POST-ACUTE REHABILITATION OUTCOME: RELATIONSHIP TO CASE-MANAGEMENT TECHNIQUES AND STRATEGY

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ABSTRACT

Successful outcome for the traumatically brain-injured (TBI) patient is dependent on both a productive clinical therapy program and an effective case-management strategy by the carrier. This retrospective study focuses on identifying those case-management techniques which contributed to improvement in the disability, living, and occupational status of patients in a post-acute rehabilitation program. Statistical analysis indicated a positive relationship between two case-management factors and improved patient outcome. Additional analysis demonstrated predictive qualities of specific admission data for patient program cost. A review of these case-management techniques and their impact on discharge disability, living, and occupational status will be discussed.

Successful outcome for the traumatically brain-injured (TBI) patient is dependent on both a productive clinical therapy program and an effective case-management strategy by the carrier[1,2]. Recent studies have pointed to positive results of post-acute therapy with the TBI population[3,4,5,6,7]. The complex neurobehavioral sequelae of patients with TBI requires intensive physical therapy[8], cognitive retraining[9], and psychological treatment[10]. The impact of non-therapeutic factors, in particular those related to case-management techniques and carrier strategy, have not been as fully investigated. Rehabilitation clinicians and administrators would be quick to point out that decisions made by case managers and carriers are critical to the patient's successful outcome. Long-term care and support, financial assistance, and vocational training are just a few of the case-management issues that can dramatically affect the patient's progress and eventual level of independence.

This retrospective study is an attempt to analyze the impact of those case-management techniques and strategies which are common to the TBI case, and to clarify their relationship to patient recovery. Additionally, non-therapeutic patient issues are outlined and analyzed, and statistical procedures performed to demonstrate any possible predictive qualities of patient admission data. Karzmark (1992) demonstrated the use of admission test scores and demographic data to predict the cognitive outcome of people with TBI. Detecting those factors associated with successful rehabilitation, and the ability to accurately predict a patient's level of disability and program cost, would provide case managers with valuable information regarding treatment strategy.

METHODS

Subjects

This study consisted of 39 patients with traumatic brain injury. The patients were selected, based on specific criteria, from approximately 350 patients treated at a post-acute rehabilitation clinic between 1980 and 1990. All were adult in-patients.

Two groups were formed for the purpose of performing comparative analyses of patient outcome, case-management techniques and strategy, and predictive qualities of admission data. Group One consisted of patients covered by the same insurance carrier and supervised by a single case manager. Group Two consisted of patients from different insurance carriers with different case managers that, when grouped, matched Group One across eight criteria.

Group One

Patient eligibility for initial inclusion in this study was based upon the following criteria:

1. An admission Disability Rating Scale (DRS) score of 10 or less (Moderately Severe).
2. Involvement in vocational rehabilitation programming.
3. Admitted by a single carrier and single case manager.

Twenty-one patients met the requirements for inclusion in Group One (Table 1). More severely disabled patients (DRS scores of 11 or higher) and those not involved in vocational programming were not included in the study because, upon admission, vocational placement was not a goal of the carrier.

Group Two

A comparison group of 18 patients (Table 1) was obtained from previously treated patients based on the same initial criteria as Group One — a DRS of 10 or less and vocational involvement. Additionally, more specific "matching" characteristics of Group One were required. They were:

1. Males only: Group One consisted of males only.
2. Latency (number of days from date of injury to date of admission) of 1500 days or less: All Group One patients had latencies of less than 1500 days.
3. Age (at date of injury) of 20 years or older: All Group One patients were at least 20 years old.
4. Admission Occupational Status Scale scores of 14 or 15: All Group One patients had admission Occupational Status Scale scores of 14 or 15.
5. Treatment at the same facility as Group One.
6. Treatment received in the years 1981 or 1983-86: All Group One patients were treated in these years.
7. Workers' compensation insurance coverage: All Group One patients were covered by workers' compensation insurance.
8. Assigned an external case manager: All Group One patients were supervised by a case manager.

Table 1
Comparison Groups Table of Means for Demographic Data

Variable	*Group One*	*Group Two*
Age (years)	32.4	38.3
Latency (days)	285	322
Program Length (days)	229.8	276.3
Program Cost ($)	88,752*	128,654
Males/Females	21/0	18/0
Number of Patients	21	18

*T-Test p<.05

Assessment

Three disability scale scores were used for analysis in this study. They were the Disability Rating Scale (DRS), the Living Status Scale (LSS), and the Occupational Status Scale (OSS). The DRS[12] consists of rating patients in areas of arousability, self-care, dependence on others, and employability (Figure 1). Total scores are calculated and then categorized as to level of disability. The DRS is considered a reliable and valid assessment of a patient's overall level of disability[13].

The LSS (Figure 2) and the OSS (Figure 3) were both developed by the post-acute rehabilitation facility in this study (Ashley et. al., 1990). A more independent living situation, considered integral to successful patient outcomes (Fryer & Haffey, 1987), was assessed by the Living Status Scale. The LSS is a 10-point scale assessing a patient's current living site and level of supervision (eg. private quarters, board and care, acute hospital). Job placement, another key factor in assessing TBI outcome (Wehman et al., 1989), was assessed by the Occupational Status Scale. The OSS is a 16-point scale evaluating a patient's current vocational placement (e.g. full-time, part-time, volunteer).

Ratings on all three scales were routinely obtained at the time of admission and at the time of discharge for all patients. The raters were clinical supervisory staff, intimately familiar with each patient's case.

Patient and Case-Management Factors

The two comparison groups were compared for differences in outcome which might exist on the basis of the following demographic and case-management factors[16,17,18,19,20,21]:

1. Type of employment at the time of injury (blue v. white collar).
2. Legal representation as an injured worker.
3. Presence of pending third-party litigation.
4. Presence of supplemental income received from workers' compensation temporary disability payments.
5. State of claim origination (eg. California, Arizona).
6. Utilization of pre-settlement permanent disability advances for economic assistance.
7. Pre-injury history of chronic substance abuse.
8. History of substance abuse since time of injury.
9. Case manager having both claims and rehabilitation authority.
10. Length of rehabilitation program (number of days from date of admission to date of discharge).
11. Rehabilitation program cost.

All rating scale scores, demographic data, and case-manager factors were analyzed with statistical procedures using the SPSS 6.0 ®[1] program.

RESULTS

Within-Groups Analysis

Statistical analysis within-groups demonstrated significant differences between admission and discharge scores on the DRS, LSS, and OSS for both Group One and Group Two (Table 2). DRS scores yielded a z of -4.0145 ($p < .05$), LSS scores a z of -3.5494 ($p < .05$), and OSS scores a z of -4.0145 ($p < .05$) using the Wilcoxon Matched-Pairs Signed-Ranks Test. Group One improved on the DRS from a

mean of 4.95 to a mean of 1.14 (moderate to mild disability), on the LSS from a mean of 4.83 to a mean of 1.05 (private living quarters with professional help to private living quarters with no help), and on the OSS from a mean of 14.95 to a mean of 3.19 (not working to part-time at former job or equal position). Group Two improved on the DRS from a mean of 5.17 to a mean of 1.94 (moderate to partial disability), on the LSS from a mean of 3.62 to a mean of 1.67 (private living quarters with professional help to private living quarters with minimal supervision from non-professional others), and on the OSS from a mean of 15.00 to a mean of 10.28 (not working to volunteer position). Statistics indicated that both groups made significant gains in level of disability from admission to discharge.

T-Tests indicated there was no statistical difference between the groups for age (t of -1.85, p = .07), latency (t of -.37, p = .71), or program length (t of -1.25, p = .22). Group One and Group Two means for age were 32 and 38 years respectively, latency 285 and 322 days respectively, and program length 230 and 276 days respectively (Table 1).

Statistical analysis of discharge scores on the three scales and program cost, however, showed there to be significant differences between the groups (Table 3). Group One made more improvement on the DRS (z of -2.2, p < .05), LSS (z of -2.3, p < .05), and OSS (z of -4.1, p < .05). Group One and Group Two means for the DRS were 1.14 (mild) and 1.94 (partial) respectively; for the LSS, 1.05 (no help) and 1.67 (minimal help) respectively; and, for the OSS, 3.19 (part-time) and 10.28 (volunteer) respectively.

Table 2
Comparison Groups Table of Means for Within-Group Analysis

Variable (Score: Min-Max)	*Group One*		*Group Two*	
	Admission Score (Category)	*Discharge Score (Category)*	*Admission Score (Category)*	*Discharge Score (Category)*
Disability Rating Scale (0-30)	4.95 (Moderate)	1.14 (Mild)*	5.17 (Moderate)	1.94 (Partial)*
Living Status Scale (0-10)	4.83 (Private Quarters w/ Professional Help)	1.05 (Private Quarters w/ no Help)*	3.62 (Private Quarters w/ Professional Help)	1.67 (Private Quarters w/ Minimal Supervision from Non-Professional Others)*
Occupational Status Scale (0-16)	14.95 (Not Working)	3.19 (Part-time at Former Job or Equal Position)*	15.00 (Not Working)	10.28 (Volunteer)*

*Wilcoxon p<.05

Between-Groups Analysis

Statistical analysis of admission rating scale scores (DRS, LSS, and OSS) showed there to be no significant differences between the two groups (Table 3). The DRS yielded a z of -.8 (p < .05), the LSS a z of -1.1 (p < .05), and the OSS a z of -.93 (p < .05) using the Mann-Whitney U Test. Group One and Group Two means for the DRS were 4.95 and 5.17 respectively (both moderate levels of disability), for the LSS 4.83 and 3.62 respectively (both private living quarters with professional help), and for the OSS 14.95 and 15.00 respectively (both not working).

The average cost of rehabilitation for Group One patients was significantly less than patients in Group Two (t of -2.2, p < .05). Program length was less for Group One (229.8 days) compared to Group Two (276.3 days), but it was not statistically significant. Program cost for Group One was just under $89,000 per patient and for Group Two just under $129,000 per patient (Table 1), a difference of approximately $40,000.00 per patient. Multiplied

over the 21 patients in the single-carrier group, savings equaled close to $840,000 for programming expenses alone. This figure does not take into account any additional savings over the life of the patient as a result of increased independent living and improved vocational placement.

Statistics indicated that both groups started with statistically similar admission rating scale scores and demographic data, but *Group One was significantly less disabled and less costly at discharge* than Group Two.

Statistical analysis, using the Kolmogorov-Smirnov 2-Sample Test, of patient and case-management factors showed significant differences between the groups for utilization of pre-settlement permanent disability advances for economic assistance (K-S z of 2.94, $p < .05$) and the case manager having both claims and rehabilitation authority (K-S z of 1.43, $p < .05$). No other patient or case-manager factors were related to outcome at discharge.

Multiple regression analysis did demonstrate that rehabilitation program cost was predicted by admission DRS, LSS, and OSS scores, as well as age of the patient at injury (Table 4). The variance controlled was an R-square of .83 with a standard error of $20,802.45. F was equal to 18.83 with a significant F equal to .00.

Discussion

The data presented in this study supports the idea that post-acute rehabilitation programming for the traumatically brain-injured patient can be highly effective in reducing overall disability. Within-group analysis (Table 2) showed that both groups made significant improvements in disability, living, and occupational status from admission to discharge.

Between-group analysis (Table 3) demonstrated more interesting results. Although, as stated above, both groups made substantial rehabilitative progress from admission to discharge, Group One made significantly more improvement on all rating scale scores than did Group Two. Potential confounding variables such as admission rating scale scores, age, chronicity, sex, treating facility, and type of insurance coverage were controlled by initial patient inclusion criteria.

Table 3
Comparison groups table of means for between-group analysis.

Variable (Score: Min-Max)	*Admission*		*Discharge*	
	Group One Score (Category)	*Group Two Score (Category)*	*Group One Score (Category)*	*Group Two Score (Category)*
Disability Rating Scale (0-30)	4.95 (Moderate)	5.17 (Moderate)	1.14 (Mild)*	1.94 (Partial)*
Living Status Scale (0-10)	4.83 (Private Quarters w/ Professional Help)	3.62 (Private Quarters w/ Professional Help)	1.05 (Private Quarters w/ no Help)*	1.67 (Private Quarters w/ Minimal Supervision from Non-Professional Others)*
Occupational Status Scale (0-16)	14.95 (Not Working)	15.00 (Not Working)	3.19 (Part-time at Former Job or Equal Position)*	10.28 (Volunteer)*

*Mann-Whitney $p<.05$

Multiple Regression

Multiple regression analysis was performed on both comparison groups to check for any possible predictive qualities for outcome based on admission rating scale scores or demographic data. Neither age nor latency was a predictor for outcome in any way. Interestingly, DRS scores at admission did not predict disability level at discharge, nor did LSS or OSS admission scores predict respective discharge scores.

It should be noted, though, that patients were homogeneous in case-management approach as well as claims perspective utilized in management of the cases in Group

Table 4
The Predictive Value of Patient Admission Data for Program Cost

Variable	*R-Square*	*Standard Error($)*	*F*	*Significant F*
Living Status Scale	.35867	36523.93	10.62588	.0041
Occupational Status Scale	.57775	30448.09	12.31455	.0004
Age	.69665	26555.67	13.01392	.0001
Disability Rating Scale	.82480	20802.45	18.83164	.0000

One. Results indicated, more specifically, that the case-management factors of: 1) the utilization of pre-settlement permanent disability advances for economic assistance, and 2) the case manager having both claims and rehabilitation authority seemed to have favorably impacted both the disability outcome of the patient and the total cost of rehabilitation. Permanent disability advances may help the patient and/or family to improve financial security and focus full attention on the rehabilitative therapy process. Thus, patients who are able to meet their financial obligations and do not have to be concerned with losing their home, car, or other important personal items can meet therapeutic demands more effectively.

Case managers with both claims and rehabilitation authority may be better able to rapidly make important decisions concerning patient care which could be critical to a successful outcome. Delayed decisions may negatively impact a patient with TBI who's condition and progress is rapidly changing. Statistically, patients made significantly more progress and at a lower cost to the carrier when these two case-management techniques and strategies were applied.

Cost of post-acute rehabilitation was the only outcome figure predicted by patient admission data (Table 4). When combined, all three rating scale scores and the patient's age at injury controlled more than 82% of the variance within plus or minus $20,802 of the program cost. Although the range of standard error was wide (17-25% of \O(x)), the results warrant further investigation into the possible predictive qualities of patient admission data for cost of rehabilitation programming. The ability to accurately project the cost of a patient's rehabilitation program would be invaluable to case managers, carriers, or any party assuming financial responsibility for the patient's care.

SUMMARY

Both comparison groups made significant gains in their level of disability which supports the contention that post-acute TBI rehabilitation is effective in reducing disability and increasing a patient's overall level of independence. Group One made more improvement than Group Two which may be attributed not only to the fact that cases were supervised by the same case manager, but that increased financial assistance and more autonomous case-manager responsibility played a significant role in patient outcome. Program cost, which was predicted by several disability scales and the patient's age at injury, may have been positively affected by the two case-management factors just described. With the reality of ever-escalating therapy costs, carriers and rehabilitation facilities would benefit by continued joint research into the effects of non-therapeutic factors on the outcome and cost of TBI rehabilitation. Carriers could increase cost containment, rehabilitation facilities could increase their clinical effectiveness, and most importantly, patients could improve their overall level of independence and quality of life.

Figure 1

DISABILITY RATING (DR) SCALE•

Name _____ Sex _____ Birthdate _____ Brain Injury Date _____

Cause of Injury: _____ MVA/MCA _____ Head Trauma** __ Infection _____ Stroke_____ Anoxia

_____ Development (Congenital) _____ Degenerative ___ Metabolic _____ Drowning

Other (specify) _____

*MVA = Motor Vehicle Accident: MCA = Motor cycle Accident. Circle one.

**Gun shot, blunt instrument, blow to head, fall, etc.

CATEGORY	ITEMS	DATE OF RATING								
Arousability	Eye Opening									
Awareness	Communication Ability[2]†									
Responsivity••	Motor Response[3]									
Cognitive Ability for	Feeding[4]									
Self Care Activities	Toileting[4]									
	Grooming[4]									
Dependence on Others•••	Level of Functioning[5]									
Psychosocial Adaptability	"Employability"[6]									
COMMENTS:	**TOTAL**									

[1]Eye Opening

0	Spontaneous
1	To Speech
2	To Pain
3	None

[2]Communication Ability†

Either Verbal; Writing or Letter Board;or Sign (viz. eye blink, head nod, etc.)

0	Oriented
1	confused
2	Inappropriate
3	Incomprehensible
4	None

[3]Best Motor Resp.

0	Obeying
1	Localizing
2	Withdrawing
3	Flexing
4	Extending
5	None

[4]Cognitive Ability

for Feeding,Toileting, Grooming (Does patient know how and when? Ignore motor disability.)

0	Complete
1	Partial
2	Minimal
3	None

† In presence of tracheostomy (place T next to score); for voice or speech dysfunction (place D next to score if there is dysarthria, dysphonia, voice paralysis, aphasia, apraxia, etc.)

[5]Level of Functioning

(Consider both physical & cognitive disability)

0	Complete independent	
1	Independent in special environment	
2	Mildly dependent	-(a)
3	Moderately dependent	-(b)
4	Markedly dependent	-(c)
5	Totally dependent	-(d)

[6] "Employability"

(As a full time worker, homemaker or student)

0	Not restricted
1	Selected jobs, competitive
2	Sheltered workshop, non-competitive
3	Not employable

a	**needs limited assistance (non-resident helper)**
b	**needs moderate assistance (person in home)**
c	**needs assistance with all major activiies at all times**
d	**24-hour nursing care required**

Disability Categories	
Total DR Score	**Level of Disability**
0	None
1	Mild
2-3	Partial
4-6	Moderate
7-11	Moderately severe
12-16	Severe
17-21	Extremely severe
22-24	Vegetative state
25-29	Extreme vegetative state
30	Death

▲ See over for item definitions Revised 8/87

• Rappaport et al. Disability Rating Scale for Severe Head Trauma Patients: Coma To Community. Arch. Phys. Med. Rehab. 63:118-123, 1982

•• Modified from Teasdale, Jennett, Lancet 2:81-83, 1974

••• Modified from Scraton et. al. Arch. Phys. Med. Rehab. 51:21, 1970

Figure 2:
Living Status Scale

0	Unknown	
1	Private living quarters	- self-care or with spouse - independently - or with parents if <25
2	Private living quarters	- supervision by family, friend, or companion - may have roommate - no regular, planned involvement in performance of activities - or with parents if >25
3	Private living quarters	- active help from family, friend, or companion - may have roommate
4	Private living quarters	- active professional help (nursing, paid aide, etc.) - may have roommate
5	Senior citizen center with private living facility and communal food service	
6	Board and care home/Group home	
7	Long-term care facility	- convalescent hospital - unlocked
8	Acute or rehab hospital	- alcohol, drug, or physical rehabilitation included
9	Locked facility	- psychiatric, geriatric, mental hospital, jail, or rehab facility
10	Deceased	

Figure 3
Occupational Status Scale

0 Unknown
1 Full-time, former job or equal position
2 Formal education at level of former job
3 Part-time, former job or equal position
4 Full time, lesser position
5 Formal education at a level below former job
6 Part-time, lesser position
7 OTJ training - paid
8 OTJ training - unpaid
9 Sheltered employment - paid
10 Volunteer position - work activity
11 Multiple jobs for brief period of time
12 Not working - vocational counselor involved
13 Not working - active legal case or disability payments contingent upon unemployment
14 Not working - placement precludes work, i.e., jail, alcohol/drug/physical rehabilitation, hospitalization for physical illness
15 Not working - cognitive and/or physical disabilities preclude employment
16 Deceased

SPSS Inc., Chicago, Ill., 1993

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