC increases costs by $10,000,000 annually (personal communication, William McGowan, 2003). Therefore, this 0.8-day difference in adjusted LOS in 14% of the inpatients with these comorbid psychiatric illnesses translates into an annual projected increased expenditure of $11,200,000 (8 × 0.14 [percent of inpatients with these psychiatric diagnoses] × $10,000,000 increased expense for 0.1 day LOS).

Prior studies have shown between a 10% and over a 100% increase in LOS for patients with psychiatric illness in the various populations studied.[4–11] Of importance, because the institution studied does not operate an inpatient psychiatric unit, lengthy hospital stays for patients with *only* psychiatric needs would not have contaminated the data. Although substance-related conditions were the most common psychiatric illness coded, the substance-related conditions were *not* associated with an increased LOS. Therefore, all of the additional LOS associated with psychiatric comorbidity appears to be referable to nonsubstance-use psychiatric comorbidity. Substance use comorbidity has previously been associated with increased LOS,[10] whereas a prior study did not find such an association.[12] With 9,834 cases of substance use disorders in 3 years from a total of 48,601 cases, the rate diagnosis of substance use disorders was 20.2%. Prospective studies using various methods have reported a rate of substance use comorbidity of between 8% and 30% in medical patients.[6,9,26,27,29,30] Thus, our rate of substance use disorders, although not derived in a prospective fashion with validated instruments, is consistent with prior reports.

Because of the coding paradigm used, all DSM-IV substance use disorders, including legal substances, such as nicotine and caffeine, are included in the database. Thus, discharge physicians could conceivably have coded nicotine and caffeine use as substance use disorders on discharge documents. Although such discharge coding seems unlikely, a different coding paradigm would be needed to resolve this issue definitively. To this extent, our results regarding substance use disorders must be viewed with caution.

Notably, although the group diagnosed with adjustment disorders was small, it had a longer LOS than cases with more substantial psychiatric illness. A possible explanation for this could be that these were patients without significant previous psychiatric illness, who, in the context of significant medical illness, developed adjustment disorders with the illness as the psychosocial stressor. Consistent with this explanation is the fact that the adjustment disorders group had the highest mean DRG weight. Further examination of this issue would require a detailed chart review for additional clinical information. Among items of interest in examining the "long LOS/adjustment disorder" cohort would be to see if and when there was psychiatric consultation for these cases or if other factors, such as problematic placement, were important factors in the patients' increased LOS.

We realize that some patients meet criteria for more than one psychiatric diagnosis and that multiple psychiatric comorbidity could have a more complex impact on LOS. Given all the potential combinations of types of diagnoses, a detailed analysis of this issue is beyond the scope of this article. In this system, diagnoses are ordered in the medical record according to their relative clinical importance. The decision of which medical/psychiatric diagnoses are listed at discharge, and in what order, is an inherently subjective process. Therefore, we used the psychiatric diagnosis considered to be most important by the treating clinician.

Despite issues of diagnostic precision and the aforementioned limitations in the database for this study, the increased LOS for patients with comorbid psychiatric illness found suggests that psychiatric illness is at least correlative, if not necessarily causative, of increased LOS. The results of the current study are consistent with those of previous studies addressing this issue, although they used different methods. Given the persistence of increased LOS

associated with psychiatric comorbidity in the present study, the impact of psychiatric comorbidity clearly persists in the managed care era. There is a continued need for awareness of the implications of psychiatric comorbidity in medical/surgical inpatients. An active inpatient psychiatric consultation-liaison service may be of assistance in the co-management of medical/surgical inpatients with psychiatric comorbidity. Additional prospective studies should investigate the potential for psychiatric consultation-liaison interventions to meet the challenge of excess LOS in these cases.

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