Cost Offset From a Psychiatric Consultation-Liaison Intervention With Elderly Hip Fracture Patients

James J. Strain, M.D., John S. Lyons, Ph.D., Jeffrey S. Hammer, M.D., Marianne Fahs, Ph.D., Allen Lebovits, Ph.D., Patricia L. Paddison, M.D., Stephen Snyder, M.D., Elton Strauss, M.D., Robert Burton, M.D., Gordon Nuber, M.D., Thomas Abernathy, M.A., Henry Sacks, Ph.D., Joann Nordlie, B.A., and Charles Sacks, B.A.

Objective: *The authors hypothesized that psychiatric liaison screening of elderly patients with hip fractures would shorten the average length of hospital stay and increase the proportion of patients who returned home after discharge.* *Method:* *The study was performed at Mount Sinai Medical Center in New York and Northwestern Memorial Hospital in Chicago. The subjects were 452 patients 65 years or older who were consecutively admitted for surgical repair of fractured hips. During a baseline year the patients received traditional referral for psychiatric consultation. During the experimental year all the patients at Mount Sinai and the patients on one Northwestern unit were screened for psychiatric consultation.* *Results:* *The patients who received psychiatric liaison screening had a higher consultation rate than those who received traditional consultation. The rates of* DSM-III *disorders in the experimental year were 56% at Mount Sinai and 60% at Northwestern. The mean length of stay was reduced from 20.7 to 18.5 days at Mount Sinai and from 15.5 to 13.8 days at Northwestern, resulting in reductions in hospital costs ($647/day) of $166,926 and $97,361, respectively. Fees generated from Medicare service delivery could have paid for the $20,000 psychiatric intervention cost at each site. There was no difference, however, between the two years in the discharge placement of patients.* *Conclusions:* *Admission psychiatric liaison screening of elderly patients with hip fractures results in early detection of psychiatric morbidity, better psychiatric care, earlier discharge, and substantial cost savings to the hospital.*

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Studies suggest that psychosocial interventions in health care settings improve patient well-being and the quality of care (1, 2), and evidence suggests that these interventions can help reduce medical costs as well (3–6). In this paper we report findings on the effects of a psychiatric intervention on the costs of health care for elderly hip fracture patients in two diverse teaching hospitals.

There is a strong indication that psychiatric and psychosocial variables are important in general hospital care. Lipowski (7) reported that more than one-half of all hospitalized and medically ill patients manifest psychological dysfunction in conjunction with medical illness and that these problems inevitably detract from effective medical care. Other authors (8, 9) have estimated that one-third to one-half of hospitalized patients have primary psychiatric morbidity. Regier et al. (10) reported that more than one-half of the patients with psychiatric morbidity are seen exclusively in the general health care system, rather than by mental specialists. More specifically, studies have provided data on the relationship between psychosocial factors and the length of hospital stays. Zimmer (11) found that for more than 2,500 patients, 11.8% of all hospital days could not be attributed to medical need. Glass et al. (12) reported that for 363 hospitalized medical/surgical patients, 18% of the hospital days were due to social rather than medical factors. Other researchers (13, 14) noted the importance of social factors in the decision to admit patients to the hospital, particularly for emergencies. Mumford et al. (15) found that a psy-

Received Feb. 7, 1990; revision received Feb. 8, 1991; accepted March 11, 1991. From the Mount Sinai Medical Center, New York, and Northwestern Memorial Hospital, Chicago. Address reprint requests to Dr. Strain, Department of Psychiatry and Behavioral Sciences, Box 1228, Mount Sinai Medical Center, One Gustave L. Levy Place, New York, NY 10029-6574.

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chosocial intervention reduced the use of medical services, especially for inpatients and patients more than 55 years old.

Two studies of orthopedic patients (3, 4) demonstrated the potential for impressive cost savings. Boone et al. (4) reported a reduction in mean length of stay of 1.25 days after institution of an early social work intervention. This translated into a gross savings of approximately $54,000 for 187 patients over 6 months. The savings for elderly patients alone would have been still larger. Levitan and Kornfeld (3) compared the patients in an orthopedic ward before and after the introduction of a liaison psychiatrist. They demonstrated a 12-day reduction in the median length of stay (42 to 30 days), which translated into a $50,000 cost reduction over 6 months, more than offsetting the cost of the psychiatric intervention ($10,000). If placement in the patient's home, rather than a nursing home, was included in these authors' cost offset estimates, $197,000 was saved in the treatment of the patients on the intervention ward.

Although provocative, both of these studies suffered from serious methodological flaws. For example, no attempt was made to specify the psychosocial services provided to the nonintervention patients. The comparison baseline groups were contaminated, at least in part, by unspecified psychosocial interventions. Levitan and Kornfeld used the patients on the same unit before the psychiatric intervention as their "control" group. Consequently, other factors could explain the results (e.g., changes in staffing or attending physicians, policy shifts, alterations in medical/surgical procedures, differences in the patients' health status or the availability of homes to go to) (16). Since the distribution of lengths of stay is almost always skewed to the right, differences in means may be misleading without proper data transformations (e.g., logarithmic).

Other methodological confounds that may have influenced Levitan and Kornfeld's important study are the lack of 1) randomized sampling techniques, 2) inclusion criteria, 3) reliable and valid measures, 4) raters blind to the hypotheses about the intervention, 5) sufficiently long observation periods, 6) information about severity of disease state, 7) specification of psychosocial disability, 8) delineation of the intervention and measurement of its intensity, 9) groups large enough to provide accurate estimates of population parameters, and 10) more comprehensive cost measures. Berk has argued persuasively for consideration of both direct and indirect costs and of who bears these costs: government, third-party payers, patients, or patients' families (unpublished paper, 1982).

This study was designed to take into account these methodological concerns. We hypothesized a reduction in the length of stay and an increase in the proportion of patients who returned home after discharge as a result of institution of a psychiatric liaison screen after a baseline year of traditional referral.

TABLE 1. Demographic Characteristics of Elderly Patients With Hip Fractures

Characteristic	Mount Sinai Hospital (N=264)		Northwestern Memorial Hospital (N=200)	
	N	%	N	%
Female	210	79.5	161	80.5
Married	54	20.5	47	23.5
Living alone	134	50.8	128	64.0
White	233	88.3	182	91.0

METHOD

The subjects were patients 65 years or older who were consecutively admitted to four orthopedic units for the surgical repair of fractured hips; one of the units was at the Mount Sinai Medical Center in New York City (N=264), and three were at Northwestern Memorial Hospital in Chicago (N=200). The mean± SD age of the patients at Mount Sinai was 83.7±8.4, and for those at Northwestern it was 80.3±8.3. Other demographic variables are shown in table 1. Informed consent was obtained from every patient who agreed to be studied and, if the patient's judgment was compromised such that he or she could not sign the permission statement required for surgery, a guardian, family member, or legal agent was asked to give permission for the patient to be studied.

Several instruments were used: a semistructured interview, a chart-review inpatient log, the Geriatric Depression Scale (17), the Arthritis Impact Measurement Scale (18), the Spielberger State-Trait Anxiety Inventory (19), the Horn Disease-Staging Evaluation (20), the Mini-Mental State (21), and the Singh index of bone density (22).

The primary outcome measures were 1) total length of stay, including the day of admission and the day of discharge regardless of hour, 2) total direct hospital charges plus per diem costs and charges by specific hospital cost centers, obtained from the hospitals' accounting departments, which maintained permanent records of all charges in 19 categories (e.g., laboratory, blood products, special-duty nursing, anesthesia, intensive care), and 3) placement of patient after discharge—home or health-related facility.

The design at Mount Sinai, which had only one orthopedic unit, was to compare two years on the same surgical inpatient unit. During the baseline year, psychiatric consultation was requested in the usual fashion by the orthopedic consultee. The next year an experimental psychiatric liaison intervention was instituted. The first year at Northwestern was also a baseline; only requested psychiatric consultations were offered. During the second year at Northwestern, one of three units (liaison unit A) provided the experimental psychiatric liaison intervention, and the other two units (control units B and C) acted as controls—offering psychiatric consultation only when requested.

TABLE 2. Frequency of Psychiatric Consultation for Elderly Patients With Hip Fractures During Baseline Year and Year of Experimental Psychiatric Liaison Program

			Northwestern Memorial Hospital							
			Baseline Year				Experimental Year			
	Mount Sinai Hospital			Control Units				Control Units		
Patient Status	Baseline Year	Experimental Year	Liaison Unit A	B	C	Total	Liaison Unit A	B	C	Control Total
Admitted	120	144	40	33	19	92	59	30	19	49
Unwilling or unable[a] to complete study	34	24	14	14	7	35	15	10	8	18
Died	2	6	0	2	0	2	0	0	0	0
Completed study	84	114	26	17	12	55	44	20	11	31
Received consultation										
Number	12	114	1	0	1	2	36[b]	2	1	3
Percent of admitted patients	10	79	3	0	5	2	61	7	5	6

[a]Unable to sign the consent form because of cognitive deficit, or family member was unavailable or unwilling to sign.
[b]Two of these patients were unwilling or unable to complete the study.

Control unit B was contiguous to liaison unit A, and the social worker was shared by both of them. Control unit C was in another section of the hospital, distant from liaison unit A and control unit B, and it had completely separate ward staff and an autonomous social worker. There was no structured exchange among units A, B, and C.

From July 1, 1987, through June 30, 1989, each patient was interviewed and evaluated within 72 hours of admission to the hospital but after surgical repair of the fractured hip; the patient was evaluated again at hospital discharge and 6 and 12 weeks after discharge. The number of subjects required to achieve the power necessary (0.80) for detection of significance in a difference in length of hospital stay of at least 2 days was 150 at both sites for each observation year ($p<0.05$).

The first year was a baseline on all four units. Psychiatric consultations were performed only for referred patients, and the psychiatrist had no other involvement with the orthopedic units. During the second year, a psychiatric liaison intervention was introduced on the Mount Sinai orthopedic unit and on unit A at Northwestern. The experimental psychiatric intervention consisted of the following components: 1) evaluation of every consenting patient by a psychiatrist and an offer of treatment for observed psychiatric morbidity if necessary, 2) weekly ombudsman rounds with a senior orthopedic attending physician, during which selected or difficult cases were discussed in detail by the attending orthopedic physician, social worker, nurse, physical therapist, and liaison psychiatrist in an attempt to achieve a multidisciplinary clinical treatment and discharge plan (23), 3) weekly nursing and discharge planning meetings to discuss cases in which the impediment to moving a patient to his or her home or to a nursing home was psychiatric morbidity, e.g., noncompliance, dementia, use of neuroleptic agents, or more global concerns about the patient's behavior, and 4) conferences with families and social workers as appropriate. The patient's family was counseled on the behavioral management of the patient, and particular attention was paid to their anxiety about dementia or psychotic thinking that was being treated with neuroleptics. Families and nursing homes expressed great anxiety about accepting responsibility for patients who manifested delusions or hallucinations or who were receiving antipsychotic medications.

A rating on the Singh bone density scale and postoperative stability were determined for every patient radiographically by the orthopedic surgeon after surgery, and these measures permitted a biological assessment of the bone and fracture status (22). The Horn severity of illness rating was determined on the basis of the patient's chart at discharge by a trained Horn rater (20). This permitted an objective assessment of other medical conditions and their complications. Where appropriate, statistical analyses were conducted with t tests for continuous variables and chi-square tests for categorical variables.

RESULTS

As shown in table 2, at Mount Sinai the consultation rate was 10% in the baseline year and 79% in the experimental year. At Northwestern, during the baseline year the overall consultation rate for units A, B, and C was 2%, and in the experimental year it was 61% for unit A and 6% for units B and C. The psychiatric diagnoses of both the Mount Sinai and Northwestern patients are presented in table 3. Approximately one-half of the intervention groups at both institutions had diagnoses of organic mental disorder.

Table 4 shows the lengths of stay for the baseline and experimental years; patients whose lengths of stay were more than two standard deviations beyond the mean were omitted. The patients at Mount Sinai during the experimental year remained in the hospital an average of 2.2 days less than the patients during the baseline year, a statistically significant difference. If we

TABLE 3. *DSM-III-R* Diagnoses of Elderly Patients With Hip Fractures Who Received Psychiatric Liaison Screening

Diagnosis	Mount Sinai Hospital (N=103[a])		Northwestern Memorial Hospital (N=36)	
	N	%	N	%
Organic mental disorder	58	56.3	17	47.2
Major depression or dysthymia	5	4.9	3	8.3
Adjustment disorder, mixed	0	0.0	2	5.6
Adjustment disorder, depressed	1	1.0	1	2.8

[a]Number of patients for whom data were available.

TABLE 4. Length of Stay for Elderly Patients With Hip Fractures During Baseline Year and Year of Experimental Psychiatric Liaison Program[a]

Location	Baseline Year[b]			Experimental Year		
		Length of Stay (days)			Length of Stay (days)	
	N	Mean	SD	N	Mean	SD
Mount Sinai Hospital[c]	114	20.7	9.1	136	18.5	8.5
Northwestern Memorial Hospital[d]						
Liaison unit A[e]	39	15.5	4.7	55	13.8	4.1
Control units	48	13.9	3.8	51	—	—
Unit B	31	14.3	3.8	31	14.1	4.3
Unit C[f]	17	13.2	3.8	19	15.7	4.6

[a]Patients whose lengths of stay were more than two standard deviations beyond the mean are not included.
[b]Significant difference between baseline length of stay at Mount Sinai and that in Northwestern liaison unit ($t=3.42$, $df=151$, $p\leq0.05$) and control units ($t=4.96$, $df=160$, $p\leq0.05$).
[c]Significant reduction ($t=1.97$, $df=248$, $p<0.05$).
[d]Significant Time by Group interaction for Northwestern when the liaison unit was compared with both control units ($F=4.03$, $df=1, 189$, $p\leq0.05$) and with control unit C ($F=4.69$, $df=1, 125$, $p\leq0.04$).
[e]Nearly significant reduction ($t=1.86$, $df=92$, $p=0.06$).
[f]Nearly significant increase ($t=1.77$, $df=34$, $p=0.10$).

use an average per diem hospital cost of $647 (1987 dollars), this translates to a reduction in the total cost to the hospital of $178,572. (Average per diem costs are calculated by using standard Medicare cost reporting methods for medical/surgical patients and do not include the costs of intensive or cardiac care.) The marginal costs may be lower. However, the average daily cost estimate is conservative because it excludes the cost of intensive care. The psychiatrists at Mount Sinai made 272 patient visits to the intervention cohort, which could have generated $21,760 in fees ($80/visit) to offset the psychiatrist's salary of $20,000 for performing the consultations and liaison activities had this not been a funded research effort.

At Northwestern, the reduction in length of stay was 1.7 days for patients on liaison unit A (with outliers removed) (table 4). This reduction was significantly different from the change in length of stay for the control units and was associated with a reduction in costs of $97,361. Control unit B, which was contiguous to the liaison unit and shared a social worker and discharge planner with it, did not demonstrate a significant difference in length of stay between the two years ($p=0.85$). However, the isolated control unit C had an *increase* in the length of stay over the two years of the study (table 4). Because of the concern that death might affect the length of stay independent of any effects of the intervention, the results were recalculated after the patients who died were eliminated. The findings were identical to those without deaths removed.

To determine whether the reductions in length of stay were associated with reductions in psychiatric symptoms, we compared the patients' discharge depression and mental state scores after adjusting for initial levels and length of stay. At Mount Sinai, the liaison intervention was associated with a significant improvement in Mini-Mental State score ($t=3.40$, $df=63$, $p<0.01$). The adjusted mean±SD Mini-Mental State score at discharge was 22.71±5.81 during the experimental year and 19.92±7.79 during the baseline year. At Northwestern, the liaison intervention was associated with a significant reduction in the Geriatric Depression Scale score ($t=3.20$, $df=92$, $p<0.01$). The adjusted discharge depression score for the liaison unit patients was 11.9±2.0 during the experimental year and 12.75±2.7 during the baseline year. Fracture status, bone density, and the Horn ratings of severity of disease were similar in the experimental and baseline years at both Mount Sinai and Northwestern.

As shown in table 5, there was no significant difference in postdischarge patient placements between the baseline and experimental years at Mount Sinai or Northwestern (e.g., home versus home, home versus nursing home, nursing home versus nursing home). After discharge approximately one-half of the patients returned home, except for the patients in the control units at Northwestern, more of whom were transferred to rehabilitation hospitals. Among the patients at Mount Sinai, there was little difference in postdischarge placement between the baseline and experimental years. Among the patients on the liaison unit at Northwestern, there was a nonsignificant increase in nursing home placements and a similar decrease in placements to sites other than home, rehabilitation hospitals, and nursing homes.

DISCUSSION

This baseline-intervention study in two disparate sites confirms the finding of Levitan and Kornfeld (3) that a structured psychiatric liaison program with elderly patients with hip fractures is associated with a shorter length of stay. The results also confirm the more global report by Mumford et al. (15) that a psychosocial intervention is associated with decreased

TABLE 5. Placement After Discharge of Elderly Patients With Hip Fractures During Baseline Year and Year of Experimental Psychiatric Liaison Program

Placement After Discharge	Baseline Year			Experimental Year		
	Admitted	Discharged N	Discharged %	Admitted	Discharged N	Discharged %
Mount Sinai Hospital	118[a]			138[a]		
Home		56	47.5		60	43.5
Rehabilitation hospital		16	13.6		12	8.7
Nursing home		41	34.7		49	35.5
Other		4	3.4		8	5.8
Northwestern Memorial Hospital	92			108		
Liaison unit	40			59		
Home		19	47.5		26	44.1
Rehabilitation hospital		7	17.5		13	22.0
Nursing home		5	12.5		16	27.1
Other		9	22.5		4	6.8
Control units	52			49		
Home		20	38.5		14	28.6
Rehabilitation hospital		14	26.9		18	36.7
Nursing home		15	28.8		8	16.3
Other		3	5.8		4	8.2

[a]Number of patients for whom data were available.

length of stay for hospitalized elderly patients. However, the study did not indicate that the psychiatric intervention had any effect on postdischarge placement. The findings indicating diminished psychiatric morbidity with the psychiatric intervention are still being analyzed.

During the baseline year, only 10% and 2% of the patients were referred for psychiatric consultation at Mount Sinai and Northwestern, respectively, in contrast to 79% and 61% who were evaluated by the psychiatrist during the experimental year. Patients who refused to participate constituted the bulk of those not seen. In the experimental year, approximately 50% of the elderly patients evidenced symptoms consistent with the *DSM-III-R* criteria for organic mental disorder, and many experienced delirium secondary to organic conditions that in many cases were reversible. This finding suggests that the majority of patients with organic mental disorders in the baseline year were not referred. Consequently, one mechanism for the shorter length of stay in the experimental year could have been the treatment for reversible organic mental disorders. The prevalence of organic mental disorder, and delirium in particular, is also important because of the association between delirium and death (24).

Fulop et al. (25) have demonstrated that psychiatric morbidity in the medically/surgically ill is associated with longer length of stay. Similar results were found by Levenson et al. (26). Further, Lyons et al. (27) reported that earlier psychiatric intervention was associated with earlier hospital discharge. This suggests that psychiatric screening (liaison) early in the hospitalization for medically ill patients at high risk for psychiatric morbidity is preferable to the traditional strategy of consultation referral by the primary care physician, which occurs for relatively few patients (28) and often after a major portion of the hospitalization has elapsed (27, 29). That earlier psychiatric intervention reduces length of stay has been further documented with patients who have spinal cord or head injuries (6).

The results at Northwestern Memorial Hospital also support Levitan and Kornfeld's findings, but in a somewhat complicated manner. The liaison unit, unit A, at Northwestern shared a floor with one of the control units, unit B. The second control unit, unit C, was not contiguous with unit A and was two floors away. A substantial reduction in length of stay occurred on the liaison unit. Unit B, which was contiguous and shared the same floor, discharge planner, and social worker, did not have a major change, suggesting a carry-over effect of the liaison intervention from the contiguous liaison unit, given that the length of stay in unit C, which was not contiguous to the liaison unit, increased over the two years of study. The control unit that was isolated from the liaison unit and had a completely independent staff showed a longer length of stay during the second year of the investigation.

This study indicates a cost offset from a psychiatric liaison intervention: not only could the psychiatrist's salary for performing consultations for all consenting elderly patients with hip fractures be generated from fees earned (although not in this research study), a substantial savings could accrue for the hospital. Not only was the decrease in length of stay at Mount Sinai statistically significant, but the reduction by $1,294 (per diem×2-day difference in length of stay) in hospital costs per patient ($178,572 total) has important implications for policy. The reduced length of stay with psychiatric liaison intervention at Northwestern would also have led to substantial savings ($97,361).

More than 200,000 hip fractures occur annually in the United States. One-fourth of nursing home residents fracture a hip at some time during their stays. Not only do these patients manifest substantial psychiatric morbidity while in the hospital, but such psychiatric conditions are largely undetected and these patients generally are not referred for psychiatric evaluation and treatment. Cost offset data support the position that hip fracture patients admitted to hospitals for surgical repair would benefit from psychiatric screening early in their hospital stays. The establishment of systematic psychiatric liaison on orthopedic wards for them would not only promote better patient care but accrue substantial financial savings as well.

Other studies indicate that earlier discharge of hip fracture patients prompted by reimbursement policies based on diagnosis-related groups (DRGs) may mean that these patients are less able to walk when discharged and are therefore more likely to be transferred to nursing homes after discharge and to remain there at 1 year (30). This finding indicates that the hospital's

cost savings from earlier discharge are transferred to costs for other institutions in the year after surgical repair of fractured hips and that these patients have less complete restoration of function at 1 year. We are currently analyzing the 6- and 12-week follow-up data from the current study to examine this cost transfer due to earlier discharge.

Finally, this study demonstrates the advantage of multisite studies. The initial lengths of stay in the baseline year at Mount Sinai and Northwestern were significantly different. This difference indicates a need to perform psychiatric intervention studies with medically ill patients at multiple sites to overcome the idiosyncratic characteristics of a given institution and of a particular case mix. The lengths of stay in the two hospitals for patients receiving similar procedures for a homogeneous disease category (hip fracture, DRG 410) were so different to begin with that the opportunity for affecting length of stay with an intervention was less at Northwestern, where the patients stayed an average of 5 fewer days. Multisite intervention studies using identical intervention methods with homogeneous patient groups and assessment that is adequate to control for seriousness of illness and demographic variations are crucial to overcoming the pitfalls of case mix anomalies that may result from single-institution studies and heterogeneous medically ill patient groups.

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