OUTCOME RESULTS OF POST-ACUTE REHABILITATION AFTER HEAD INJURY
FIVE CONSECUTIVE STUDIES OF 198 INDIVIDUALS
OVER A FIVE-YEAR PERIOD

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Although still in its infancy, the field of post-acute rehabilitation for the traumatically brain-injured (TBI) patient has made dramatic strides in the past decade, both in treatment modalities and in outcome results. Program accountability and quality assurance are now being measured in terms of functional outcome and cost containment.

A series of five outcome studies have been conducted by Total Therapy Management, Inc. (TTM), following post-acute rehabilitation of 198 TBI individuals enrolled in intensive day treatment programs. A Client Status Scale, developed by TTM, was utilized to measure cognitive, physical, medical, and behavioral changes of clients seen in interdisciplinary treatment programs. Successful outcome was defined in terms of ability to achieve specific individualized goals including work, school, living status, and quality of life.

These studies indicate functional, vocational, or academic placement in 78.4% of cases in Studies I-III and 100% in Studies IV and V for clients completing programming. (Employment records were unavailable for 31% of the clients in the first three studies.) Fifty-four percent of clients completing programming in Studies IV and V were placed in competitive employment (see Table 1). These studies indicate that rehabilitation after acquired brain injury is highly constructive and contributes to an increase in the successful return to a productive lifestyle.

Cognitive rehabilitation of head injury survivors has a relatively brief history, because severe head injuries were generally fatal before this century. It was not until the early 1980s that rapid development of both acute and post acute cognitive rehabilitation programs for closed head injury patients took place. Even in 1980, 9 in 10 persons sustaining a severe traumatic brain injury (TBI) died. Today, just one decade later, that statistic is reversed and 9 in 10 survive.

Advances in medical technology now spare countless lives, but this has also resulted in an ever-growing number of individuals suffering varying degrees of brain damage and cognitive/physical impairments. A conservative estimate puts the total number of TBI injuries at over two million per year, with 500,000 hospitalized and 50,000 to 70,000 severely disabled. Survivors of head injury often attain an average life span and, therefore, the quality of life is of paramount importance. Head-injured persons are most often young adults with many years ahead of them. The economic cost to the nation for TBI approaches $25 billion per year. The sheer number of TBI survivors that spawned the increase of TBI rehabilitation programs and subsequent increase in health care costs. According to the National Head Injury Foundation (NHIF), today there are more than 600 specialized rehabilitation programs in the U.S. to meet this growing need.

Despite its rapid growth and acceptance as a viable form of intervention for persons with TBI, cognitive remediation is still in its infancy. Only 10 years ago, most TBI survivors with severe cognitive deficits were discharged to nursing homes or psychiatric institutions because there were no other facilities capable of providing care. The traditional models of rehabilitation were found to be inadequate to treat the unique characteristics and recovery patterns of this population. Rehabilitation philosophy and practice utilizes an interdisciplinary versus a multidisciplinary approach. It is an interactive treatment process in which patient goals, rather than discipline goals, are developed and tracked, and in which all members of the team monitor and reinforce patient goals. Rehabilitation therapists have moved beyond “more is better” to an outcome orientation that is functional, measurable, and increasingly data driven.

As the focus in health care continues to shift toward quality assurance and cost-effective care, both head injury survivors and third party payers expect accountability for the efficacy of rehabilitation programs. Rehabilitation professionals have been hampered by the lack of standardized assessment measures and the availability of longitudinal studies. According to Gerben DeJong, Director of Research at the National Rehabilitation Hospital in Washington, D.C., one reason for this void is that outcome measures tend to lag behind clinical practice. A classic example can be found in spinal cord injury rehabilitation. Prior to the introduction of sulfa drugs and antibiotics in the late 1930s and early 1940s, persons with spinal cord injury did not die as a result of their injury but rather from secondary health problems. But even in the ‘40s and ‘50s, most persons with spinal cord injuries were destined to have very limited lifestyles, often in an institutional setting. It was not until the 1970s that post rehabilitation opportunities existed. Similarly, prior to the 1980s few TBI victims survived.

In the past decade, however, the field of TBI rehabilitation has made dramatic strides, both in treatment modalities and functional outcome results. The Commission on Accreditation of Rehabilitation Facilities (CARF) states that outcomes, the results of program services, are the true measure of success of
any organization serving people with disabilities. And, according to Conder, “One of the most telling outcome variables is the ability to return to competitive employment. This is because of the intensive multi-dimensional demands on physical, cognitive, interpersonal, emotional, and behavioral abilities.” Kreutzer et al. concur, stating that “because of its clear link to financial status and self-esteem, vocational status has become one of the most important outcome variables in head injury research.”

Total Therapy Management (TTM) is a Michigan-based community reintegration program specializing in interdisciplinary treatment of children, adolescents and adults with acquired brain injury. A series of five extensive outcome studies have been conducted following post-acute rehabilitation programming of 198 traumatically brain-injured individuals enrolled in intensive day treatment programs. These studies indicate functional, vocational, or academic placement in 78.4% of cases (Studies I-III) and 100% (Studies IV and V) for clients completing programming. Employment records were unavailable for 31% of the clients in the first three studies. Fifty-four percent of clients completing programming in Studies IV and V were placed in competitive employment (see Table 1). Study time periods for the five studies involved were between 1985 and 1990.

Outcome from post-acute rehabilitation of head-injured individuals appears best viewed in functional terms. TTM developed the Client Status Scale for this purpose. Interdisciplinary therapists utilize this tool to rate client progress on admission and discharge. This tool is designed to quantify five parameters, including overall dependence/independence in medical, physical, cognitive, and behavioral status. Refinements were made to the tool for Study III, i.e., the rating scale was narrowed to allow more specificity, and family involvement was added as a fifth assessment. Other improvements in data collection and documentation have also evolved in later studies. In addition, program modifications were implemented after reviewing results of the earlier studies. Future studies will also include a chemical dependency scale.

**Study Summary I, II, and III (n = 118)**

**Method**

Data from the first three studies were compiled. Study I and II included 83 clients discharged between January, 1985 and September 1987. Only vocational-oriented clients were selected. Selection was also based upon the availability of statistics. Study III included all clients (n = 35) discharged between September 1987 and October 1988. The average age of clients for the three studies was 27.9 years. Eighty-one percent were males. The amount of time elapsed from onset of injury to admission averaged 3.2 years, with a range of 3 weeks to 16 years.

### Table 1

<table>
<thead>
<tr>
<th>Employment Status at Time of Admission</th>
<th>Study I, II, &amp; III</th>
<th>IV &amp; V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults n=67</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>Competitive Employment</td>
<td>4%</td>
<td>5%</td>
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<tr>
<td>(Same or other, FT, PT)</td>
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<tr>
<td>Supported Employment</td>
<td>2%</td>
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<tr>
<td>Unemployed</td>
<td>85%</td>
<td>84%</td>
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<tr>
<td>Student</td>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
<td>8%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
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</table>

<table>
<thead>
<tr>
<th>Employment Status at Time of Discharge</th>
<th>Study I, II, &amp; III</th>
<th>IV &amp; V</th>
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</thead>
<tbody>
<tr>
<td>Adults n=37</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive Employment</td>
<td>23%</td>
<td>54%</td>
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<tr>
<td>(Same or other, FT, PT)</td>
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</tr>
<tr>
<td>Supported Employment</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>Self-Employed</td>
<td>--</td>
<td>3%</td>
</tr>
<tr>
<td>Unemp/Unknown</td>
<td>31%</td>
<td>--</td>
</tr>
<tr>
<td>Student</td>
<td>17%</td>
<td>14%</td>
</tr>
<tr>
<td>Avocational Placement</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>(volunteer, retired, home)</td>
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</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Results

Sixty-seven clients completed treatment programming with an average length of stay of 11.59 months (range = .79 months to 2.11 years). Seventy-eight percent of these clients were able to return to goal-oriented activities after treatment; 23% were placed in competitive employment; 18% in supported employment (Table 1).

Study Summary IV and V (n = 80)

Method

Selection criterion included all discharged clients between September 1988 and October 1990, separated adults (n = 62), and children age 17 and under (n = 18). The average age of adults for the two studies was 34.5 years, with a range of 18.3 years to 65.9 years. Sixty-five percent were males. The average age of children was 14.1 years, with a range of 7.7 years to 17.8 years (male, 71%).

The period of time elapsed from onset of injury to admission for clients completing program averaged 2.5 years for adults with a range of 1.1 months to 21.1 years. Elapsed time for children averaged 1.3 years, with a range of 1.9 months to 5.3 years.

Clients in Studies IV and V were referred to programming earlier than in previous studies, but still averaged two years post-injury for adults. Overall ratings indicate a level of client somewhat less impaired (but still considered moderate) in most parameters upon admission than in previous studies, although separating the children from adults accounts for some of the reduction. These individuals at admission were estimated to require an average of 30% assistance in completing most tasks in the post-acute aspect of the rehabilitation continuum. Studies IV and V also showed a notable increase of female clients.

Total time in treatment for the total study population averaged 8.8 months (range = 5.9 months to 2.4 years) for adults and 10.8 months (range = 1.02 months to 3.8 years) for children. (A length-of-stay (LOS) comparison with previous studies is difficult because earlier studies compiled data for children and adults together.) The LOS for adults in Studies IV and V remained consistent, however, LOS increased for children in Study V. One explanation for this increase is that in a small sample group, one client with a longer LOS can skew the percentages. Another reason for the increase may be the special educational needs and long-term follow-up identified for school children.

Review of the Client Status Scale ratings upon discharge indicated that all clients benefited from programming, but greatest gains were realized with program completion (see Figures 1 and 2). Clients partially completing programming were more impaired in all areas at admission and demonstrated less gain and limited functional outcome; in fact, none were placed in competitive employment. In Studies IV and V, 38% of clients partially completing the program were discharged for behavioral and/or psychiatric reasons. This indicates that for clients with behavioral and/or psychiatric deficits, the day treatment program may not be the most appropriate setting.

Future studies will include more detailed information relating to treatment hours and costs as a result of recent company-wide computerized billing systems. A review of records available for 11 of the 14 adult clients completing the program in Study V shows that IDT treatment hours ranged from 18.5 hours to 1,151, or an average of 346 hours per client and an average length of stay of 8.8 months (see Table 2). (IDT includes physical therapy, occupational therapy, speech-language pathology, recreational therapy, academic support, and nursing.) Total charges for these 11 clients, including all IDT services, vocational counseling, neuro-psychological services, and residential care had a range of $11,096 to $133,735, with an average of $50,407 per client.

IDT treatment hours data were available for eight of the nine children completing programming in Study V and ranged from 21 hours to 1,801 or an average of 642 hours per client (Table 2). Again, the small sample group makes it difficult to reflect true averages.

Studies show a wide variation in treatment time based upon individual abilities. These studies do not reflect decreased intensity of program participation, which is anticipated to be demonstrated in future studies. Also, clients frequently completed various "phases" of programming, including the final vocational training phase.

In Studies IV and V, all adult clients completing the program had functional placement, with 54% in competitive employment and 16% in supported employment, compared to 23% in competitive and 18% in supported employment in previous studies. Table 1 delineates specific types of placement and outcome of the 37 adults who completed programming in Studies IV and V and the 67 clients who completed programming in the previous three studies. All children (n = 18) returned to school; approximately 50% were placed in special education and 50% in regular classes with some support.

Implications

These studies indicate that rehabilitation after acquired brain injury appears highly constructive and contributes to the successful return to a productive lifestyle. Successful outcome was defined in terms of ability to achieve specific individualized, functional goals including work, school, living status, and quality of life. This is particularly apparent with 54% of adult clients in competitive employment placement. A survey, conducted approximately one year post discharge, of clients who completed programming in Study V (we were able to contact 12) showed the following:

- Competitive employment 33%
- Supported employment 17%
- Student 8%
- Homemaker 8%
- Unemployed 29%

This data correlates with national studies on vocational re-entry and provides evidence that, although TBI programming can effectively contribute to successful outcome, some follow-up services (i.e., neuropsychology and/or substance abuse services and job coach services) should be implemented to reinforce and maintain stability; in fact, 67% of clients still in...
Figure 1

STUDY IV & V: COMPARATIVE DATA
ALL DISCHARGED CLIENTS (N=80) 9/88 - 10/90

Ratings are as follows:
0 - Stable and independent
1 - Independent with adjusted environment
2 - Mildly dependent (requires assistance 10-30% of time)
3 - Moderately dependent (requires assistance 30-70% of time)
4 - Markedly dependent (requires 24 hour care)

Figure 2

STUDY IV & V: COMPARATIVE DATA

Table 2

INTENSIVE DAY TREATMENT (IDT)*
AVERAGE HOURS/ CHARGES - STUDY V

<table>
<thead>
<tr>
<th></th>
<th>Adults (n=11)</th>
<th>Pediatric (n=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.O.S. (months)</td>
<td>8.8</td>
<td>10.8</td>
</tr>
<tr>
<td>L.O.S. (weeks)</td>
<td>37.8</td>
<td>46.4</td>
</tr>
<tr>
<td>Hrs. in prog.</td>
<td>346</td>
<td>640</td>
</tr>
<tr>
<td>Tx. hrs./wk.</td>
<td>9.15</td>
<td>13.8</td>
</tr>
<tr>
<td>Total IDT chgs.</td>
<td>$32,721.00</td>
<td>$58,705.00</td>
</tr>
<tr>
<td>Ave. chg./hr.</td>
<td>$94.57</td>
<td>$91.72</td>
</tr>
</tbody>
</table>

*IDT includes physical therapy, occupational therapy, speech-language pathology, recreational therapy, academic support, and nursing.
competitive or supported employment were receiving limited services in these areas. Substance abuse problems and lay-offs in industry were cited as contributing factors for unemployment. All children who completed programming in Study V were still in school full time, with approximately 50% placed in special education and 50% in regular classes with some support.

As mentioned, post-acute rehabilitation programs for TBI are a relatively new health care field, consequently, published outcome research is limited. A review of the literature summarized by Ben-Yishay in 1987 reported employment outcomes on available studies ranged from 12-95%, with an overall average of 51.75%. These studies often did not account for level of client impairment or variations in length of follow-up, or have any consistency with regard to the definition of "work." Diller and Ben-Yishay report that there are as yet few long-term, prospective longitudinal studies tracking persons with TBI for a 5- or 10-year period.

One major challenge facing rehabilitation providers today is to demonstrate that its services are not only effective but, in the long run, will also help to avert future medical complications and costs. DeJong states that outcome measurement is every provider's responsibility and must be mainstreamed in each facility's program evaluation protocol to demonstrate its effectiveness to the buyers of its services. He believes that reimbursement changes may result in the industrywide utilization of functional indices and that outcome measurement will become routine.

As head injury programs document that aggressive rehabilitation treatment for TBI improves outcome and reduces the likelihood of long-term institutionalization and re-hospitalization, insures may increase benefits for such treatment because it will ultimately cost the insurer less. For example, many insurance policies currently cover continued hospitalization or long-term nursing care but deny TBI rehabilitation. Consequently, the insurer may pay more because the patient does not receive appropriate treatment. Many payers already recognize and reimburse programs that attempt to maximize physical, cognitive, and psychosocial recovery because they have determined that it is more cost and outcome effective.

Despite the infancy of the TBI rehabilitation field, data on the efficacy of TBI treatment are now emerging. One such study conducted at a free-standing inpatient rehabilitation center in California indicated that rehabilitation patients achieved better long-term outcomes than did patients with no formal rehabilitation, even though they were more severely injured.

Another more recent study conducted by Ashley et al. at the Centre for Neuro Skills in California rated 218 patients at admission and discharge, utilizing a disability rating scale and a living status scale. Cost of care in different living status settings (i.e., private living quarters with professional help, long-term care facility; psychiatric hospital, etc.) was obtained and analyzed by the two scales to demonstrate the cost/benefit outcomes. The study indicates that cost savings of $3,650 to $419,500 annually per patient are possible for those patients receiving post-acute rehabilitation. This study further indicates that post-acute rehabilitation services may be provided to some patients at the same or lesser cost than that of their living status category prior to admission.

In summary, current studies reflect that post-acute rehabilitation programs not only enhance the quality of life for the TBI population, these programs are also cost effective in the long term. According to the NHIF, real cost savings are achieved, not only in the rehabilitation phase, but in preventing the long-term disablers in head injury—those being family system disintegration, development of behavior problems, and hospital recidivism.

Yet, as Elizabeth Horn, Executive Director of the Virginia Head Injury Foundation, reports, "It is estimated that today only one survivor in 20 can access lifelong adequate care; the others either go without treatment or end up in programs designed for other disability groups. From a fiscal standpoint it makes no sense to spend billions of dollars investing in trauma care and then renege on that investment with policies that promote maintenance rather than independence and productivity." Arnow concurs, stating that once the resources are committed to save the life of TBI victims, the continued consumption of dollars to maintain that life can simply be thought of as a given. For, as the parent of a TBI survivor asks, "If we as a caring nation cannot provide essential services for the lives saved through medical technology, then why are we saving those lives?"

With the declaration of the 1990s as the Decade of the Brain, it is hoped that more research and resources will be focused on brain injury. As Horn reminds us, brain injury can strike anyone at any time. This disability knows no cultural, racial, or socioeconomic bounds; we are all vulnerable.

**REFERENCES**

3. The Trauma of Brain Injury. ASHA, August 1989.


