

Total charges for inpatient medical rehabilitation

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Descriptive information on inpatient charges for a sample of 151 individuals discharged from three Boston area medical rehabilitation facilities is presented in this article. The total charges for inpatient rehabilitation were nearly \$3 million, and the mean charge was \$19,568. Also presented are a

description of how charges vary by medical, demographic, social, and external factors and an identification of predictors of total charges for inpatient medical rehabilitation. These results establish a reference point for developing prospective payment systems for inpatient medical rehabilitation.

Introduction

Technological advances in medicine and the aging of the population have contributed to a greater prevalence of chronic conditions (Gruenberg, 1977). The number of persons with some major chronic limitation of daily living increased by 37 percent from 1966 to 1976, from 22 million to 30.2 million (Colvez and Blanchet, 1981). The prevalence of severe disability increased by more than 70 percent from 1966 to 1979, to a rate of 365 persons per 10,000 population (DeJong and Lifchez, 1983). The high cost of providing health care to the chronically ill and disabled is exacerbated by the increasing number of these persons in the general population.

Greater demand for medical rehabilitation has been precipitated by three factors: the greater number of persons with disabilities, medical rehabilitation facilities' current exemption from Medicare's diagnosis related groups (DRG's), and the growing awareness of the efficacy of medical rehabilitation. Acute hospitals, which now must comply with DRG's, have powerful financial incentives to transfer patients earlier and more frequently to rehabilitation facilities.

Greater demand for rehabilitation services and the high percent of admissions to medical rehabilitation facilities financed by Medicare has caused the Federal Government to reassess the current fee-for-service reimbursement of these services. Research in this area is under way (National Association of Rehabilitation Facilities, 1986; Health Care Financing Administration, 1988), but progress toward a prospective payment system is slow because of the lack of comprehensive data on charges and on factors that affect charges for inpatient medical rehabilitation.

Inpatient medical rehabilitation

The focus of medical rehabilitation is on the multiple medical problems and functional limitations associated with chronic disease and disability. In contrast to acute care, the emphasis of rehabilitation

is more on functional descriptors than on etiologic ones (Health Care Financing Administration, 1988).

Most rehabilitation patients are initially admitted to acute-care hospitals, where their medical conditions are diagnosed and stabilized; acute-care hospitals rarely have either the resources or the expertise to handle patients' rehabilitation needs. Once medically stable, appropriate patients are transferred to rehabilitation facilities, where intensive, individualized therapy programs are designed to maximize self-care, mobility, communication, and cognitive skills.

The goal of rehabilitation is to restore functional independence when possible and to facilitate psychosocial adjustment to residual disability. Medical rehabilitation is provided through interdisciplinary teams that include physicians, rehabilitation nurses, occupational and physical therapists, speech and language pathologists, vocational counselors, psychologists, and social workers (National Association of Rehabilitation Facilities, 1986).

Differences between acute care and rehabilitation care are exemplified by the average time patients spend in each setting. In 1983, the national average length of stay (LOS) in acute-care facilities was 7.6 days, compared with 41.0 days in medical rehabilitation facilities. The mean charge for patients in an acute-care facility was \$3,221, compared with a mean charge of \$11,614 for patients in medical rehabilitation facilities (American Hospital Association, 1983). The longer LOS and the greater mean charge reflect the chronic nature of the conditions treated in medical rehabilitation facilities.

Rehabilitation's diagnosis-related groups exemption

The 1983 Amendments to the Social Security Act mandated prospective reimbursement for acute-care inpatient hospital services provided to Medicare patients, based on 467 DRG's. Medical rehabilitation facilities were exempt from DRG's for three reasons: Their patients' diagnoses did not conform to the DRG's; the mix of services they provide differed significantly from those of acute-care facilities; and the data used to develop DRG's contained little, if any, input from the field of medical rehabilitation (Ernst and Whinney, 1983).

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The Health Care Financing Administration (HCFA) requires all rehabilitation facilities to apply annually for exemption from DRG's and to do the following:

- Have a provider agreement to participate in Medicare.
- Be primarily engaged in providing intensive rehabilitation services, with 75 percent of their patients falling into 10 specific diagnoses (stroke, spinal cord injury, congenital deformities, amputations, multiple trauma, hip fracture, brain injury, polyarthritis, neurologic disorders, and burns).
- Use preadmission screening to select only those cases with potential for significant improvement from an intensive rehabilitation program.
- Provide close medical supervision, rehabilitation nursing, and occupational and physical therapy, and other services as needed (e.g., speech therapy, prosthetic services, social/psychological counseling).
- Have a full-time medical rehabilitation director.
- Demonstrate individual treatment plans.
- Utilize a coordinated multidisciplinary approach (Federal Register, 1985).

With health care cost containment a national priority, medical rehabilitation programs will soon be forced to provide quality services within prescribed financial limits. Thus, more accurate data on the charges for inpatient medical rehabilitation are needed so that rehabilitation professionals can begin to consider possible alternatives for prospective payment.

Presented in this article are descriptive data on the charges for inpatient medical rehabilitation. Here we show how charges vary with medical, demographic, external, and social factors; and we identify predictors of total charges for inpatient rehabilitation. Our purpose is to provide medical rehabilitation professionals and leaders in health finance with detailed documentation of current expenditure patterns for inpatient medical rehabilitation.

Project design

Patients were recruited from three rehabilitation facilities in greater Boston—the Rehabilitation Institute at New England Medical Center Hospitals, Spaulding Rehabilitation Hospital, and New England Rehabilitation Hospital.

Data sources

Data for this analysis come from three sources: medical records, questionnaires completed by participants, and inpatient rehabilitation bills. Age, sex, DRG, functional level at admission, severity of illness, referral hospital, payer, and LOS in acute-care hospitals and rehabilitation hospitals were obtained from the medical record.

Functional level at admission was measured by an activities of daily living (ADL) index that was completed within 3 days of admission by an occupational therapist or a physical therapist. These

ADL indexes measure personal care skills (bathing, dressing, toileting, and eating) and mobility skills (ability to transfer, maneuver, and transport oneself). The scores reflect how much assistance is required by the individual to complete a task. The participating institutions used either the Barthel Index (Mahoney and Barthel, 1965) or the Kenny Scale (Schoening et al., 1965). Although the Barthel Index and the Kenny Scale use different scoring systems, they measure the same skills; and results are comparable. The two systems were standardized, resulting in one measure of ADL, based on a 100-point Barthel equivalent scale.

A severity score (based on both the acute and rehabilitation stays) was assigned using the Severity of Illness Index (SII). The SII, developed by Susan Horn and associates, is comprised of the following seven components:

- Stage of principal diagnosis.
- Concurrent interactions.
- Complications.
- Dependency on staff.
- Procedures (nonsurgical).
- Rate of response to therapy.
- Residual effects (Horn et al., 1983).

Each component was ranked from one to four, yielding a possible range of 7 to 28, when the scores were totaled. Information was abstracted from patients' medical records by two members of the study team. Each component was rated, and the seven scores were totaled. The interrater reliability was .74 when the total scores of the two raters were compared. In instances of disagreement on specific components, the medical record was reviewed again until agreement was reached. Changes made to reach a consensus were incorporated into the final score. Physician fees were not listed on the bills and are therefore not included in the analyses.

Patient description

Patients discharged from medical rehabilitation facilities were eligible for participation in the longitudinal study, provided they did not meet any of the following exclusion criteria:

- Under 18 years of age.
- Length of stay in rehabilitation less than 7 days.
- Functional score greater than 75 at admission to rehabilitation.
- Prior rehabilitation admission for current disability.
- Discharge to institutional setting (e.g., nursing home, hospital, or long-term care facility) or deceased.
- Non-English speaking.
- Primary focus of admission was chronic pain, substance abuse, chronic renal dialysis, brain tumor or any malignancy, neuropsychiatric condition (e.g., dementia or psychosis), or medical management (overriding emphasis of hospitalization was therapeutic or palliative care of medical illness rather than rehabilitation).

- Rehabilitation program not completed (patient left against medical advice).
- No telephone.
- Residing outside the continental United States.

A total of 1,554 medical records were screened, yielding 481 eligible patients. The criterion that LOS be at least 7 days was used to exclude patients who were admitted for evaluation rather than for intensive rehabilitation. (Generally, those with an LOS of less than 7 days were either there for evaluation or were found to be inappropriate rehabilitation candidates.) To obtain a sample of the most severely disabled rehabilitation patients, persons with a functional score at admission above 75 were excluded. In contrast to the two exclusion criteria above, which result in eligibles being more severely ill, the exclusion on discharge to an institutional setting renders eligibles less severely ill.

Among the 481 persons who were eligible, 209 completed the entire study, 110 refused to participate, 100 were not successfully contacted for recruitment, 47 dropped out of the study after initial consent, and 15 died during the course of the 12-month study period. Unreported results show that these categories of patients (e.g., completers, refusers, those not contacted, dropouts, and deceased) were not significantly different on diagnostic composition, sex, or function at admission, except that persons who refused to participate were significantly older than those in the other four groups. Other studies document that age is associated with higher refusal rates among the elderly (Norris, 1972).

This article is based on 151 of those who completed the study ($n = 209$). There were 58 completers not included in this analysis because there were not sufficient numbers in any one DRG. Of these 151 persons, 127 completed the entire study, 16 were dropouts, and 8 died in the course of the study period. The authors do not claim that this sample is representative of all patients cared for in these rehabilitation centers. However, it is expected that many of the findings reported in this study would be similar for patients from other rehabilitation centers given the same exclusion criteria.

The ages of the 151 patients ranged from 32 to 95 years of age, with 76 percent 65 years of age or over. Sixty percent were female, 42 percent were currently married, and the mean education was 11.5 years. Study participants were categorized as follows: stroke (DRG 014), hip fracture (DRG 210), hip replacement (DRG 209), and amputees (DRG 213).

Analysis of variance (ANOVA) was used to examine total inpatient rehabilitation charges by age, sex, education, DRG, severity of illness, function at admission, type of referral hospital, payer, acute LOS, number of persons in household at discharge, and marital status. ANOVA was also used to explore the variation in service mix by DRG, function at admission, severity of illness, and age. Stepwise and hierarchical regression were used to identify factors that could predict total charges for inpatient medical rehabilitation.

Findings

For this sample of 151 patients, total inpatient rehabilitation charges were nearly 3 million dollars for 6,951 days of care. The mean charge was \$19,568, with a range of \$3,095 to \$97,566 and a median of \$14,759. The mean length of stay was 46 days with a range of 9 to 172 days.

Thirty-two percent of the patients returned home to live alone, 37 percent returned home to live with one person, and 31 percent returned home to live with two people or more. The mean functional score (Barthel equivalent) at admission was 51.3, with a standard deviation of 14.1 and a range of 10 to 75; higher scores denote greater independence. The mean SII score was 13.4, with a standard deviation of 2.3 and a range of 10 to 21; higher scores denote greater severity.

Sixty-two percent of the sample were covered by Medicare (60 percent of whom were also covered by supplemental insurance), 14 percent were covered by Blue Cross/Blue Shield, 14 percent were covered by Medicaid, 7 percent were covered by commercial insurance, and 3 percent either had coverage through an HMO, Workman's Compensation, or had no coverage.

Utilization patterns within patient groups

The following analyses are based on ANOVA. Rehabilitation LOS (Figure 1) and per diem charges (Figure 2) were examined within DRG's: stroke (DRG 014), hip replacement (DRG 209), hip fracture (DRG 210), and amputation (DRG 213). Results indicate that there are significant differences in mean LOS and per diem charges by DRG ($p < .01$).

Charges for inpatient rehabilitation were examined by three medical factors: DRG, function at admission, and severity of illness (Table 1). There was a statistically significant difference in mean charges between DRG's: Patients with amputation had a mean charge of \$26,825, compared with a mean charge of \$8,002 for patients with hip replacement. This finding was expected because patients with amputations had both longer LOS and higher per diem charges than patients with hip replacements. The median charges are shown in Table 1 to demonstrate the normality or skewness of the distribution within each category of the independent variables. For instance, in the stroke category the lower median (vis-a-vis the mean) indicates that the charges are skewed to the right because of high cost outliers. In contrast, the mean and median charges in the amputation category are almost identical, indicating that this is not a skewed distribution.

To examine differences in mean charges by function at admission, scores were dichotomized at the midpoint of the functional scale; those with lower scores (less than 50) were compared with those with higher scores. Patients with lower scores (i.e., more functionally impaired) had a mean charge of \$25,874, compared with a mean charge of \$16,162 for patients

Figure 1
Length of stay of patients in medical rehabilitation facilities,
by diagnosis-related group, 1984

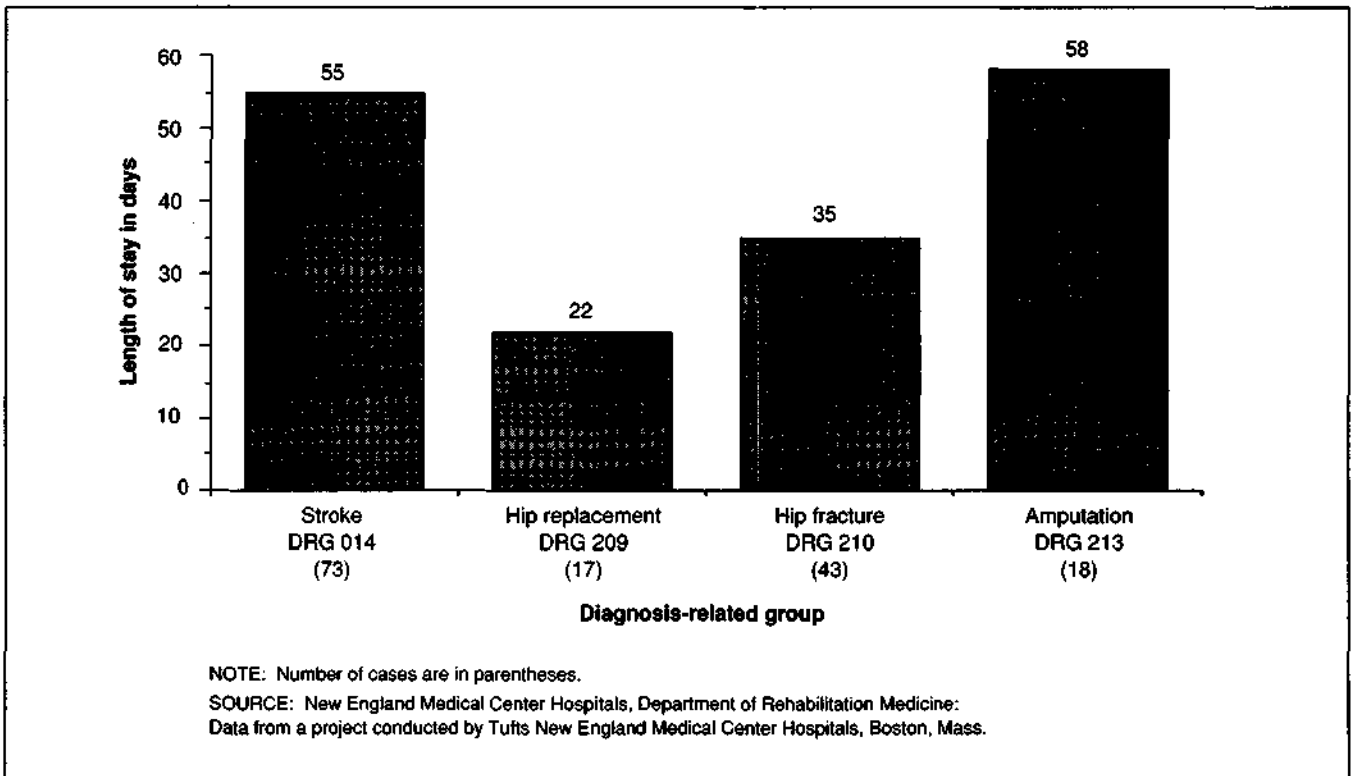


Figure 2
Per diem charges for patients in medical rehabilitation facilities,
by diagnosis-related group, 1984

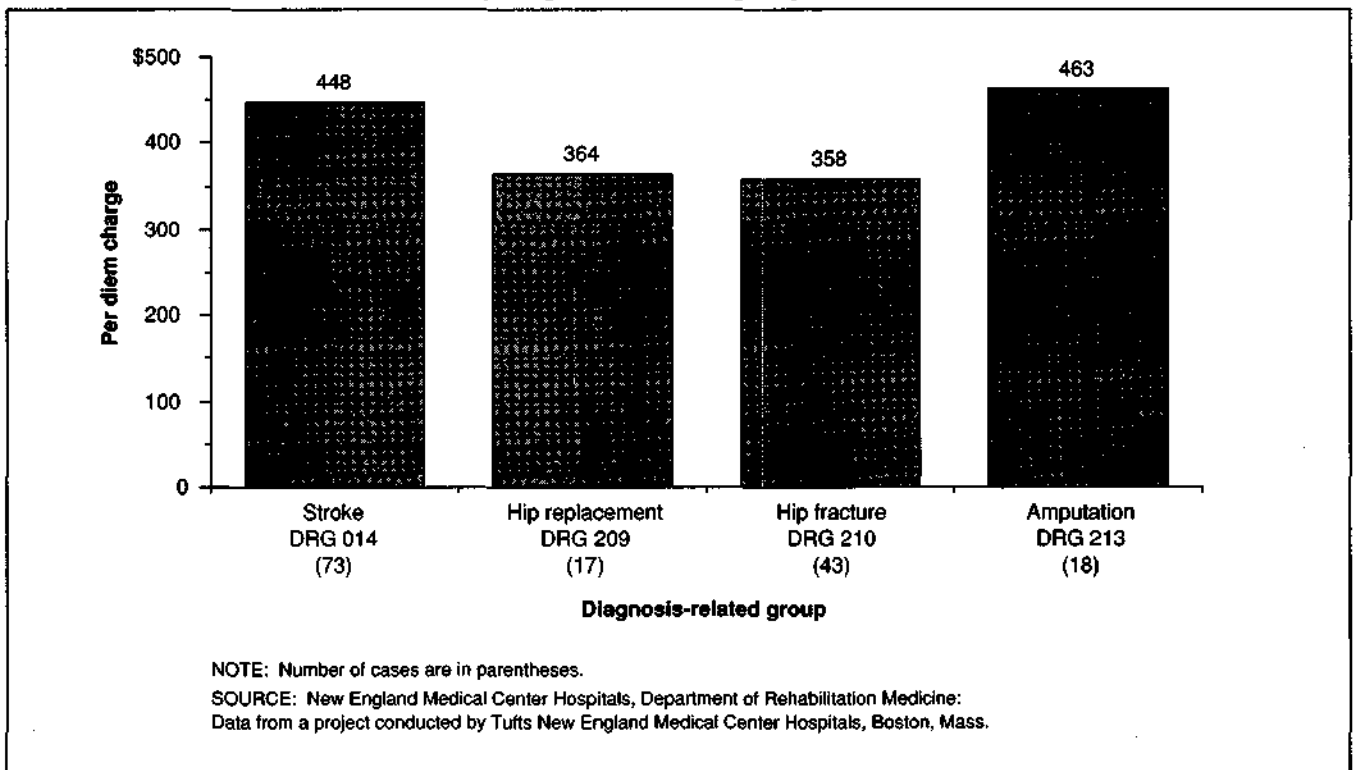


Table 1

Mean, median, and standard deviation of charges for inpatient care in medical rehabilitation facilities, by patient characteristic: 1984

Characteristic	Mean	Median	Standard deviation	Number of cases
Total	\$19,568	\$14,759	\$14,840	151
Diagnosis-related group¹				
Hip replacement (209)	8,002	6,248	3,516	17
Hip fracture (210)	12,522	12,347	7,267	43
Stroke (014)	24,623	19,732	16,796	73
Amputation (213)	26,825	26,432	13,472	18
Function at admission¹				
Higher (GE 50)	16,162	13,437	10,565	96
Lower (LT 50)	25,874	19,938	21,152	54
Severity of Illness Index Score¹				
Lower (LE 14)	16,784	14,297	10,937	115
Higher (GT 14)	28,461	20,824	21,152	36
Age¹				
32-59 years	27,262	25,562	18,435	23
60-75 years	21,542	17,928	15,975	63
76-95 years	15,257	12,630	10,501	52
Sex¹				
Male	24,115	17,700	15,740	57
Female	17,321	13,285	14,157	81
Payer¹				
Medicare	16,357	14,093	9,745	37
Medicare and Medex	16,397	12,507	12,416	56
Other payers	15,829	13,570	6,649	4
Medicaid	21,092	18,422	12,764	21
Commercial	22,293	20,840	12,912	11
Blue Cross/Blue Shield	30,904	22,336	24,024	22
Others in residence¹				
0	14,398	12,828	8,198	44
1	24,085	20,840	15,527	51
2 or more	21,295	14,360	18,392	43

¹P < .01, based on F-test.

NOTES: GE is greater than or equal to. LT is less than. LE is less than or equal to. GT is greater than.

SOURCE: New England Medical Center Hospitals, Department of Rehabilitation Medicine: Data from a project conducted by Tufts New England Medical Center Hospitals, Boston, Mass.

with higher scores. Similarly, SII scores were dichotomized: scores of 14 or less (less severely ill) and over 14. Patients with lower SII scores had a mean charge of \$16,784, and patients with SII scores greater than 14 had a mean charge of \$28,461 (Table 1).

Inpatient rehabilitation charges were examined by demographic factors (age, sex, and education) using ANOVA (Table 1). The results indicate that the youngest age group had the highest mean charges (\$27,262), and the oldest age group had the lowest mean charges (\$15,257). Further analyses revealed that these differences were principally the result of differences in diagnostic composition by age. Charges were also significantly different for males (\$24,115) and females (\$17,321); this also appears to be a reflection of different diagnostic composition by sex. Education was not related to charges and, thus, was

not included on Table 1.

Inpatient rehabilitation charges were examined by external factors: payer, type of referral hospital, and length of stay in acute hospital (Table 1). Mean charges varied by payer with patients covered by Medicare having a mean charge of \$16,357, compared with a mean charge of \$30,904 for those covered by Blue Cross/Blue Shield. The difference in mean charges, in part, reflects differences in diagnostic composition by payer. The Medicare subset had a high percent of persons with hip replacement and hip fracture. Mean charges for patients referred by teaching hospitals did not differ significantly from those of patients referred by nonteaching hospitals. Similarly, mean charges for patients with shorter acute LOS (less than 18 days) did not differ significantly from those of patients with longer acute LOS.

Charges for inpatient rehabilitation were examined by existence of social support systems and were found to differ significantly (Table 1). Discharged patients who returned home to live alone had a mean charge of \$14,398, and those returning home to live with two people or more had a mean charge of \$21,295. This result was surprising; it was expected that individuals returning home to live alone would have higher mean charges because they would need to be more functionally independent to live alone. To reach this level of independence, they would need more therapy and would therefore have a longer LOS and a higher mean charge. Looking within DRG's revealed that diagnostic differences confound the relationship between charges and number of persons in the household. The group of individuals who returned home to live alone accounted for a higher proportion of patients with hip fractures, and they usually required a short rehabilitation program.

Table 2 presents charges for inpatient rehabilitation among the two largest DRG's in the sample (DRG 014, stroke; and DRG 210, hip fracture) by function at admission, age, and severity of illness. Among patients with stroke, those with higher functional scores (less functionally impaired) at admission had a significantly lower mean charge of \$18,894 compared with a mean charge of \$29,900 for those with lower functional scores at admission ($p < .01$). However, function at admission was not a good discriminator among hip fracture patients.

Among patients with stroke, those with lower SII scores (less severely ill) had a significantly lower mean charge of \$21,764, compared with a mean charge of

\$34,041 for those with higher SII scores ($p < .01$). The SII was also a significant discriminator among patients with hip fracture; those with lower SII scores had a mean charge of \$11,023 compared with a mean charge of \$16,882 for those with higher SII scores.

Mean charges for inpatient rehabilitation were compared for patients under 65 years of age and those 65 years of age or over. Among younger stroke patients, the mean charge was \$30,438 compared with a mean charge of \$21,233 among older stroke patients. The younger hip fracture patients also had significantly higher mean charges—\$23,144 compared with a mean charge of \$11,529 for older persons.

It is apparent from these findings that total charges for inpatient medical rehabilitation vary significantly with certain medical, demographic, external, and social factors. Furthermore, DRG alone is not an adequate discriminator of total charges; other variables are significant predictors of charges even within DRG's.

Variations in service mix

To explore the variation in service mix by various factors, total mean charges were divided into types of service charges as a percent of the total charge (bed-to-total, therapy-to-total, and other-to-total). The therapy-to-total ratio was compared by DRG, function at admission, SII, and age. Results indicated that there was no significant difference in the percent of total charges consumed by therapies for any of these medical variables.

Table 2
Mean, median, and standard deviation of charges for inpatient care in medical rehabilitation facilities, by selected patient characteristic: 1984

Characteristic	Mean	Median	Standard deviation	Number of cases
	Charges			
Stroke (014)				
Higher function (GE 50) ¹	\$18,894	\$17,308	\$9,265	35
Lower function (LT 50)	29,900	21,053	20,259	38
Lower SII (LE 14) ¹	21,764	19,237	11,626	56
Higher SII (GT 14)	34,041	21,265	26,113	17
Older (GT 64 years) ²	21,233	17,928	12,107	43
Younger (LE 64 years)	30,438	23,414	21,571	28
Hip fracture (210)				
Higher function (GE 50)	12,066	11,529	7,479	31
Lower function (LT 50)	14,401	14,370	6,720	11
Low SII (LE 14) ²	11,023	9,256	6,690	32
High SII (GT 14)	16,882	14,370	7,412	11
Older (GT 64) ¹	11,529	10,251	6,558	33
Younger (LE 64)	23,144	25,566	9,777	3

¹ $P < .01$, based on F -test.

² $P < .05$, based on F -test.

NOTES: GE is greater than or equal to. LT is less than. LE is less than or equal to. GT is greater than. SII is for Severity of Illness Index.

SOURCE: New England Medical Center Hospitals, Department of Rehabilitation Medicine: Data from a project conducted by Tufts New England Medical Center Hospitals, Boston, Mass.

Differences between participating centers

Institutional comparisons were made for the entire sample ($n = 151$) as well as among stroke and hip fracture patients (Table 3). Variables considered were mean charge, age, LOS in acute-care hospitals and in medical rehabilitation facilities, function at admission to and discharge from medical rehabilitation facilities, change in function (discharge function - admission function), number in household at discharge, and SII score. Only six patients were recruited from Center C; therefore comparisons are limited to Center A and Center B ($n = 145$).

There was a significant difference in mean charges between the centers, with Center A having a mean charge of \$23,905 compared with a mean charge of

\$13,860 for Center B ($p < .01$). Initial LOS in acute-care hospitals was significantly longer for patients at Center B ($p < .01$), and LOS in medical rehabilitation facilities was significantly longer for patients at Center A ($p < .01$). Patients at Center A had slightly (but not significantly) higher function at admission than patients at Center B and significantly higher function at discharge ($p < .01$). However, change in function during inpatient care was similar for the two centers. The two centers differed on the number of persons in the household at discharge: Center A had 2.0 persons, compared with 2.5 persons for Center B ($p < .05$).

Differences between centers existed within DRG's as well. Patients with stroke had a mean charge of \$30,651 at Center A, compared with a mean charge of \$19,062 at Center B ($p < .01$). As in the total sample,

Table 3
Variations in the mean and in the standard deviation between Centers A and B, by selected variables

Selected variable	Center A		Center B	
	Mean	Standard deviation	Mean	Standard deviation
Total sample		($n = 79$)		($n = 66$)
Total charge	\$23,905	\$16,209	\$13,860	\$10,790
Age	73	12	70	13
Length of stay in acute-care hospital	17	10	21	¹ 9
Length of stay in medical rehabilitation facility	53	31	37	¹ 22
Admission function	53	13	49	15
Discharge function	78	13	70	¹ 13
Change in function	25	10	22	12
Number in residence	2.0	0.9	2.5	² 1.7
Severity	13.3	2.3	13.3	2.4
Stroke (014)		($n = 36$)		($n = 33$)
Total charge	\$30,651	\$19,274	\$19,062	¹ \$12,001
Age	69	13	66	12
Length of stay in acute-care hospital	15	7	20	² 8
Length of stay in medical rehabilitation facility	66	35	45	¹ 25
Admission function	49	16	43	15
Discharge function	75	16	68	² 13
Change in function	25	10	25	13
Number in residence	2.3	1.0	2.7	2.0
Severity	13.4	2.4	14.0	2.5
Hip fracture (210)		($n = 26$)		($n = 17$)
Total charge	16,418	6,718	6,563	¹ 2,385
Age	78	9	80	10
Length of stay in acute-care hospital	16	12	22	9
Length of stay in medical rehabilitation facility	41	16	26	¹ 8
Admission function	54	9	53	14
Discharge function	80	8	70	¹ 12
Change in function	27	10	18	² 9
Number in residence	1.8	1.0	2.1	1.3
Severity	13.6	2.2	12.4	2.0

¹ $P < .01$, based on F -test.

² $P < .05$, based on F -test.

NOTE: n is for number of cases.

SOURCE: New England Medical Center Hospitals, Department of Rehabilitation Medicine: Data from a project conducted by Tufts New England Medical Center Hospitals, Boston, Mass.

stroke patients at Center B had longer LOS in acute-care hospitals ($p < .05$), and stroke patients at Center A had longer LOS in medical rehabilitation facilities ($p < .01$). As in the total sample, admission function was slightly (but not significantly) higher at Center A, and discharge function was significantly higher at Center A ($p < .05$). There was no significant difference in the amount of functional improvement between the two centers.

Hip fracture patients at Center A had a mean charge of \$16,418 compared with a mean charge of \$6,563 at Center B ($p < .001$). Again LOS in medical rehabilitation facilities for hip fracture patients at Center A was longer than that at Center B ($p < .001$); but among hip fracture patients, there was no difference in LOS in acute-care hospitals between the two centers. The differences in charges and LOS between the two centers may in part be explained by greater functional improvement at Center A ($p < .05$).

Bed composition also may account for differences in mean charges between the two centers. Center A has only hospital level rehabilitation beds, and Center B has both skilled nursing and hospital level rehabilitation beds. The skilled nursing beds are one-half the cost of the rehabilitation beds per day and, therefore, patients in these beds have lower charges.

With the exception of the aforementioned differences, patients at both centers were similar at admission to rehabilitation facilities. Differences in LOS and charges appear to reflect institutional differences (e.g., differences in organization, locality, medical school affiliation, bed composition).

Regression results

Regression analysis was used to allow simultaneous control of interrelated factors and, thereby, to identify the most important predictors of inpatient rehabilitation charges. All variables considered in the bivariate analyses were reconsidered in the regression analyses.

In the preliminary regression equation the order of variables entering the model was SII, center, Medicare, stroke, amputation, and function at admission. Age and sex did not enter when considered in this multivariate design. It is interesting that center and Medicare entered on early steps in the model, but there may be confounding factors that explain this. For example, all hip fracture patients in this study are covered by Medicare, and these patients were found to have lower mean charges than patients with stroke and amputation. Possible confounding factors with center include how acutely ill patients were on admission to medical rehabilitation facilities and the bed composition of the facility (e.g., presence of skilled nursing beds).

An important policy question is whether or not these two variables are important after controlling for the medical and functional indexes. In other words, which is a more significant predictor of charges—case-mix or facility-specific measures? To answer this,

a combined hierarchical and stepwise approach was used. Among the six variables that entered the preliminary equation, Medicare and center were allowed to enter the equation only after SII, function at admission, stroke, and amputation had entered—a hierarchical approach. Among the first four variables and between the last two, order of entry was based purely on ability to explain variance, given other variables already in the equation—a stepwise approach.

More than 60 percent of the variance in total charges was explained by six variables, using the combined hierarchical and stepwise approach (Table 4). The SII was the best predictor of total charges entering the equations on the first step and explaining over 20 percent of the variance in total charges for inpatient medical rehabilitation (Table 4). One would expect that patients who are more severely ill would use more resources in acute-care hospitals; it was interesting to see this trend prevail for inpatient rehabilitation services as well.

Stroke was the next variable to enter the regression equation, indicating that stroke patients had significantly higher charges than nonstroke patients. Amputation entered next, with amputees having higher charges than the remaining hip fracture patients. (This is consistent with earlier bivariate results that indicated significantly shorter LOS in medical rehabilitation facilities and lower mean charges for hip fracture patients.) Function at admission entered on the fourth step, with high admission function associated with lower charges, even when controlling for severity and diagnosis. These four variables explained 39 percent of the variance in total charges for inpatient medical rehabilitation.

Center entered the equation at the fifth step, indicating that Center B patients generated significantly lower total charges than Center A patients, even when controlling for severity, function at admission, and DRG. This strongly suggests that there are facility-specific characteristics that affect utilization of inpatient medical rehabilitation services.

Medicare entered the equation on the sixth step, indicating that Medicare patients generated

Table 4
Multiple regression results: Predicting total charges for inpatient medical rehabilitation

Independent variable	R-square	Beta
Severity of illness Index	.21	.23
Stroke (DRG 014)	.30	.28
Amputation (DRG 213)	.35	.29
Function at admission	.37	-.25
Center	.53	-.46
Medicare	.61	-.30

NOTE: All variables included on this table added significantly to explained variance at the .05 level.

SOURCE: New England Medical Center Hospitals, Department of Rehabilitation Medicine: Data from a project conducted by Tufts New England Medical Center Hospitals, Boston, Mass.

significantly lower total charges than non-Medicare patients, even when controlling for severity, function at admission, DRG, and center. To determine whether this finding was purely a result of cost shifting across payers or whether it was related to differences in service delivery among the different payer groups, the combined hierarchical and stepwise regression was repeated. This time LOS in medical rehabilitation facilities was the dependent variable. The order of entry into the equation was identical, and these variables explained 55 percent of the variance in LOS in medical rehabilitation facilities. This strongly suggests that prescription of medical rehabilitation services is affected by insurance coverage.

Age, sex, and number of persons in residence did not enter the regression equation.

These findings indicate that case-mix measures are good predictors of inpatient rehabilitation charges; and although inexact, they may serve as the basis of a prospective payment system for inpatient medical rehabilitation services. Furthermore, these results suggest that there are differences across facilities that may need to be taken into account (e.g., location, medical school affiliation, bed composition, etc.) when setting up a prospective payment system. The fact that Medicare was a significant predictor of total charges and LOS in medical rehabilitation facilities strongly suggests that the prescription of rehabilitation services is affected by insurance coverage.

Implications

There is a dearth of information in the scientific literature regarding charges for inpatient care in medical rehabilitation facilities. This analysis documents the high resource utilization by a small number of individuals (nearly 3 million dollars for 151 patients) for one component of medical care—rehabilitation. To fully assess the cost of medical rehabilitation, charges for initial acute care, postrehabilitation care, and physician care must be determined.

The mean charges for this sample are considerably higher than the national average. Although the national average LOS for rehabilitation hospitals and units is 41 days (American Hospital Association, 1983), the average LOS in our sample was nearly 49 days, or 20 percent higher than average. Furthermore, although the national mean charge for patients in rehabilitation hospitals and units is \$11,164 (American Hospital Association, 1983), the mean charge in our sample was \$19,568, nearly twice the national average.

Higher mean charges in this sample are largely the result of the selection criteria used. These criteria excluded patients who did not complete the medical rehabilitation program (e.g., patients who died or who were transferred to another institution) and would generally have shorter lengths of stay and lower mean charges. In addition, the criteria excluded patients with LOS of less than 7 days and persons with high functional levels at admission. Excluding these

individuals, who would clearly have had lower mean charges, resulted in a sample with more severe impairments and therefore higher mean charges. Although this sample is not representative of all rehabilitation patients, it is expected that these same variables would be important in other rehabilitation samples. The exclusion criteria, which narrowed the range of admission function and LOS in rehabilitation facilities, may have reduced the importance of certain predictors.

Bivariate analyses reveal that total inpatient rehabilitation charges varied with several factors including age, sex, DRG, function at admission, severity of illness, payer, and existence of social supports. However, the most compelling results were those from the regression analysis, where a combination of case-mix and facility variables explained 60 percent of the variation in charges for inpatient medical rehabilitation. The finding that "center" entered the regression equation, even when other factors were forced in first, underscores the importance of such facility-specific factors as medical school affiliation, bed composition, admission criteria, and location. These findings suggest that a prospective payment system for inpatient rehabilitation may need to consider institutional characteristics along with case mix when determining reimbursement levels.

An unexpected result pertained to the similarity in service mix among patients with very different functional levels at admission. Patients with lower function at admission were expected to have a greater percent of their total charge consumed by therapies, compared with those with higher functional levels at admission. The results indicated that, in both the total sample and within DRG's, there was no difference in the percent of total charges consumed by therapies between those with higher and lower function at admission. The most probable reason for this finding is that rehabilitation facilities are required by law to provide at least 3 hours of therapy daily to all inpatients in order to be exempt from DRG's (Medicare Hospital Manual, 1982). Hence, therapy resources appear to be allocated more by Federal regulation than by individual patient need.

Although the results of this analysis strongly suggest that certain case-mix and facility-specific variables can be used to categorize patients into relatively homogeneous charge groups, one must proceed with caution. In developing such a system, quality and access issues must be addressed. Using a single diagnostic payment rate would create powerful financial disincentives for providers to admit complex, expensive cases and would therefore make it difficult for these patients to gain access to needed care. Compared with acute-care hospitals, medical rehabilitation facilities currently have a great deal of control over admissions, and they can select the more profitable cases. In fact, many rehabilitation facilities have waiting lists, which could potentially make the wait for cost intensive cases unreasonably long.

Another issue relating to access and quality of care

is the potential for premature discharge of patients with remaining functional and cognitive impairments. Under the current acute PPS, there is clear financial incentive to discharge patients earlier. There is evidence from these findings that insurance coverage already impacts the prescription of medical rehabilitation services. Although it appears that insurance coverage is a good predictor of utilization, it would be discriminatory to consider it as a determinant of reimbursement levels. In rehabilitation this practice would not only lower quality of care, but ultimately inflate total health care expenditures by increasing the incidence of future acute-care inpatient episodes or by precipitating admission to long-term care settings.

The impact of medical rehabilitation on other sectors of the health care system is difficult to quantify. However, long-term savings resulting from the availability of these services should not be overlooked when developing prospective rates for rehabilitation. These savings may be realized through shorter LOS in acute-care hospitals (which is partially accomplished by timely transfer of typically expensive cases to lower cost medical rehabilitation facilities). In addition, enhancing functional independence may reduce the need for long-term institutionalization in chronic care and skilled nursing facilities. Further studies are needed to examine the potential impact of medical rehabilitation on costs in other sectors of the health care industry.

A special concern regarding the financing of medical rehabilitation is the high percentage of patients covered by Medicare. According to a 1983 survey done by the National Association of Rehabilitation Facilities, 51 percent of patients admitted to medical rehabilitation facilities are covered by Medicare (National Association of Rehabilitation Facilities, 1984). In this sample, 62 percent of the patients admitted to medical rehabilitation facilities were covered by Medicare. Because Medicare is the primary payer for inpatient medical rehabilitation services, any changes in Medicare's reimbursement policies can have a profound effect on the rehabilitation industry.

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