

INTEGRATING OUTCOMES, VALUE, AND QUALITY

AN OUTCOME VALIDATION SYSTEM FOR POST-ACUTE REHABILITATION PROGRAMS

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Introduction

Post-acute rehabilitation for persons with acquired brain injury (ABI, i.e., trauma, stroke, anoxia) refers to a variety of rehabilitation services provided in various, typically non-hospital contexts. Post-acute service options include skilled nursing facility-based rehabilitation programs (also commonly referred to as "sub-acute" programs), residential treatment programs (also referred to as transitional living programs and community reentry programs), home-based treatment options, and hospital- and non-hospital-based day treatment and outpatient services (see Kreutzer and Wehman, 1990, for a review of post-acute rehabilitation options for persons with ABI).

Recent years have witnessed tremendous growth in the number and variety of post-acute options for persons with ABI. Several factors have contributed to their proliferation, including (1) an increase in the survival rate of ABI, (2) growing awareness that acute-stage rehabilitation is not always adequate preparation for persons with ABI returning to the community, (3) the presumption that post-acute services are effective in returning persons with ABI successfully to community living, and (4) a trend, sparked by the managed-care movement, toward rapid de-hospitalization of persons experiencing catastrophic injury (in this regard, post-acute rehabilitation is viewed as a "step down" in cost from acute rehabilitation).

With increasing diversity in (and sometimes confusion about) post-acute treatment options, the need has been recognized to establish criteria by which to evaluate the quality of programs and identify factors to consider in making the choice of an appropriate program for a particular client.^{1-3,5,11} Most evaluation criteria emphasize that post-acute programs should include an ongoing program evaluation methodology for examining and documenting program quality with respect to client outcomes.

For example, Goka and Arakaki⁵ have presented the concept of "centers of excellence" as a model for identifying exemplary rehabilitation programs. A center of excellence is a regional healthcare provider with an established record of exceptional clinical outcomes and cost-effective service delivery for a specific patient group.^{6,9} Goka and Arakaki emphasize that a center of excellence should be able to provide outcome data attesting to its effectiveness and cost-effectiveness. They site among key questions to ask in selecting a program: (1) Has the program achieved successful outcomes with its clients? and (2) How are former clients functioning in the community (i.e., how reliable is the program in achieving outcomes and how durable are these outcomes over time)?

Similarly, the Commission on Accreditation of Rehabilitation Facilities³ has promulgated standards requiring that CARF-accredited programs include a functional, ongoing program evaluation system that includes the following: (1) linkage between the organization's management information functions and program evaluation methods in order to evaluate the impact of services and programs on persons served; (2) a focus on aggregate outcomes of persons served; (3) at a minimum, inclusion of a representative sample of clients in all program evaluation efforts. The sample should be drawn from all persons served, including those who do not complete the program; (4) evaluation of client outcomes postdischarge; (5) evaluation of both service effectiveness and resource efficiency (effective use of resources); and (6) ethical representation of program evaluation information (i.e., program evaluation findings should corroborate the organization's claims and accomplishments as recorded in public relations and other public documents).

Calls for honest, objective outcome documentation as a feature of quality rehabilitation programs highlight the fact that it is no longer sufficient to presume the benefits of post-acute rehabilitation. It is incumbent upon service providers to develop systems for outcome verification that have the capacity to demonstrate, on an ongoing basis, the value derived from post-acute rehabilitation.

This article describes a methodology for outcome verification and presents findings from a preliminary evaluation of clinical outcomes achieved with head-injured individuals receiving post-acute rehabilitation services. The Outcome Validation System (OVS) is a management information system for investigating treatment effectiveness and outcome reliability and durability. It is an inclusive system that tracks every client who enrolls in a Learning Services's post-acute rehabilitation program.

The OVS addresses *functional outcomes*, documenting client status in three outcome areas: residential setting, living assistance, and productive activity. These variables were chosen because: 1) they have face validity as outcomes of functional utility/value; 2) they can be reliably assessed; and 3) they are judged to be important rehabilitation outcomes by clients, family members, and financial providers (e.g., Jones and Evans, 1991).

The OVS involves a *repeated-measures, longitudinal analysis* of client outcomes. Client status is assessed at pre-injury, program enrollment, program discharge, and follow-up intervals after program discharge. Repeated measures at these points provide a benchmark of optimal functioning (pre-injury status), a baseline

to gauge treatment effectiveness (status at enrollment), and measures of long-term durability of outcomes.

The system is also *multipurpose*: In addition to documenting client outcomes, OVS provides "internal" feedback to program managers to facilitate refinements in program effectiveness. The system also has the capacity to provide different "customers" (e.g., financial providers, consumer groups) with specific analyses of interest, including periodic assessment of program performance and treatment value for a specific group of clients (e.g., treatment outcomes and associated costs for all clients funded by a particular indemnity carrier).

OVS appears to meet or exceed criteria described above for program evaluation and outcome documentation in post-acute rehabilitation programs. The following analysis illustrates the utility of OVS in documenting client outcomes and, therefore, validating program quality as a rehabilitation "center of excellence." The analysis presented here involved collecting outcome data with 154 clients consecutively enrolled in Learning Services' programs from July 1989 to June 1990. This sample includes all clients enrolled for treatment in Learning Services programs during the one-year period. The period selected permitted collection of follow-up outcome data for all clients at least 5 months and as long as 18 months after program discharge.

Methodology

Program Description

All subjects were clients enrolled in the five Learning Services' post-acute rehabilitation programs operational at the time of the study. All five programs are CARF accredited (Post-Acute Brain Injury standards), residential-based, community reentry programs. Each program offers comprehensive rehabilitation services for clients with acquired brain injury. (For a more detailed description of program activities and services, refer to the CARF, 1991, Standards for Post-Acute Brain Injury programs.) Primary treatment objectives are to (1) measurably and significantly increase clients' ability to live and function independently in the least restrictive environment; (2) identify, evaluate, train, and place clients in the most appropriate and independent level of productive activity possible; and (3) reduce or eliminate clients' continued use of professional rehabilitation services. Specific treatment approaches used to achieve these objectives have been reported elsewhere.⁴

Subject Demographics

Subject demographic variables are presented in Table 1. Note that the average follow-up interval after program "graduation" is 10.6 months (range = 5-17 months). A total of 121 of 154 clients (79%) were successfully contacted for follow-up data collection. Graduation refers to clients who successfully completed their prescribed treatment program (86%). Also of note is the duration between injury and program entry (mean = 1.8 years). There was considerable variation in the injury-enrollment interval, with a range of 14 days to 29 years (S.D. = 3.4 years).

Key injury variables are presented in Table 2. It is noteworthy that this sample of individuals with ABI represents a very high percentage (82%) of those with severe injuries. Whereas nationally, severe injuries comprise approximately 10% of all

head injuries occurring annually.⁷ The severely injured ABI population is characterized by a high level of impairment and disability, resulting in long-term care needs, high usage of health care services post-injury, and a high rate of loss of income and depletion of family financial resources.

Table 1
Subject Demographics

Consecutive Cases	N = 154	
"Graduation" ^a	N = 132 (86%)	
Follow-up Sample ^b	N = 121 (79%)	
Received Vocational Services	N = 72 (47%)	
	Mean	Range
Age at Injury	32.6 yrs.	2 - 76 yrs.
Duration Between Injury and Entry	1.8 yrs.	0.5 mos. - 29 yrs.
Length of Stay	5.4 mos.	1.1 - 20.77 mos.
Follow-up Interval	10.6 mos.	5.17 - 17.17 mos.

^a Refers to those clients who have successfully completed treatment as prescribed.

^b Refers to those clients who were successfully contacted for follow-up data collection.

Table 2
Key Injury Variables

Primary Diagnosis	N	%
Traumatic Brain Injury	122	79%
Stroke	17	11
Anoxia	11	7
Other	4	3
Mechanism of Injury		
Motor Vehicle Accident	72	47%
Falls	17	11
Stroke	17	11
Sports/Accidents	17	11
Anoxic Events	11	7
Pedestrian Accidents	8	5
Assault	7	4
Other	5	4
Level of Severity of Injury		
Severe ^a	127	82%
Mild ^b	20	13
Unknown	7	5

^a Glasgow Coma Score 8 and/or Coma 48 hrs

^b Glasgow Coma Score 12 and/or Coma 1 hr

Dependent Variables

As noted, three primary outcome variables were assessed. These variables are:

- 1) *Residential Setting*—Rank ordered from least to most restrictive of independent functioning: home or apartment, long-term supported living setting, post-acute rehab program, acute rehab program, acute hospital.

- 2) *Living Assistance*—The amount of time per 24-hour period that the client requires supervision and/or assistance. Supervision/assistance may be required due to functional limitations (e.g., unable to complete ADLs, manage financial affairs, etc., without assistance) or for safety risk management.
- 3) *Productive Activity*—The extent to which client is regularly engaged in some productive activity, including competitive employment, degree-directed academic or vocational training, homemaker responsibilities, sheltered employment, volunteer service, avocational leisure activities, and no productive activity.

Procedure (Data Collection and Analysis)

Information on client status pre-injury, at program entry, at discharge, and at follow-up was obtained from multiple sources. Data sources are presented in Table 3. Data were collected and used by trained evaluators (all with clinical experience in ABI) to rate clients' functioning status at each observation interval. Ratings of client status were facilitated by use of a data sheet listing definitions and instructions for scoring each of the three dependent variables. For Living Setting and Productive Activity, mutually exclusive scoring categories were established to provide an ordinal scale.

Table 3
Data Sources for Evaluating Client Status

Client Status	Data Source
Pre-Injury	Interviews with client and family
	Reviews of pre-injury school/employment records
Entry	Interviews with client and family
	Review of post-injury medical, school, and employment records
	Clinical evaluations completed at program entry
"Graduation"/ Discharge	Clinical reports of client progress
	Interviews with client and family
Follow-Up	Interviews with client and family (corroboration with additional source as necessary)

A sample of data was coded by two independent examiners to evaluate inter-rater reliability. Inter-rater reliability for ratings of status categories exceeded 95%. Data analysis consisted primarily of calculating descriptive statistics (e.g., percentages, means, ranges, standard deviations). All analyses were computer-generated with periodic manual checks. Results were summarized for each observation interval independently without knowledge of results for other observation intervals.

Results

Residential Setting

As witnessed in Table 4, a significant reduction in client need for inpatient care (either in a hospital or skilled nursing facility) is demonstrated following program completion. Of those clients needing continued institutional care at follow-up (15.8% of the sample), the majority (89%) were served ade-

quately in a group home or supervised apartment. Figure 1 shows graphically the percentage of clients (79.9%) who were able to return home after program completion. More importantly, this graph illustrates the durability of this outcome over time: Over 84% of the sample was living at home at follow-up.

Table 4
Residential Setting Status

Setting	Pre-Injury	Entry	"Graduation"/ Discharge	Follow-up
Home	99.0%	24.0%	79.9%	84.2%
Institutional				
ABI-Acute	0.0	46.0	0.6	0.0
ABI-Post Acute	0.0	12.0	0.0	1.9
Hospital ^a	0.0	10.0	1.9	0.6
Long-Term	0.0	7.0	14.3	9.1
Other	<u>1.0</u>	<u>1.0</u>	<u>3.3</u>	<u>4.2</u>
	100	100	100	100

^a Refers to hospital setting where subject was not being treated primarily for ABI (i.e. orthopedic, psychiatric services, etc.)

Figure 1
Client Outcomes

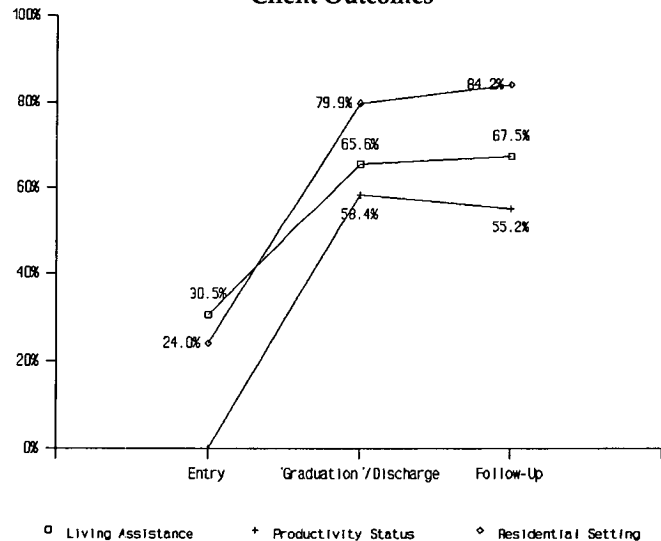


Table 5
Living Assistance Status

Setting	Pre-Injury	Entry	"Graduation"/ Discharge	Follow-up
Independent	98.0%	30.5%	65.6%	67.5%
Dependent				
Supported ^a	1.3	26.0	15.6	17.3
Intensive ^b	<u>0.7</u>	<u>43.5</u>	<u>18.8</u>	<u>15.2</u>
	100	100	100	100

^a 1-2 hours/day of assistance in ADLs

^b 24 hours/day of assistance/availability for ADLs

Living Assistance

Table 5 shows that only 30.5% of clients enrolled for services were considered sufficiently safe and independent at program entry to live with less than one hour of assistance per day. Figure 1 shows that at discharge over 65% were able to live safely with less than one hour of assistance daily and at follow-up this percentage had increased to over 67%.

Productive

Activity Table 6 illustrates that clients' ability to engage in competitive productive activity decreased dramatically after injury and prior to post-acute intervention. For those clients receiving vocational services, however, over 58% were able to resume competitive pursuits upon program completion (see Figure 1). An additional 16.6% were engaged in non-competitive vocational activities. It should be emphasized that 72 (47%) of the total client sample actually received vocational services. The remainder either were judged too severely disabled to benefit from vocational rehabilitation or were specifically excluded from vocational services at the instruction of the funding source.

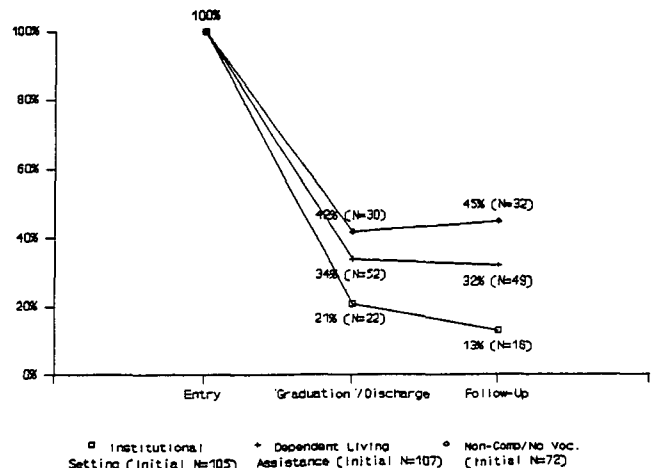
Table 6
Productivity Status of Clients Receiving Vocational Services (N=72)

Setting	Pre-Injury	Entry	"Graduation"/ Discharge	Follow-up
Competitive				
Employment	75.0%	0.0%	48.6%	36.2%
Academic	15.0	0.0	5.6	13.8
Training	1.4	0.0	4.2	1.8
Homemaker	6.0	0.0	0.0	3.4
	97.4	0.0	58.4	55.2
Non-Competitive				
Sheltered	0.0	1.4	8.3	6.9
Volunteer	0.0	0.0	8.3	6.9
	0.0	1.4	16.6	13.8
Avocation/None				
	2.6	98.6	25.0	31.0
	100	100	100	100

Discussion

Results of this outcome analysis illustrate that, even with a sample of clients biased heavily toward severe injury, dramatic outcomes can be achieved from post-acute rehabilitation. Moreover, the outcomes achieved appear to be durable over time. Although the time span between treatment completion and follow-up is relatively brief, these findings support the fact that many, even severely disabled clients can maintain improvements in function achieved from post-acute rehabilitation without the need for continued treatment or support.

Figure 2
Value Index



Rehabilitation Value Index

Rehabilitation "value" can be addressed in a number of ways, including prudent analysis of cost-benefit factors, return on investment, treatment effectiveness, and durability of outcomes. We have attempted to encompass these issues by establishing a Rehabilitation Value Index. We propose that the true value of any rehabilitation intervention must consider, at a minimum: (1) treatment effectiveness, measured in functional terms; (2) outcome durability, measured in functional terms over time; (3) financial return realized, when compared to anticipated costs without rehabilitation; and (4) overall reduction in disability resulting from injury (i.e., return to least restrictive setting, return to financial self-sufficiency, reduction in need for professional support).

Combining treatment effectiveness with outcome durability, Figure 2 illustrates significant reductions in disability across all domains. That is, at the time of follow-up, (1) only 16 clients (13%) continued to require an institutional residential setting compared to 105 clients at initiation of post-acute rehabilitation; (2) two-thirds (68%) of the 107 clients requiring living assistance at the time of program entry were able to live independently after program completion; (3) 40 clients (55%) were able to maintain employment in a competitive capacity after completing post-acute rehabilitation compared to no clients competitively employed at program entry.

While circumstances vary in every case, making direct cost analysis difficult, this Value Index suggests (1) a significant reduction in overall cost exposure when compared with pre-entry costs, and (2) long-term savings in the form of benefits preservation due to extended durability of outcomes and avoidance of re-hospitalization.

Predicting Outcomes

In preparation of the Outcome Validation System, a survey of financial providers was conducted to determine what they considered to be important outcomes of post-acute rehabilitation with persons with ABI (Jones and Evans, 1991). Survey respondents were asked to rate the importance of two sets of variables: preferred patient/client outcomes and provider considerations

in the purchase of rehabilitation services. Financial providers rated as the most important consideration in purchase of services early identification of a patient's optimal outcome status. Predictable costs and delivery of specified outcomes at or below predicted cost were also rated as very important considerations. To examine outcome prediction reliability, the outcomes predicted for each client at the time of initial evaluation were compared with outcomes actually achieved at program completion. Results of this analysis revealed 94% accuracy in predicting the outcomes achieved. The ability to predict at program entry the actual length of stay (an accurate measure of cost since most funding is on a per diem basis) was also quite high. Within plus or minus two weeks, length of stay was accurately predicted for 97% of the clients in this sample.

Future Applications of OVS

The results presented above demonstrate the utility of OVS as an outcome-oriented program evaluation methodology. The system is currently being refined and expanded to permit a number of future applications. These applications have three primary audiences: (1) the scientific and health care community, both practitioners and policymakers, (2) the financial provider community, and (3) our own internal management. Following are examples of specific applications of OVS.

As the sample size of OVS continues to grow, further validation will be provided of the importance of post-acute rehabilitation for persons with ABI. An enlarged database will make it possible to examine program effectiveness for different disability types (e.g., CVA, anoxia). It will also permit investigation of the relationship between post-acute intervention and other outcome determinants such as injury-treatment interval and treatment duration. By examine these relationships we can begin to answer questions about the importance

of early intervention and standards for optimal and minimal treatment durations for different levels of impairment.

A critical application of OVS will be in continued development of a Value Index for financial providers. Inclusion of treatment cost data and refinement of realized-benefit measures (i.e., value associated with client status change) will permit the type of "cost-outcome" analyses suggested by Swanson,¹² so that financial providers can "address cost issues in light of clinical outcomes achieved by providers." Along these lines, OVS will make it possible to perform specific epidemiological studies for financial providers. For example, a payors' caseload history could be analyzed to identify average costs and typical outcomes achieved for clients with different impairments. This information would have obvious benefits in setting future reserves and utilization review.¹⁰

For internal management, the OVS will allow comparisons to be made between programs. From these comparisons, we can establish standards for expected clinical outcomes and associated costs, and manage program performance to these standards. Comparisons between programs of specific clinical procedures will identify those practices which yield the best overall outcomes. These "best practices" may then be codified and systematically replicated at other programs.

Conclusion

The need for objective documentation of clinical outcomes and, therefore, of the subsequent value of rehabilitation in ABI is widely acknowledged. Rehabilitation providers aspiring to the standards of a center of excellence must embrace a program evaluation methodology which provides this documentation. The Outcome Validation System presented here satisfies this requirement. It is proposed as a model to establish the defining characteristics of rehabilitation centers of excellence.

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