



# Traumatic Brain Injury

## Facts and Figures

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The Traumatic Brain Injury Model Systems National Data Center



### Focus On Cognitive Rehabilitation

Cognitive rehabilitation has been an important, but controversial, part of the comprehensive rehabilitation approach for persons with brain injury for the past two decades. Definitions of cognitive rehabilitation (or neuropsychological rehabilitation) vary between programs, but it usually connotes a systematic intervention or interventions designed to compensate for or ameliorate the impact of cognitive/behavioral deficits following traumatic brain injury.

Within the TBIMS, cognitive rehabilitation was targeted as one of the interventions to be evaluated as to its short and long-term impact on functional outcome. The following are descriptions of three ongoing TBIMS research projects that hold promise for providing a stronger scientific basis for the relative efficacy of cognitive rehabilitation. Finally, a summary of the recent evidence-based review of cognitive rehabilitation is provided by one of its authors,

### Comprehensive Day Treatment for Cognitive and Behavioral Rehabilitation after Brain Injury

*James F. Malec, Ph.D. - Mayo Traumatic Brain Injury Model System*

Comprehensive (holistic) day treatment (CDT) is a milieu-oriented approach to postacute brain injury (BI) rehabilitation pioneered and articulated by Ben-Yishay and Prigatano.<sup>1</sup> Defining features of CDT (as described in a national consensus conference<sup>2,3</sup>) include: a neuropsychological focus that includes attention to cognitive, metacognitive, and neurobehavioral impairments and to interpersonal, psychosocial, and affective issues; an integrated transdisciplinary team; group interventions that address awareness, acceptance, and social skills; involvement of significant others; vocational and/or independent living trials; and systematic outcome measurement. Funding through NIDRR for the Mayo TBI Model System supported this retrospective study of outcomes of CDT.

Outcomes for 96 program graduates admitted consecutively to the Mayo Brain Injury Outpatient Program from 1988 through 1998 were studied. Participants were persons with brain injuries with limited self-awareness

of disabilities; cognitive impairments (e.g., deficits in concentration, memory, generalization, problem-solving, initiation, reasoning, planning); ineffectual communication and social skills; and limited emotional/behavioral self-control. Persons admitted to the program were typically unemployed or failing in employment. The average length of stay for program graduates was about 6 months. Most (89%) of those admitted to the program had moderate to severe initial injuries. Participants entered the program within months to 10 or more years post-injury.

Most services were provided in a group format by rehabilitation therapists. A transdisciplinary approach and supportive feedback through a variety of modalities (peer, staff, videotape) to build self-awareness have been the cornerstones of the therapeutic milieu provided by the Mayo CDT program. Peer interactions in the group format are facilitated to provide feedback to increase self-awareness of deficits, support to reduce distress and denial,

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### Comprehensive Day Treatment for Cognitive and Behavioral Rehabilitation after Brain Injury

and an opportunity to practice social, behavioral self-management, and emotional coping skills. The CDT approach uses a variety of more specific methods and techniques, vocational interventions and work or independent living trials, and actively attempts to engage family and significant others in the rehabilitation process.

Independent living and vocational outcomes are described here. Outcomes were also assessed using the Mayo-Portland Adaptability Inventory and Goal Attainment Scoring.

Prior to program participation, 47% were living independently. Following program completion, 69% were living independently and 72% were living independently at one-year follow-up.

Prior to program participation, 84% of graduates were unemployed; 6% were in sheltered work; 3% in supported work; 3% in transitional placements; and 4% in independent employment. Those who were employed were struggling in their jobs and this was typically a factor in their being admitted to the CDT program. At program end, unemployment decreased markedly and most graduates entered a transitional placement: 26% were unemployed; 8% in sheltered work; 3% in supported work; 53% in transitional placements; and 10% independently employed. At one-year follow-up, percent unemployed remained at about the same level as at program end. Most of those who graduated to transitional placements had advanced to independent work with some continuing in long-term supported employment. At one-year follow-up, 27% were unemployed; 6% in sheltered work; 18% in supported work; 10% in transitional placements; and 39% working independently.

The Figure shows changes in the percent of graduates in community-based employment divided into cohorts grouped by the time since injury. Although the percent in community-based employment settings prior to program participation increases with time since injury, significant gains in the proportion in community-based employment are apparent regardless of time since injury.

Preadmission score on a Rasch-converted Mayo-Portland Adaptability Inventory (MPAI) predicted long term outcomes. 86% of graduates with preadmission MPAI scores below the 60th percentile were in completely independent living at one-year follow-up. In contrast, less than half of those with scores greater than the 60th percentile were living independently at follow-up. Only 30% of graduates with preadmission MPAI scores less than the 70th percentile were unemployed or in sheltered work at one-year follow-up. In contrast, about three-fourths of those with preadmission scores above the 70th percentile were in sheltered work or unemployed at long-term follow-up.

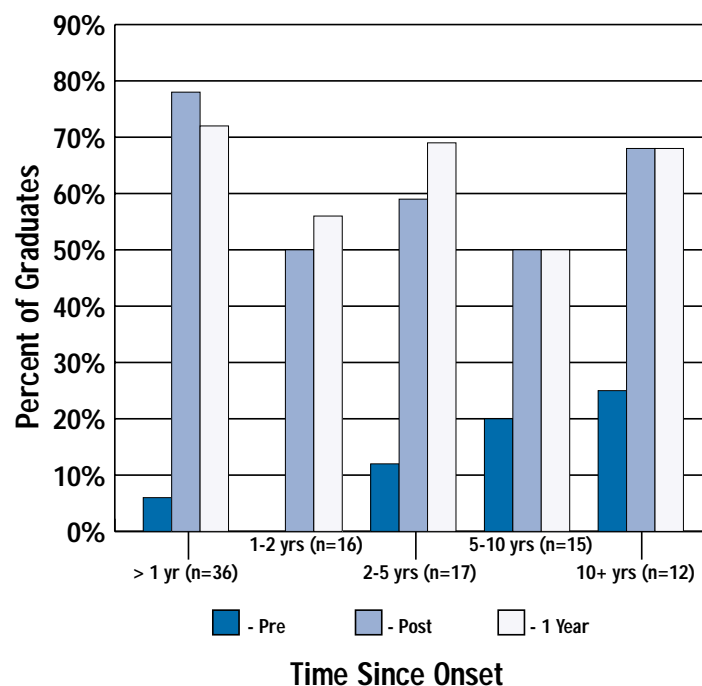
CDT improves societal participation even among persons with a long history of limited participation after BI. This de-facto extended baseline analysis indicates the effectiveness of CDT and paves the way for randomized control trials of active treatment components. Preadmission status as assessed by the

MPAI is related to long-term outcome. Although this predictive relationship is not sufficiently strong for patient selection, consideration of a participant's disability profile is helpful in setting treatment goals and planning for the intensity of treatment. The small percentage of the most severely disabled persons who were in community based employment at one-year follow-up challenges the field to develop more effective interventions and supports for assisting vocational re-integration with this group. More detailed results of this study will appear in a forthcoming issue of the *Archives of Physical Medicine and Rehabilitation*. Ongoing studies being conducted through the Mayo TBI Model System are examining outcomes of CDT in contrast to other models for postacute rehabilitation as well as the appropriateness of each type of intervention for persons with specific disability profiles.

#### References:

1. Ben-Yishay Y, Prigatano GP: Cognitive remediation. In Rosenthal M, Griffith ER, Bond MR, Miller JD (eds): *Rehabilitation of the adult and child with traumatic brain injury*. 2nd ed. Philadelphia: Davis, 1990, pp. 393-400.
2. Trexler LE, Diller L, Gleuckauf R, Tomusk A, Anreiter B, Ben-Yishay Y, Buckingham D, Christensen A-L, Grant M, Klonoff P, Malec J, Mauer B, Seller S: *Consensus conference on the development of a multi-center study on the efficacy of neuropsychological rehabilitation*. Zionsville, IN, June, 1994.
3. Malec JF, Basford JS: Postacute brain injury rehabilitation. *Arch Phys Med Rehabil* 1996;77:198-207.

#### Percent in Community-based Employment by Time Since Injury



## Neuropsychological Rehabilitation for Persons with Mild and Moderate TBI: A Randomized Clinical Trial

*Lana A. Tiersky, Ph.D. - Northern New Jersey Traumatic Brain Injury Model System*

Integrated neuropsychological rehabilitation programs have been used to treat people with brain injury for many years. Many of these programs integrate cognitive remediation techniques with psychotherapeutic interventions to help people better adapt to post-injury life. Interventions to help the family cope are also offered. Treatment practices and length of treatment vary across programs and the effectiveness of any of these programs remains equivocal. Despite the popularity of such programs, few studies have empirically investigated their efficacy. In fact a recent study by Salazar et al. (2000) reported that attending a cognitive rehabilitation program did not enhance the ability to return to work or fitness for military duty. While the study is controversial due to methodological limitations, it is important because its conclusions, having been published in *JAMA*, have been widely disseminated. If TBI rehabilitation as we know it is to justify itself to society – especially to referral sources and funders – more and better data on the efficacy of neuropsychological rehabilitation is needed. The Northern New Jersey TBI System has sponsored a study to begin to obtain such data.

In many programs, the cognitive remedial training focuses on three domains of cognitive functioning: 1) attention/information processing, 2) memory and 3) “executive functions” (i.e., problem solving, reasoning, planning, etc.). In addition, the cognitive remediation interventions most often consist of two types of tasks: retraining exercises and exercises designed to improve compensatory skills. The retraining exercises involve tasks that are designed to retrain and strengthen the specific cognitive skill, such as attention/concentration. A typical task designed to strengthen attention/concentration skills may involve listening to an audiotape for a sustained period of time and pressing a buzzer each time a certain word is heard. In regard to the compensatory training, individuals will be trained to do such things as modify their environment, complete one task at a time, and use a notebook to help with their attention/concentration and memory difficulties.

The goals of cognitive-behavioral psychotherapy component of the rehabilitation program often includes: improving coping skills, decreasing stress, and helping individuals cope with feelings of loss related to decreased cognitive and physical functioning. The treatment is often educative and collaborative. For example, an individual may learn stress management techniques. Assertiveness training and communication skills training may also be completed.

The study we are conducting is one of the first to use rigorous scientific techniques to determine if such rehabilitation programs are effective in treating the emotional and cognitive sequelae of mild and moderate brain injury. Specifically, we will evaluate the efficacy of a comprehensive rehabilitation program comprised of cognitive-behavioral psychotherapy (CBT) and cognitive remediation in reducing persisting symptomatology among people with mild and moderate TBI. The study uses a randomized, individual baseline design with repeated measures for two groups: a group that receives the treatment and a group on a waiting list for treatment. The findings will help establish treatment guidelines and develop programming to meet persisting disability following mild and moderate TBI.

The treatment protocol is based on the models of cognitive rehabilitation developed by respected clinicians in the field that are widely used by cognitive rehabilitation programs across the country. Like many of the other programs in existence, the overall goal of our program is to improve neuropsychological functioning, emotional well-being and functional status through integration of the remedial and psychotherapeutic interventions.

Individuals accepted into the study undergo a series of three pre-tests, three weeks apart. They are then randomly assigned to the treatment or wait list group. Immediately following completion of the protocol, individuals are re-tested and receive follow-up evaluations at one, three, and six months. Individuals in the treatment group receive two one-hour periods of one-on-one individualized treatment by a qualified therapist, three days per week, for an 11-week period. In addition, they complete daily half-hour homework assignments following each therapy session. The treatment program is divided into two components: 1) Cognitive Remediation and 2) Cognitive-Behavioral Psychotherapy.

At this point we can identify individuals whose functioning clearly improved following treatment, but results are not complete. Subject recruitment is continuing, and data collection is scheduled for completion in September 2002. We plan to use these findings of this pilot study as the basis for a larger clinical trial.

### Reference:

1. Salazar AM, Warden DL, Schwab K. et al. Cognitive rehabilitation for traumatic brain injury: A randomized trial *JAMA*, 2000, 283:3075-3081.

### Home-Based Cognitive Stimulation

*Tom Novack, Ph.D. - University of Alabama at Birmingham Model System*

In Alabama there are very little post-acute rehabilitation services other than outpatient therapy. To address the needs of people at home following acute rehabilitation, the Interactive Community Based Model was implemented by the Alabama Department of Rehabilitation Services (ADRS). This program employs six TBI Care Coordinators located throughout the state. They are responsible for visiting people in their homes following discharge from the hospital. The goal is to better identify people with TBI who are capable of participating in vocational rehabilitation and expediting transition to vocational training when that is feasible. During regular visits the Care Coordinators assist in establishing a daily routine for the person with head injury in the home and make recommendations concerning cognitively and physically stimulating activities.

In cooperation with Dr. Tom Novack of the Spain Rehabilitation Center at UAB, a research project was initiated to develop a home stimulation program that can be used by the Care Coordinators to assist people with TBI and their family members. Rather than have the Care Coordinators carry volumes of written material and books, it was decided to develop a program that could be stored on the laptop computer carried by each Care Coordinator.

The program, as it presently exists, involves tiered activities for people with Rancho scores ranging from four to eight. At each Rancho level, activities in areas such as attention, concentration, memory, reasoning, and language skills are listed. Each activity is described in a hierarchy, with maximum structure present in early stages, which is diminished as the person progresses. The use of the laptop computer allows easy access to this material, which would occupy several hundred pages of written text. The program is arranged so that when a particular level of Rancho functioning is identified, the Care Coordinator can access a list of stimulation tasks in a particular area and then select those that might be suitable for the client in question. For instance, someone struggling with concentration skills may benefit from stimulation involving focused attention on visual stimuli, such as in the form of the traditional "shell game" played at carnivals.

Once a task is selected it can be printed (each Care Coordinator carries a portable printer) and the instructions can be reviewed with the caregiver and client. It is then the responsibility of the client and family member to follow through with the tasks that have been recommended. This provides the family and client with structure in terms of their activities and some means of gauging improvement over time. When the Care Coordinator returns, the client's file can be accessed to review the results of the interventions with the client and family. An update of the stimulation program can be generated, hopefully involving increasingly complex tasks. This project is not intended as a cognitive remediation program as might be implemented by a speech therapist, but rather as a cognitive stimulation program for the home environment to help direct family efforts, which otherwise might be haphazard.

The experimental component of the project involves assessing people at regular intervals after enrollment into the project. Every two months the Care Coordinator completes a brief mental status screening with the client, evaluates the family and client involvement in the program, completes a questionnaire with the client and family focused on community activities, and evaluates life satisfaction for the client and the primary caregiver. In the first eighteen months of the project, when the computer program was being developed, people were enrolled as a control sample. In other words, these are people with TBI who worked with a TBI Care Coordinator without the benefit of the computer program. Seventy-one individuals comprise the control sample. Beginning in May of 2000, the treatment arm of the study began when the TBI Care Coordinators began using the computer program with new clients. Thus far, forty treatment cases have been enrolled in the study, with an intention of enrolling another 30 subjects prior to completion of the project. It is hoped that the value of the intervention will be confirmed by the treatment group exhibiting more rapid recovery of cognitive abilities based on mental status screening, an increased satisfaction with life, increased involvement in their recovery program, and perhaps a more rapid referral to vocational rehabilitation services. Thus far, the treatment program has been well received by the Care Coordinators and the clients. Even if the results do not suggest a significant improvement in functioning based on participation in the treatment of program it is possible that the computer-based program may be helpful to structure interventions for family members and clients and provide them with a feeling of focus and accomplishment.

Thus far, it is too early in the course of the data collection, particularly for the treatment group, to provide statistical analysis of the results. If this program is found to be a benefit to clients and families, it is hoped that it will be readily available, such as on the internet.

#### **TBIMS RESEARCH AND PUBLICATION REGISTRY NOW ON-LINE**

A new website ([www.tbimdc.org](http://www.tbimdc.org)) has been launched recently featuring a comprehensive listing of the 200 research projects currently in progress or recently completed by the TBI Model System Centers. In addition, completed projects are linked to publications listed in PubMed (when available) and a separate Publication Registry is also accessible. Users can search both registries by keyword, center and author.



## ACRM BI-ISIG Evidence-based Review of Cognitive Rehabilitation

*James F. Malec, Ph.D. - Mayo Traumatic Injury System*

An evidence-based review of cognitive rehabilitation was recently published by members of the Brain Injury Interdisciplinary Special Interest Group (BI-ISIG) of the American Congress of Rehabilitation Medicine (ACRM).<sup>1</sup> This review found three nonrandomized controlled trials of CDT with a total of 138 subjects which demonstrated significant reduction in disability after treatment and supported the effectiveness of CDT. A number of uncontrolled (pre-post) studies of CDT reporting positive outcomes were also reviewed by the BI-ISIG group.

Following guidelines for evidence-based reviews of clinical practices, the BI-ISIG study group reviewed 171 studies of cognitive rehabilitation in all with particular attention to study design and the strength of empirical evidence. Of these studies, 29 were prospective randomized controlled trials; 35 were cohort case control or other nonrandomized controlled designs; and 107 were clinical series without controls or controlled case studies.

The evidence-based methodology resulted in support for the effectiveness of many cognitive rehabilitation practices. Specific recommendations were made for practice in the remediation of language, visuoperceptual abilities, attention, memory, functional communication and executive cognitive functions after brain injury and stroke.

Results of this evidence-based review will be discussed by members of the review panel at the meeting of ACRM to be held in Tucson, AZ, October 25-29, 2001. Representatives from 4 TBI Model Systems will also present a 3-1/2 hour symposium on outcome prediction following moderate to severe TBI at the ACRM meeting. Outcomes will encompass the full range of possibilities: utilization of acute medical and rehabilitation services, use of government financial services, return to work, independent living status, community integration, emotional status, and quality of life. Specific predictors will include preinjury functioning, injury severity, psychosocial factors, neuroimaging, and impaired self-awareness. Innovative approaches (e.g., "twisted pear" model) to modeling the relationship between potential predictors and outcomes will be explored.

Reference:

Cicerone KD, Dahlberg C, Kalmar K, Langenbahn DM, Malec JF, Bergquist TF, Felicetti T, Giacino JT, Harley JP, Harrington DE, Herzog J, Kneipp S, Laatsch L, Morse PA: Evidence-based cognitive rehabilitation: Recommendations for clinical practice. *Arch Phys Med Rehabil*, 2000; 81:1596-1615.

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### The 2001 Traumatic Brain Injury Model Systems National Data Base Syllabus

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## Rehabilitation Institute of Michigan Wayne State University Detroit, Michigan

This marks Rehabilitation Institute of Michigan's 50th Anniversary. Since 1951, Rehabilitation Institute of Michigan (RIM) has been helping people rebuild their lives after serious illness or injury. RIM is one of the largest free-standing academic rehabilitation hospitals in the nation. With its 94-bed specialty hospital and 12 outpatient sites located throughout Southeastern Michigan, RIM treats more than 1,600 inpatients and conducts over 160,000 outpatient visits each year. A full spectrum of comprehensive inpatient and outpatient services are available for spinal cord injuries, brain injuries, stroke, cerebral palsy, musculoskeletal disorders, low back problems, amputations, geriatric conditions, work-related injuries, sports injuries, and other medical conditions requiring physical rehabilitation. RIM is a member of the Detroit Medical Center (DMC) and serves as the clinical research and training site for Wayne State University School of Medicine.

In 2000, U.S. News and World Report named RIM as one of "America's Best Hospitals." Our national and local reputation for excellence in physical medicine and rehabilitation is built on years of conducting cutting-edge research, providing quality clinical care, training skilled rehabilitation professionals and advocating for the rights of people with disabilities. These important goals support our mission of helping our patients reach their maximum potential.

There are currently many exciting changes occurring on the DMC's main campus. Construction for a modern six-floor health care education and research center is underway. The new building will house the WSU College of Pharmacy and Allied Health Professions. It is located on property adjacent to RIM. Also, for the first time in DMC's history, the medical center received a capital allocation in the federal budget. Congress has earmarked a \$1 million grant for the DMC and another \$500,000 for Rehabilitation Institute of Michigan. RIM plans to use the allocation for capital improvements.

### Community Outreach Activities offered by RIM

Annually, members of the RIM staff coordinate the "Living without Limitations Exposition and Job Fair for Persons with Disabilities and Seniors." RIM and several other area organizations hosted this spring's event in Detroit. This event offers members of the community the opportunity to meet area service

providers catering to the needs of the disabled and the elderly. Vendors are also on site exhibiting and demonstrating various supportive equipment and promoting independent living.

Pioneers for Peace is another community outreach program sponsored by RIM. The program is a unique initiative for violence prevention and awareness. Program leaders and all former RIM patients travel to area schools and present students with a vivid portrait of the effects of gun violence through discussions and hands-on workshops that allow students to experience life with a disability.

### Selected RIM Research Activities

During the last five years, RIM has been awarded \$9.5 million in federal and private grants for rehabilitation research focusing on restoring function, improving quality of life and developing innovative therapeutic techniques. Our physicians,



psychologists, and rehabilitation professionals publish numerous professional articles each year and guest lecture locally, nationally and internationally. We have a well-rounded research team with expertise in the areas of clinical research, basic science, physiology, kinesiology, rehabilitation engineering, neuropsychology, and educational and qualitative research.

The Institute houses a state-of-the-art Motion Analysis and Gait Laboratory. Research in the lab focuses on improving human performance on skills such as walking or stair climbing, or improving sports related techniques through proper body mechanics. There are currently several research studies being conducted in the Gait Laboratory. One study that could potentially assist patients with lower limb spasticity, stroke conditions, and cerebral palsy, involves the use of the Adeli suit. This suit was designed in 1971 for use as a prescription for bone loss and muscle atrophy in the Soviet Space Program, and contains elastic cords that provide axial loads to mimic the effects of gravity on bones during space flight. When a patient wears the suit, the cords passively assist the body. RIM researchers are trying to find out why the suit works and determine which patient populations may optimally benefit.

## TBI Model System Activities

RIM has earned the rare distinction of being one of 17 federally designated “model systems” of care in the country for the treatment of traumatic brain injuries. The Southeastern Michigan Traumatic Brain Injury System (SEMTBIS) was established in 1988; one of the original five model system centers funded by the National Institute on Disability and Rehabilitation Research (NIDRR). SEMTBIS is a joint effort between the Rehabilitation Institute of Michigan, Detroit Receiving Hospital and University Health Center, Sinai-Grace Hospital, and Wayne State University School of Medicine. The unique partnership between an expert trauma center and a leading rehabilitation facility allows for efficient and continuous care for people with traumatic brain injuries and their families.

Historically, SEMTBIS has consistently submitted the greatest percentage of cases to the national TBI Model Systems (TBIMS) database. To date, 487 (21%) of the total cases in the database have been submitted by SEMTBIS. Accordingly, a total of 2425 follow-up cases have been submitted; 1458 (60%) have some survivor and/or family data and 475 (40%) have neuropsychological test data. Considering RIM’s urban population, collecting follow-up data is very challenging. Nevertheless, we have been successful at doing so. The overall percentage of cases with follow-up data in the TBIMS database is 61%.

In addition to contributing to the TBIMS database, SEMTBIS is actively involved with numerous local and collaborative activities. Due to RIM’s urban location, the population is significantly different from the other TBIMS centers in several ways. Study participants are highly representative of the population in the surrounding area of the DMC. Study participants tend to be male (81%), African American (68%), single (57%), have a high school education or less (75%), be unemployed (41%), and have a TBI as a result of violence (47%). Despite these population disparities, significant differences between SEMTBIS and the other TBIMS centers are not found in the severity of the injuries, acute and rehabilitation length of stays, or functional outcomes. Due to this unique population, RIM is involved in several research studies examining the etiology of violence. We are also conducting studies describing community integration, vocational re-entry, quality of life, and primary care health services for persons surviving TBI. For further information regarding SEMTBIS research studies, please refer to the TBIMS Research Registry accessible via the TBIMS website ([www.tbimdc.org](http://www.tbimdc.org)).

SEMTBIS also leads various educational outreach and research dissemination activities. The SEMTBIS Advisory Board is comprised of TBI professionals, families and survivors. The group meets semi-annually to discuss the progress and future direction of the project. The SEMTBIS Advisory Board is chaired by the president of the Brain Injury Association of Michigan (BIAM); thus strengthening the relationship between the two organizations.

SEMTBIS hosts a website ([www.semtbis.org](http://www.semtbis.org)). The website is an educational resource and referral center for professionals, survivors, families, and caregivers. Another dissemination product developed and distributed by SEMTBIS is a semi-annual newsletter entitled “The Thinking Cap.” This publication is sent to study participants in efforts to increase education and awareness regarding TBI, as well as SEMTBIS-specific activities.

Additionally, SEMTBIS staff have authored numerous TBI-related publications and presentations (refer to [www.tbims.org](http://www.tbims.org) for a list of publications by SEMTBIS staff). These research efforts have been disseminated in various professional publications, at local, national and international conferences. SEMTBIS staff also offer various educational presentations to students, faculty and clinicians at Wayne State University, Rehabilitation Institute of Michigan and throughout the Detroit Medical Center.



SEMTBIS staff members have also been actively participating in the State of Michigan’s TBI Advisory Group. This group is composed of representatives throughout the state including government agencies, the Department of Community Health, the Brain Injury Association of Michigan, health professionals, survivors and families. The focus of this group is to coordinate and provide TBI education and resource information, and direct TBI surveillance activities throughout the state.

## Data From the Traumatic Brain Injury Model Systems of Care

The Traumatic Brain Injury Model Systems (TBIMS) Project is a prospective, longitudinal multi-center study examining the course of recovery and outcomes following traumatic brain injury (TBI). The seventeen Model System centers, funded by the National Institute on Disability and Rehabilitation Research, provide coordinated emergency care, acute neurotrauma management, comprehensive inpatient rehabilitation and long-term interdisciplinary follow-up services.

Information contained in the database is collected during initial hospitalization and annually thereafter on the anniversary of injury. The database contains 423 variables describing the initial hospitalization period, and 412 variables relevant to the follow-up period. The Database Syllabus contains detailed information about the database and is available for purchase from the TBIMS National Data Center.

Presently, the database contains 2553 discharged from the TBIMS between March 1989 and February, 2001; with annual follow-up information extending, thus far, to twelve years post injury. The table below summarizes several key characteristics of the TBIMS population, which have been updated from previous issues of TBI Facts and Figures:

Number of Cases	2553
Mean Age in Years	36
% Male	75
% White	60
% African American	28
% Unmarried at Injury	71
% w/o High School Diploma at Injury	32
Mean Lowest Glasgow Coma Scale	7
% Vehicle-related injury	52

### Incidence and Prevalence

It is estimated that 1.3 million Americans experience TBI each year: Approximately 5.3 million Americans are currently living with this condition.

*(Figures from CDC's National Center for Injury Prevention and Control data; 1999. All other data obtained from the TBI MS National Database; 2001)*

### Employment

At time of injury, approximately 59% of persons with TBI are competitively employed. One year after injury, only 24% are competitively employed.

### Residence

At time of injury, 97% reside in private residences. One year after injury, 85% live in private residences.

### Loss of Consciousness (LOC)

94% of persons with TBI in the database experienced a loss of consciousness at time of injury. Of those with LOC, duration of unconsciousness lasted 3.8 days.



### Inpatient Length of Stay

TBI patients in the Model Systems database averaged 22 days in acute care and 32 days in an inpatient rehabilitation facility.

### Disability Rating Scale (DRS)

Average DRS score upon admission to rehabilitation facility was 12.63 (Severe Disability). Average score at rehab discharge was 5.98 (Moderate Disability). At one and two year post injury testing, average DRS scores were 2.95 and 2.95 respectively (Partial Disability).

### Alcohol Use

Persons with TBI tested positive for alcohol at time of injury in 41% of cases. Of these, blood alcohol levels of 100 mg/dl were detected in 46% of cases.

### Post Traumatic Amnesia (PTA)

Approximately 98% of patients experience PTA. Of these, PTA lasts 30 days or longer in 34% of cases. Post Traumatic Amnesia lasts between 8 and 29 days in 34% of cases as well. PTA between 1 and 7 days in duration is seen in 8% of cases.

### Hospital Charges

Average acute care costs for treating TBI patients injured were \$98,612. Mean costs for inpatient rehabilitation care of these individuals was \$43,212 (excluding physician charges).

### Functional Independence Measure (FIM)

Mean Total FIM score for patients upon admission to rehabilitation facility is 56. Mean score upon rehab discharge is 97. Total FIM scores at one and two years post injury are 114.87 and 115.21. The maximum possible score is 125.

### Community Integration Questionnaire (CIQ)

At one year post injury, individuals with TBI have an average CIQ self-assessment score of 15.48. Average CIQ patient assessment scores reported by significant others is 13.86. Normal control subjects scored 20.5 (Willer et al, J Head Trauma Rehabil. 1993 8(2) p.75-87) The maximum possible score is 29.

## Cohort Outcome Measures

Measure	Rehab Admit	n	Rehab Discharge	n	Year 1	n	Year 2	n	Year 5	n	Year 10	n
FIM	55.71	2320	96.89	2387	114.87	1171	115.21	632	115.91	317	117.76	64
DRS	12.63	2461	5.98	2476	2.95	1212	2.95	678	2.71	337	2.36	67
CIQ (self)	n/a		n/a		15.48	1037	15.68	560	15.82	284	17.72	63
CIQ (other)	n/a		n/a		13.86	823	13.52	407	13.92	81	19.15	15

**National Institute on Disability and Rehabilitation Research (NIDRR)  
Washington, DC**

Program Officer: . . . Ruth Brannon, MSPH  
Ph: . . . . .202-358-2971  
E-Mail: . . . . .ruth\_brannon@ed.gov

Project Officer: . . . Constance Pledger, EdD  
Ph: . . . . .202-205-4352  
E-Mail: . . . . .connie\_pledger@ed.gov

Project Officer: . . . Theresa San Agustin, MD  
Ph: . . . . .202-205-9194  
E-Mail: . . . . .theresa\_sanagustin@ed.gov

Project Officer: . . . Richard Wilson, Ed.D.  
Ph: . . . . .202-205-9088  
E-Mail: . . . . .richard\_wilson@ed.gov

**Traumatic Brain Injury  
National Data Center (TBINDC)  
West Orange, New Jersey**

Project Director: . . Mitchell Rosenthal, Ph.D.  
Ph: . . . . .973-243-6971  
E-Mail: . . . . .mrosenthal@kmrrec.org

Manager: . . . . .Kenneth Wood, Ph.D.  
Ph: . . . . .973-243-6871  
E-Mail: . . . . .kwood@kmrrec.org  
[www.kmrrec.org](http://www.kmrrec.org)

**University of Alabama  
Birmingham, Alabama**

Project Director: . . . Thomas Novack, PhD  
Ph: . . . . .205-934-3454  
E-Mail: . . . . .novack@uab.edu  
[www.uab.edu/tbi](http://www.uab.edu/tbi)

**Santa Clara Valley Medical Center  
San Jose, California**

Project Director: . . . Jeffrey Englander, MD  
Ph: . . . . .408-885-2000  
E-Mail: . . . . .jeffrey.englisher@hns.co.santa-clara.ca.us  
[www.tbi-sci.org](http://www.tbi-sci.org)

**Craig Hospital  
Englewood, Colorado**

Co-Project Director: Gale G. Whiteneck, PhD  
Ph: . . . . .303-789-8204  
E-Mail: . . . . .gale@craig-hospital.org  
[www.craighospital.org](http://www.craighospital.org)

**Georgia Model Brain Injury  
System (GAMBIS)  
Atlanta, Georgia**

Project Director: . . Anthony Y. Stringer, PhD  
Ph: . . . . .404-712-5667  
E-Mail: . . . . .anthony\_stringer@emory.org  
[www.shepherd.org](http://www.shepherd.org)

**The Spaulding Rehabilitation Hospital  
Boston, Massachusetts**

Project Director: . . . Mel Glenn, MD  
Ph: . . . . .617-573-2625  
E-Mail: . . . . .mglen@partners.org  
[www.spauldingrehab.org](http://www.spauldingrehab.org)

**Southeastern Michigan Traumatic Brain  
Injury System (SEMTBIS)  
Rehabilitation Institute of Michigan (RIM)  
Detroit, Michigan**

Project Director: . . . Robin Hanks, PhD  
Ph: . . . . .313-745-9763  
E-Mail: . . . . .rhanks@dmc.org  
[www.semtbis.org](http://www.semtbis.org)

**Mayo Medical Center  
Rochester, Minnesota**

Project Director: . . . James F. Malec, PhD  
Ph: . . . . .507-255-3116  
E-Mail: . . . . .malec.james@mayo.edu  
[www.mayo.edu/model-system](http://www.mayo.edu/model-system)

**TBI Model System of Mississippi  
Jackson, Mississippi**

Project Director: . . Mark Sherer, PhD, ABPP  
Ph: . . . . .601-364-3490  
E-Mail: . . . . .marks@mmrcrehab.org  
[www.mmrcrehab.org](http://www.mmrcrehab.org)

**University of Missouri  
Columbia, Missouri**

Project Director: . . . Brick Johnstone, PhD  
Ph: . . . . .573-882-6290  
E-Mail: . . . . .johnstoneg@health.missouri.edu  
[www.hsc.missouri.edu/~mombis](http://www.hsc.missouri.edu/~mombis)

**Kessler Medical Rehabilitation Research  
and Education Corporation (KMRREC)  
West Orange, New Jersey**

Project Director: . . . Mark Johnston, PhD  
Ph: . . . . .973-243-6810  
E-Mail: . . . . .mjohnston@kmrrec.org  
[www.kmrrec.org](http://www.kmrrec.org)

**Charlotte Institute of Rehabilitation  
Charlotte, North Carolina**

Project Director: . . . Flora Hammond, MD  
Ph: . . . . .704-355-4330  
E-Mail: . . . . .fhammond@carolinas.org  
[www.charweb.org/health/rehab](http://www.charweb.org/health/rehab)

**The Ohio State University  
Columbus, Ohio**

Project Director: . . . John D. Corrigan, PhD  
Ph: . . . . .614-293-3830  
E-Mail: . . . . .corrigan.l@osu.edu  
[www.ohiovalley.org](http://www.ohiovalley.org)

**Oregon Health Sciences University  
Portland, Oregon**

Principal Investigator: Randall Chestnut, MD, FCCM  
Ph: . . . . .503-494-7372  
E-Mail: . . . . .chesnutr@ohsu.edu  
[www.ohsu.edu/som-ntrg/](http://www.ohsu.edu/som-ntrg/)

**Moss Rehabilitation Research Institute  
Philadelphia, PA**

Project Director: . . . John Whyte, MD, PhD  
Ph: . . . . .215-456-5925  
E-Mail: . . . . .jwhyte@aehn2.einstein.edu  
[www.einstein.edu](http://www.einstein.edu)

**The Institute for Rehabilitation and  
Research (TIIR)  
Houston, Texas**

Project Director: . . . Walter M. High, Jr., PhD  
Ph: . . . . .713-666-9550  
E-Mail: . . . . .whigh@bcm.tmc.edu  
[www.tiir.org](http://www.tiir.org)

**Virginia Commonwealth University/  
Medical College of Virginia  
Richmond, Virginia**

Project Director: . . . Jeffrey Kreutzer, PhD  
Ph: . . . . .804-828-9055  
E-Mail: . . . . .jskreutz@hsc.vcu.edu  
[www.neuro/pmr,vcu.edu](http://www.neuro/pmr,vcu.edu)

**University of Washington  
Seattle, Washington**

Project Director: . . . Sureyya Dikmen, PhD  
Ph: . . . . .206-685-7529  
E-Mail: . . . . .dikmen@u.washington.edu  
[www.weber.u.washington.edu/~rehab/bi](http://www.weber.u.washington.edu/~rehab/bi)

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## Facts and Figures

Editorial Staff:

Mitchell Rosenthal, Ph.D., ABPP

Ken Wood, Ph.D.

Donna Cifelli

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Model Systems National Data Center  
1199 Pleasant Valley, West Orange, NJ 07052

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