Comprehensive Brain Injury Rehabilitation in Post-hospital Treatment Settings

James F. Malec

Abstract

The mission of comprehensive brain injury rehabilitation (CBIR) is to assist individuals with traumatic brain injury and their close others to resume full participation in family, work, and community life. In pursuing this goal, CBIR addresses the needs of participants holistically including cognitive and metacognitive impairments, neurobehavioral dysfunction, and interpersonal and affective issues, and identifies barriers and resources in their physical and social environments. Treatment is integrated and, in its most intensive form, relies heavily on developing a positive transdisciplinary therapeutic milieu with an emphasis on group treatment. This chapter describes characteristics of participants best suited for CBIR and reviews interdisciplinary team evaluations and the operation and care of the rehabilitation team. Important components of CBIR include the development of a therapeutic milieu and therapeutic alliance, dynamic group treatment, cognitive rehabilitation, and interventions to address impaired self-awareness as well as co-morbid and premorbid conditions. This chapter describes how to provide these components in an integrated fashion in collaboration with close others and how to further integrate treatment with transitional interventions, such as, vocational rehabilitation, work and independent living trials, and resource facilitation. Methods for systematic measurement of progress and outcome both in the individual case and at a programmatic level are recommended in a continuous quality improvement model.

Keywords

Brain injuries • Rehabilitation • Postacute • Outpatient • Interdisciplinary • Outcome measurement

J.F. Malec, Ph.D. (✉)
Professor and Research Director, Physical Medicine and Rehabilitation, Indiana University School of Medicine and Rehabilitation Hospital of Indiana, Indianapolis, IN, USA
e-mail: jmalec@rhin.com

Emeritus Professor of Psychology, Mayo Clinic, Rochester, MN, USA

M. Sherer and A.M. Sander (eds.), *Handbook on the Neuropsychology of Traumatic Brain Injury*, Clinical Handbooks in Neuropsychology, DOI 10.1007/978-1-4939-0784-7_15,

Overview

The methods and concepts of holistic comprehensive post-hospital brain injury rehabilitation were originally defined through the work and writings of Ben-Yishay and Prigatano [1–3]. A consensus conference in Zionsville, Indiana in 1994 codified the key elements of this approach (see Table 1) [4]. Ben-Yishay, as well as Pamela Klonoff from George Prigatano's program and other developers of this approach to rehabilitation, participated in this conference. The Ben-Yishay/Prigatano model stressed the importance of developing a therapeutic milieu in which a highly integrated, transdisciplinary team provided neurosychologically focused rehabilitative treatment based in group process. Although goals included reduction of impairments, the primary emphasis of this form of rehabilitation is to assist the participant in reintegrating into family, community, and work life. This holistic milieu-oriented treatment is clearly and extensively described in a book by Ben-Yishay and Diller [5] which includes a number of compact discs illustrating practices and methods in actual participant groups.

At the present time, few programs exist that include all the features of Ben-Yishay's original program at the Rusk Institute in Manhattan. Due both to shrinking reimbursement and advances in rehabilitation intervention research, comprehensive programs have become more streamlined. Nonetheless, the basic principles identified during the Zionsville Conference continue to characterize current comprehensive programs. The nature of the milieu has become more varied as well. With increased interest in community-based programming, the rehabilitation team may seek to develop a more stable therapeutic milieu within the participant's own family or social network rather than within a treatment facility. In this chapter, component interventions and team interactions that characterize comprehensive brain injury rehabilitation (CBIR) will be reviewed in detail. The types of individuals best served through this approach will be described, as will methods for monitoring process and outcome. As Table 1 indicates, continuous quality improvement through monitoring and evaluating individual and programmatic outcomes is a key feature of CBIR.

Table 1 Defining features of holistic day treatment (from Malec JF, Basford JS [45]; based on text from Trexler LE, et al. [4])

I. Neuropsychological orientation focusing on
A. Cognitive and metacognitive impairments
B. Neurobehavioral impairments
C. Interpersonal and psychosocial issues
D. Affective issues
II. Integrated treatment that includes
A. Formal staff meetings with core team in attendance four times/week
B. A team leader or manager for each participant
C. A program leader or manager with at least 3 years experience in BI rehabilitation
D. Integrated goal setting and monitoring
E. Transdisciplinary staff roles
III. Group interventions that address
A. Awareness
B. Acceptance
C. Social pragmatics
IV. Dedicated resources, including
A. An identified core team
B. Dedicated space
C. A participant to staff ratio no greater than 2:1
V. A neuropsychologist is part of the treatment team, not just a consultant
VI. Formal and informal opportunities for involvement of significant others, including systematic inclusion of significant others on a weekly basis
VII. Inclusion of a dedicated vocational or independent living trial
VIII. Multiple outcomes are assessed, including
A. Productive activity
B. Independent living
C. Psychosocial adjustment
D. Emotional adjustment

Types of Participants

Comprehensive and holistic evaluation and treatment arguably characterize all high-quality rehabilitation and medical care. However, a significant proportion, if not a majority, of individuals with traumatic brain injury (TBI) do not require a CBIR day or residential treatment program.

Table 2 Characteristics CBIR participants

• Limited self-awareness of disabilities
• Cognitive impairments: e.g., concentration, memory, generalization, problem-solving, initiation, reasoning, planning
• Poor communication and social skills
• Limited emotional/behavioral self-control
• Unemployed or failing in employment
• No imminent risk of harm to self or others

Many individuals with TBI, even those with moderate to severe injuries, emerge from the acute period of recovery with reasonable self-awareness of a limited number of circumscribed deficits. Problems with memory and attention and difficulties in emotional control are perhaps the most common of these. Such participants with a few circumscribed disabilities and reasonable self-awareness will typically benefit from rehabilitation and associated medical care provided on a more limited scope (3–5 h per week) that is less costly both financially and in time demands on the participant and their family and close others [6].

On the other hand, CBIR is required in more complex cases in which a number of cognitive, behavioral, and often physical disabilities are present, interact, and are compounded by limited self-awareness and co-occurring or pre-injury conditions, such as, a history of substance abuse, psychiatric disorder or family dysfunction. Definitive research studies identifying which types of participants benefit from specific forms of brain injury rehabilitation are not available. However, based on the author's clinical experience, characteristics of the type of participant most suited for comprehensive treatment are listed in Table 2.

These more complex cases require a comprehensive approach because their disabilities frequently interact. They also require a transdisciplinary approach in which all therapists collaborate in an overall plan of rehabilitation treatment. Although individual therapists bring their specific expertise to their interventions, each must be aware of the goals and approaches of the other therapists involved and able to assume each other's roles, as needed, to keep the rehabilitation "on mission." Transdisciplinary team process will be discussed in more detail later in this chapter.

Interdisciplinary Evaluation

A thorough interdisciplinary evaluation will help determine who requires CBIR and who may benefit from more limited and focused rehabilitation. Ideally, this evaluation includes individual evaluations by the following disciplines: a rehabilitation physician (physiatrist) and other medical specialties as required; a clinical neuropsychologist; speech/language pathologist; occupational and physical therapists; a family liaison; and a resource facilitator. Although most participants who enter post-hospital rehabilitation are medically stable, a thorough re-evaluation of the participant's medical status by a physician specializing in medical rehabilitation is important for several reasons: (1) to determine any overlooked medical problems related to the brain injury; (2) to identify co-occurring or pre-injury conditions that may require additional treatment or special attention during rehabilitation; and (3) to identify medical risk factors and assist the participant to develop a medical life care plan. Masel and DeWitt [7] have noted that individuals with TBI may be more vulnerable to medical conditions and benefit from ongoing medical care to minimize these risk factors. Physical therapy (PT) evaluation assesses possible motoric disabilities as well as general cardiovascular fitness and the need for intervention in these areas.

A thorough neuropsychological evaluation that includes both neuropsychometric testing and a clinical interview will identify cognitive impairments as well as emotional and adjustment issues, more serious psychiatric disorders including substance abuse issues, and possible family and social concerns. Speech/language pathology evaluation focuses specifically on cognitive communication, and occupational therapy (OT) evaluates functional abilities that affect everyday activities. Both speech and OT evaluations assess the degree to which cognitive impairments contribute to functional disability in interpersonal communication and complex activities of daily living. These functional cognitive and communication evaluations are important because the ecological validity of neuropsychological testing is not perfect.

That is, cognitive impairments identified on neuropsychometric testing do not always translate into functional disability; conversely, cognitive deficits that are apparent in more real life or interpersonal settings may not be apparent in the highly structured and supportive setting in which neuropsychometric testing is conducted.

Although a complete neuropsychological evaluation also touches on the participant's family and social support network, these are important enough to the long-term success of rehabilitation that a specific evaluation is critical to rehabilitation planning. In most cases, further development of the participant's network of social and practical support will be required for community reintegration. This is the role of the *resource facilitator* and will be discussed in greater detail later in this chapter. The assessment of the participant's network of family, social, and practical support and resources may be conducted by a social worker, family counselor, or other individual with training and experience in working with family, social and community systems. This assessment of the participant's integration in home and community life includes leisure, recreational, and work interests and activities. Ideally such evaluations are conducted by experts in these areas, i.e., vocational counselor, recreational therapist, but in some settings these evaluations may be included in the evaluations of other rehabilitation team members.

This interdisciplinary evaluation is focused on current functional abilities. Several studies [8–10] have shown that current functional abilities are better predictors of long-term rehabilitation outcomes than initial injury severity as measured by, for instance, the Glasgow Coma Scale or duration of post-traumatic amnesia. In two studies, an initial assessment on admission to post-hospital rehabilitation with the Mayo-Portland Adaptability Inventory (MPAI-4) accounted for over 60 % of the variance on progress and outcome, also assessed by the MPAI-4 [11, 12].

The Rehabilitation Team

Rehabilitation teams may be organized in several ways: multidisciplinary, interdisciplinary, and transdisciplinary. A *multidisciplinary* team is one in which each of the team members work independently with the participant in their area of expertise and do not coordinate their therapeutic activities or treatment plans. Multidisciplinary teams are perhaps most common in traditional outpatient rehabilitation settings in working with participants who have a small number of clearly defined goals. For instance, a participant post-stroke will see the Speech/Language Pathologist for dysarthria, PT for ambulation, and OT to improve use of the affected hand.

In an *interdisciplinary* team, each member works with the participant in their area of expertise but in a coordinated manner and with an integrated treatment plan. Each team member is aware of, and reinforces the goals and methods of, other team members. Interdisciplinary teams are most appropriate in working with more complex or acute participants when the objectives of each discipline overlap and are affected by those of other team members. Inpatient rehabilitation teams are most commonly organized in an interdisciplinary fashion.

In a *transdisciplinary* team, members not only work in a coordinated manner from an integrated treatment plan and reinforce each other's efforts, but are also able to temporarily assume each other's roles. In other words, the PT can assume the role of the psychologist if a participant begins to exhibit inappropriate anger in the PT session, and the psychologist can remind the participant about the current parameters of the aerobic conditioning program that the PT has prescribed. To be maximally effective, the organization of the rehabilitation team delivering CBIR must be transdisciplinary. Being able to assume each other's roles requires a good deal of information sharing among team members, exquisite confidence in one's own and each other's professional abilities, and a high degree of trust among team members.

The ability to assume each other's roles is critical because most participants with brain injury who require CBIR have severe difficulty in acquiring and generalizing new learning. Individuals with significant cognitive impairment need to have learning experiences in close temporal proximity to their expression of problematic behaviors. For instance, when a participant exhibits inappropriate behavior, it will not be

effective to note this and bring it to the attention of the psychologist for discussion at a later point in time. The participant's behavior and its negative consequences must be addressed in the here-and-now. Then alternative, appropriate behaviors must be prompted or coached, and the more positive consequences of these behaviors identified. This type of training in the here-and-now can be applied to every type of cognitive and behavioral problem. Arguably new learning of this nature is most effective in assisting individuals with problematic behaviors to learn more adaptive behaviors whether or not they have TBI. However, for individuals with TBI, organizing new learning in this way is critical because of their limited capacity to remember and to generalize new learning.

Operation of the Transdisciplinary Team

Not uncommonly rehabilitation team members exhibit the typical human characteristic of protectiveness of their "territory," i.e., their disciplinary knowledge and skills, and anxiety about working outside of their comfort zone. While these types of feelings are understandable and normative for human beings, a maximally effective transdisciplinary team is able to function beyond this level of self-interest and keep their eye on the mission. In this regard, the transdisciplinary team functions like other high performance teams, such as, elite surgical teams or military squads. Raemer [13] in *Simulators in Critical Care and Beyond* recommends four routines of military commando teams for emulation by high performance medical teams: (1) practice, (2) briefing, (3) debriefing, and (4) celebration.

Practice is essential for the efficient and effective operation of a high performance team. Nonetheless, busy schedules can restrict the amount of time that teams have to practice their roles as a team with a given participant. In order to develop the capacity for the members of transdisciplinary teams to assume each other's roles, it is helpful for the team to discuss and role play the appropriate response to critical participant events. For instance, team members might review how to respond to expressions of anger from a participant, or how to respond to memory failures. In the former instance, the psychologist may be the primary team member to guide colleagues through the appropriate responses to the participant. In the latter, the occupational or speech therapist who is primarily responsible for organizing the cognitive rehabilitation program may be the primary guide. However, in the end, each team member should be able to, at least temporarily, respond as capably as a psychologist to expressions of anger and as ably as the memory expert on the team to memory failures.

Briefing refers to preparing for the mission, or in the case of rehabilitation teams, the coordinated treatment program with a given participant. In rehabilitation settings, this means designing and reviewing the integrated treatment plan. Documentation of a rehabilitation treatment plan is required in most rehabilitation settings. Regular review and appropriate updating of the treatment plan may be challenged by busy schedules of the treatment team members but is essential to assure high team performance.

Debriefing refers to regular examination of the functioning of the team in completing its mission with the participant. While most rehabilitation teams have team conferences on a regular basis, these conference are often focused on participant progress. The most informative debriefing sessions include not only participant status and performance (i.e., to what degree are the goals of the mission being accomplished) but also careful examination of the methods that are being used. What is working and what is not working? How can the team be more effective in working with this participant both as individual practitioners and as a team? A high performance CBIR team needs to have a formal debriefing conference three to five times a week. The objective of these debriefing conferences is to examine in what ways specific interventions as well as their overall plan with specific participants is effective as well as ineffective, and to revise their transdisciplinary rehabilitation plan to improve progress and outcome. Debriefing conferences typically occur without the participant present. The focus is primarily on team process and function and on participant status and progress only as these represent the functioning of the team.

Table 3 Team communication ground rules

1. We will periodically review our effectiveness as a Team
2. We will not judge, challenge, nor evaluate an idea until we hear or understand the whole idea
3. We will attack problems, not people (each other)
4. We will disagree without becoming disagreeable
5. Once the Team reaches a decision, and I have the opportunity to be heard, I will support the Team decision 100 %
6. We each participate in discussions, fully and openly. We do not use silence as a weapon or as a defense
7. We deal with our conflicts and frustrations directly and promptly
8. We feel free to bring up problems and invite possible solutions
9. We say nothing about any third party that we would not say if that person were present
10. We respect each other's work, tasks, and contributions without regard for titles or status

Finally, effective, high performance teams regularly *celebrate* their successful missions. Central to the concept of celebration is tying the celebration to a specific accomplishment. Some CBIR teams formalize this celebration with a graduation party that includes the participant who has successfully completed the program, their close others, and the treatment team. However, to maintain *esprit de corps* and avoid burnout, even minor victories merit celebration.

Care of the Team

Providing transdisciplinary CBIR can often be challenging and stressful. The participants selected for this type of intensive rehabilitation typically lack self-awareness, are disinhibited and intermittently aggressive, and can split the team through dramatic and frustrating behaviors. Briefing and debriefing sessions provide opportunities for team members to support each other, particularly team members who may be showing signs of stress and burnout. The team leader, who is often a neuropsychologist, has a primary role in supporting the healthy psychological functioning of the team.

Explicit ground rules for team interactions can also be helpful in avoiding inappropriate exchanges and harmful splitting among team members under stress. Disagreements and differences of opinion are healthy and constructive in brainstorming approaches to challenging participant behaviors. However, interactions with participants must be unified and consistent within the team. In the CBIR at Mayo Clinic, we developed a set of guidelines (Table 3) for team interactions. These were posted in the team conference area, and not infrequently referred to during heated team discussions.

Transdisciplinary Treatment

The Therapeutic Milieu

A fundamental concept underlying CBIR is development of a *therapeutic milieu*. In a nutshell, a therapeutic milieu is a treatment environment in which virtually every action and interaction has a therapeutic value, that is, assists participants in accomplishing the goals of treatment. In addition to formal treatments, the therapeutic value of all other activities in the treatment setting, such as, informal conversations among participants, with staff, with family/close others; going to lunch; and formal and informal outings, is recognized and reinforced. The rest of this section examines how the various elements of CBIR create a therapeutic milieu.

Group Therapy

Most CBIR programs provide treatments in groups. Providing therapy to more than one participant simultaneously creates efficiency and lessens the personnel costs of providing treatment. However, this is not the primary rationale for group therapy. Group therapy also improves clinical care. Developing a positive dynamic for participants in a therapeutic group can be a powerful intervention to develop self-awareness, reinforce effort and progress, and create a therapeutic milieu.

Providing therapy in a group is not necessarily group therapy. In less effective groups, therapy is provided to one person in the group at a time. Others in the group may benefit from observation of the therapeutic process and serve to encourage

and reinforce the intervention. However, what is missing in this scenario is the use of the powerful group dynamic. In a relatively short period of time, every group develops an identity that goes beyond the identity of the individual members. Each member finds a role in the group that is consistent with the identity of the group. Group identity and the roles can be positive or negative. A skilled group therapist will work with the group to create a positive and constructive milieu.

Examples of common roles in a group are: the rational one (who tries to be the voice of reason), the helper (who tries to be supportive), the challenger (who tends to question or challenge the "common wisdom" of the group or the leader), and the quiet one (who has difficulty speaking up in the group). This list is not exhaustive; roles in the group can be many, highly nuanced, and changing. These examples illustrate, however, how roles may be positive or negative. For instance, the rational one may in fact only *think* they are being rational, while they advance idiosyncratic ideas. The challenger can play an important function in making other group members think about recommendations and suggestions but, without a good group leader, can easily turn into a naysayer who enjoys the attention afforded to a "rebel."

Typically, individuals find roles in the group that are consistent with their interpersonal style. In a psychotherapeutic group, getting members to reflect on the roles they play in the group, and how and when these roles are effective or ineffective, creates important learning experiences to improve the effectiveness of their interpersonal style. For instance, the quiet one may be a very good listener, but needs to learn to be more assertive to share the perceptions that they have for the benefit of the group and themselves. The helper offers valuable support to others, but may also feel, at times, that they are "always giving" (which they are). Like the quiet one, the helper may be able to learn through practice in the group to be more assertive in getting their own needs met as well as in helping others.

Most CBIR groups, however, are not fundamentally psychotherapeutic but are focused on other goals, such as, developing cognitive, social, or functional skills. In these other CBIR groups, understanding and developing the identity of the group and the roles of the members is critical to using the group process to accomplish the goals of the group. For example, in a cognitive group in which the primary goal is to help members develop and use memory notebooks, a positive group process can be a powerful tool. With skilled guidance and reinforcement from the therapist, the rational one will explain the sense of using a memory notebook; the challenger will question this and voice the objections that others have—so these can be addressed; the quiet one may need to be drawn out, but will often be the swing vote in the process to keep things moving in a positive direction; and the helper will reinforce everybody for using the memory notebook. This quick summary is of course an oversimplification but may give the basic idea of how group process can be used to accomplish the goals of any group, not just psychotherapeutic groups.

A basic premise underlying group process is that the members of the group will respond to their peers more readily than to therapists and that the guidance and reinforcement that they receive from each other is more powerful than that of a therapist. Like most people, people with TBI tend to listen most closely to their peers, to those people who they identify are most like themselves and who they feel share their life experience. The therapist's skill is required to manage the group process and to keep its energy focused on moving its members positively toward accomplishing their goals.

Therapeutic Alliance

Therapeutic alliance is the bond of trust and collaborative working relationship that develops between therapist and participant in effective therapy. The concept of therapeutic alliance originally developed through studies of psychotherapy where it was identified as a "necessary but not sufficient (NBNS)" condition for therapeutic change [14, 15]. That is, a therapeutic alliance does not in and of itself produce positive behavioral change; however, change will not occur or will occur only minimally if a bond between

therapist and participant is not present. In recent years, therapeutic alliance has been increasingly studied in brain injury rehabilitation and has been found to have a similar positive effect on outcome [16–18]. Although therapeutic alliance often involves feelings of liking and affection between participant and therapist, it is more than this. Therapeutic alliance is "mission-oriented" in that both therapist and participant see themselves as a team that is working collaboratively to accomplish the participant's goals. The participant develops trust in the therapist's treatment recommendations and feedback; the therapist also develops trust that the participant is dedicated and committed to the therapy despite the inevitable ups-and-downs of therapeutic progress.

Addressing Self-Awareness

Self-awareness of disability is present in a significant minority of cases of moderate to severe brain injury. Most likely because of cognitive impairments affecting both their ability to conceptualize as well as to remember changes in themselves due to their injuries, participants with impaired self-awareness (ISA) act as if they are the same people they were before their injury. Sherer and Fleming present a thorough discussion of ISA in this volume. The focus here will be on addressing ISA through CBIR and the therapeutic milieu.

Most participants selected for CBIR have some degree of ISA, and ISA is often the overarching disability that will most dramatically interfere with community reintegration for them. ISA can be effectively addressed through CBIR and typically cannot be addressed through more specific individual therapies, for instance, cognitive rehabilitation alone. Participants with no self-awareness of disability cannot be engaged in rehabilitation. In their minds, they are unimpaired; so rehabilitation is of no value. However, most participants are able to identify a specific problem for which they will acquiesce that they may need a little help, often with the encouragement of family or close others. Addressing the identified disability for participants with ISA is the hook to engage the participant; the CBIR treatment plan, however, can be more comprehensive and include addressing ISA as part of the rehabilitation program. Working to develop self-awareness is a delicate operation of balancing feedback with support. The trusting, collaborative working relationship that characterizes *therapeutic alliance* is essential to this work. The *therapeutic milieu* is also particularly important to the development of accurate self-awareness after TBI because the development of more accurate self-appraisal is most effectively accomplished if appropriate and consistent feedback and support are provided throughout the day rather than only in a few therapy sessions dedicated to this process.

ISA is challenging to address and may be complicated by pre-injury personality tendencies to respond to stress with denial or support from close others who are also coping by a degree of denial. In almost all cases, it is unreasonable to expect that self-awareness that is impaired due to brain injury will ever completely return to normal after a brain injury. Goals for CBIR should be to improve self-awareness to the degree that the participant can (1) participate effectively in rehabilitation, (2) set realistic goals for rehabilitation and community reintegration, and (3) not engage in behaviors in which they are at risk for harm because of their disabilities. Nonetheless, CBIR provides an effective means to achieve these goals through interventions described below.

Education about brain injury generally and specific to the individual. Explaining the nature of brain injury in general and how it has affected the individual with TBI specifically typically will not in and of itself greatly improve ISA. However, this knowledge is a NBNS condition for improving ISA. A participant cannot be expected to understand how their brain injury has affected them—particularly the more subtle effects—if no one has taken the time to thoroughly explain this to them. General education about brain injury is provided in CBIR groups with easily readable and understandable written material provided as a reference. Education specific to the individual participant can also be provided in a group context, including review of neuropsychological test results, neuroimaging, and how the two connect.

It may be psychologically less stressful to learn about the effects of brain injury from review of a peer's case. Group members also provide mutual support to confronting the stressful realities of brain injury and the sense that none of the members "are alone" in struggling with the effects of brain injury. Educational information will likely need to be repeated several times over the course of a CBIR program—as the participant's self-awareness improves, they will become more able to assimilate this information.

Family/close other education and participation. Brain injury education should also include the participant's close others. Close others also often have very limited knowledge about how the brain works and how it recovers from injury. Misconceptions about brain function and recovery may lead to unrealistic expectations. As mentioned previously, close others can also have biased and inaccurate assessments of the participant's status. In order for any ISA intervention to be successful, it is very important that the rehabilitation team and the participant's close others are "on the same page" regarding the participant's abilities, goals, and expectations for recovery. This is important so that the participant's close others can become allies of the CBIR team in reinforcing more accurate self-assessments and realistic expectations by the participant as well as appropriate progress toward realistic goals. The most common situation is one in which the rehabilitation team and the participant's close others generally agree on the participant's status and the participant tends to minimize their disabilities and their impact on their activities. However, the author has observed every possible variation of discrepancy in the appraisal of the participant's current abilities by the participant, close others, and the rehabilitation team. The MPAI-4 (to be discussed in more detail later) is designed primarily as an evaluation and outcome measure to be completed by consensus of a rehabilitation team. Nonetheless, during the initial interdisciplinary evaluation, we have routinely asked participants and a close other to complete the MPAI-4 independently of each other. Comparing these self- and close other assessments with the assessment of the CBIR team on the same measure gives a clear idea of where areas of agreement and disagreement are present regarding the participants' abilities, adjustment and community reintegration. We have found it more productive to know from the beginning where we agree and where we disagree, rather than to be surprised by these discrepancies in perception or expectation once a rehabilitation treatment plan has been set in motion. Sometimes disagreements are not easily or quickly resolved. Our approach has been to begin focusing on areas in which there is relatively good agreement about the need for rehabilitation and gradually work on coming together in areas where expectation of needs are more discrepant.

Structured repeated learning experiences with feedback. While education may be NBNS for improving self-awareness, repeated exposure to situations in which the participant's disabilities and their consequences are made apparent to the participant is very likely the active ingredient in treatment to improve self-awareness. CBIR offers numerous opportunities each day for this type of learning to occur. These types of experiences are potentially very stressful to participants—no one likes to be confronted with their failures or mistakes. Consequently, very direct or harsh feedback to participants about their disabilities, failures, and mistakes is usually not constructive. To the contrary, confronting participants about, for example, their memory problems, is most likely only going to reinforce denial and resistance. A more productive approach is to structure these experiences as supportive learning opportunities. It is not uncommon, however, for CBIR team members to disagree about how direct and confrontational feedback to a given participant should be and can lead to heated debate that threatens to split the team. Agreeing on the most constructive approach with a given participant will appropriately occupy many briefing/debriefing sessions and require skill and sensitivity from the team leader to help team members deal with their frustrations in working with participants with severe ISA.

Peer feedback. Feedback may take many forms: feedback from therapists, results of objective tests or measures, recorded video. However, the

most effective feedback is from peers. Like most of us, people with TBI tend to listen most closely to people who they feel are much like themselves. Direct confrontation is also better tolerated when delivered by peers than when delivered by authority figures like therapists. Shrewd and skillful management of group process and dynamics and the therapeutic milieu by the CBIR team will result in many constructive opportunities for this type of feedback.

Individual and group psychotherapy. The development of more accurate self-appraisals is a double-edged sword. More accurate self-appraisal will lead to more appropriate goal setting and avoidance of activities in which current disabilities will frustrate success or put the participant at risk. However, more accurate self-appraisal can also lead to feelings of discouragement, depression, anger, and other emotional reactions as the participant begins to recognize that life has changed because of brain injury and that some activities and goals that they had prior to the injury may be forever out of reach. For this reason, psychotherapeutic interventions to address feelings of loss and to develop coping skills are another essential component of any intervention to address self-awareness. As self-awareness increases, sometimes depression can become marked, and intensive treatment, including medication should be considered.

In this author's experience, the transition between increased self-awareness and reactive emotional distress is not clearly staged. That is, the participant does not suddenly develop self-awareness and then become depressed or angry. Rather the process is one in which self-awareness improves a little; negative emotional reactions occur; and the participant defends against these unpleasant feelings with a degree of minimization and denial. With psychotherapeutic intervention, these defensive reactions diminish and self-awareness improves a little more—only to begin the cycle again. Support and feedback of peers in psychotherapy and other CBIR groups can be very effective in helping participants to work through these cycles of psychological growth.

Cognitive Rehabilitation

Interventions to improve cognitive function are an integral part of CBIR programs. The most common targets for cognitive rehabilitation are attention, memory, problem-solving, and goal-setting. Because cognitive abilities interact, a thorough neuropsychological evaluation is essential to planning a targeted cognitive rehabilitation program. For example, almost all individuals presenting for CBIR (or their close others) will report that they have "memory problems." However, for many, the problem is not so much with storing and retrieving new information but with attending to the information when it is presented so that it can be stored in memory. Participants whose primary cognitive disability is attention will benefit from different cognitive rehabilitation methods than those whose primary problem is long-term storage and retrieval. For others, difficulty in organizing new information for memory storage may be the primary problem. These individuals typically also have great difficulty organizing other aspects of their lives and consequently, organization may be the primary target for intervention and memory only a secondary target.

The functional impact of cognitive impairments is also important to evaluate. While cognitive impairments may be a very significant frustration and impediment to community reintegration for many people with TBI, this is not true for all. Some individuals have learned to compensate for low average or mildly below average cognitive abilities throughout their lives, and have found work and other activities where strong cognitive abilities are not required. Such individuals often do not require intensive cognitive rehabilitation in order to re-engage with their communities—regardless of the results of their neuropsychological testing.

A number of evidence-based methods for rehabilitation of various cognitive functions have been identified through a series of reviews [19–21]. Haskins and colleagues [22] have recently published a manual that clearly describes in practical terms how to apply these techniques in practice. The Haskins book also provides a number of exercise guides and materials for use by therapists. A

recent volume by Sohlberg and Turkstra details the most effective processes for organizing cognitive rehabilitation interventions. Cognitive rehabilitation techniques are reviewed in this volume as well (see Chaps. 9–11). The interested reader is directed to these other sources for a more in-depth treatment of this topic. The focus here is on integrating cognitive rehabilitation into the therapeutic milieu.

Attention Process Training (*APT*). Originally developed by Sohlberg and Mateer [23], APT involves practice in which the complexity in auditory and visual modalities of the foci of attention is gradually increased. In their volume on cognitive rehabilitation, Sohlberg and Mateer [24] also describe a number of exercises in which attentional focusing and shifting, dividing attention, and shifting attention can be practiced in everyday life. Similar exercises can be practiced in a group setting and throughout the day in the CBIR therapeutic milieu.

Group therapy and the milieu also provide opportunities to address emotional reactions that may interfere with attention. Depression, anxiety, anger, and worry all interfere markedly with the range of attentional functions. This is true for the normal population and doubly so for individuals with TBI. In some cases, the frustration of loss of attention may set off strong negative emotions and create a downward spiral for the participant in which the negative emotions lead to further difficulty regulating attention—leading in turn to increased frustration, anxiety, dysphoria or anger—creating further loss of attentional control. Through cognitive-behavioral therapy, individuals who experience such disruptive emotional reactions learn to identify the thought processes that lead to these negative emotions and interrupt them with more constructive self-talk. In a group milieu, other participants and therapists can assist by prompting this kind of self-talk when they observe a loss of attention accompanied by emotional upset.

The Memory Notebook. Development of a "memory notebook" for each participant is a standard component of CBIR. These notebooks should be individualized to the needs of each participant with sections designed to help organize their schedule and make frequently used information readily accessible (see Chap. 9 for further detail). Although the "memory notebook" appears to be almost universally used as a name for this tool, one of the participants with whom we worked challenged this. He made the point that the use of daily planners, smart phones, and other memory assists has become ubiquitous in the normal population, and asked why these aids should be called something different when used by people with TBI. In fact, his point is well taken. Simply referring to the "memory notebook" as what it is, i.e., a calendar, planner, or smart phone, may normalize the experience of its use for the person with TBI and help increase its acceptance.

As alluded to above, many participants experience some resistance to the use of an external memory aid. Very likely these aids serve as reminders of their injuries and disabilities, particularly if they were not in the habit of using such aids before their injury. Addressing such emotional issues in group therapy and in the therapeutic milieu is critical to remove these obstacles to developing individualized aids to assist participants to compensate for their impairments in organization and memory. Group treatment and the milieu also provide many opportunities to reinforce the use of memory aids through planning and scheduling group and individual activities, as well as opportunities to bring the consequences of either using or not using these aids to the awareness of participants.

Systematic Problem-solving. Teaching simple, systematic approaches to problem-solving is important to help participants learn ways to analyze and prioritize possible solutions for life problems. Teaching problem-solving also works well in groups since it closely resembles a brainstorming exercise. Input from other group members and therapists may be very helpful to participants in identifying, selecting, and prioritizing various solutions to problems. As with other cognitive rehabilitation interventions, identifying and addressing emotional issues that may arise during a problem-solving exercise are just as important as teaching participants the mechanics of a systematic approach to problem-solving.

Goal Management Training (*GMT*). Goal identification and attainment is an essential element of any rehabilitation program and a critical skill for success in life. However, the capacity to set and systematically pursue realistic goals is often diminished due to brain injury. GMT [25] has emerged as an evidence-based method to develop these skills. GMT can be applied as a method to engage the ownership of program goals by CBIR participants. GMT can also help participants develop goals that reach beyond the program and are useful in structuring their current and future lives. In all forms of rehabilitation, treatment goals are best set collaboratively by participant and therapist. Agreeing on goals, however, is challenging with individuals who lack awareness of their impairments and of the impact of these impairments on their functional abilities and activities. The process of developing realistic and attainable goals, both within and beyond the CBIR program, is integral to building more realistic and accurate self-appraisals and self-awareness of impairments.

Perhaps even more so than in other types of cognitive rehabilitation, the goal setting process frequently precipitates strong negative feelings from participants, as they begin to recognize (with feedback from their peers as well as from therapists) that goals that they had prior to their injuries are no longer realistic because of the impairments resulting from their injuries. In many cases, even repeated feedback will not be sufficient to convince CBIR participants that former goals are no longer realistic—they will have to try themselves out in pursuing these goals in real life structured independent living or work trials. This process will be discussed later in the chapter, as will a formal process for program goal identification and monitoring progress and achievement: Goal Attainment Scaling (GAS).

Social Communication Skills Training

It has long been recognized that, while basic language abilities are often spared in frontal lobe injuries, these types of injuries frequently result in dramatic impairment in other types of communication skills. These other skills, such as turn taking in conversation, sequencing, gestures and facial expression, and active listening, have become known as *pragmatic communication* skills. These skills comprise the array of nonverbal and social interaction skills that support or enhance communication through language. There is good evidence that these pragmatic social-communication skills can be developed through group treatment that includes instruction, guided rehearsal, personal and videotaped feedback [26]. A social communication group is an important feature of CBIR. In addition, social communication skills are other targeted skills to be practiced and reinforced in all interactions in the therapeutic milieu.

Behavior Management Training

The focus of CBIR is on developing self-awareness and self-management skills. Participants who have a very limited capacity for self-awareness and self-management (at least initially) may be inappropriate for outpatient or community-based CBIR. Such participants may be more effectively treated in a residential setting in which a carefully controlled program of *applied behavior analysis* can be consistently implemented. Such a program carefully orchestrates environmental stimuli and behavioral consequences to assist individuals in gaining better control over problematic behaviors [27].

Nonetheless, some elements of applied behavior analysis may be beneficially introduced into an outpatient or community-based CBIR program. Participants can learn and be assisted by others within the therapeutic milieu to identify stimuli that reliably precipitate problematic behaviors. For instance, does discussion of the participant's memory problems usually make them angry or withdrawn? Do particular activities or interactions tend to lead to expressions of anger? As these stimuli are identified, other stimuli—typically more constructive self-talk—can be prompted. Other aids can be introduced to prompt constructive and rewarding behaviors—ranging from a simple label on the participant's planner that reminds them to "Stop and Think" to more elaborate prompts contained in a planner, schedule, or smart phone.

Reinforcers of problematic behaviors can also be identified and examined. What is the payoff when an individual gets angry about their memory problems? Does it simply feel good to discharge the frustration? Or does it also get them attention or sympathy from others or get them out of the difficult work of developing methods to compensate for these problems? As reinforcers of problematic behaviors are identified and reduced, more constructive behaviors and more positive naturally occurring reinforcers can be introduced. For instance, teaching a newer participant about using a daily planner effectively may be a more gratifying kind of attention than the kind of attention elicited through raging about having to use a daily planner.

Ultimately, the CBIR participant will become an active participant in identifying, analyzing and modifying the stimulus–response-reinforcer sequences that form the core of behavior management training. However, initially in cases in which self-management and self-awareness are more limited, the process may begin with therapists taking more responsibility for regulating stimulus–response-reinforcer dimensions and gradually transferring this control to the participant.

Vocational Interventions and Resource Facilitation

Treatment of the impairments and disabilities that occur after TBI set the stage for return to work. However, it is a mistake to assume that reduction in impairment and disability alone will assure a successful return to work. Return to work is a separate step in the process of CBIR that requires a specialized focus and intervention. Reviews of naturalistic and controlled studies [28, 29] reveal that without specialized vocational services, less than 30–40 % of individuals with moderate to severe TBI successfully return to work; whereas, with specialized vocational services, 60–70 % or more can maintain employment in the community [28, 30–32]. Supportive employment services (such as job coaching, job shadowing, work trials, environmental adaptations, employer and co-worker education and work peer support) are typically required in work reintegration after TBI. In most cases, these supportive services can be discontinued over the first year following initial vocational placement.

Buffington and colleagues [33] outline the fundamental features and key elements (see Table 4) of what they termed to be a "medical-vocational case coordination system." In many ways this is a "whatever it takes" model in which a designated service provider assists the individual with TBI and their close others to develop a network of medical, rehabilitation, and community-based supports and services that assist them in obtaining and maintaining employment. More recently this type of intervention has been termed "resource facilitation." Although the target of resource facilitation is often return to work, Trexler et al. [32] demonstrated in a randomized controlled trial that this model not only almost doubles return to work rates compared to controls but also improves community reintegration more generally.

For complex cases requiring CBIR, the process of vocational reintegration is typically and best begun while the individual is still actively receiving rehabilitation. This allows individuals to receive more focused therapy in areas that emerge as particularly critical to return to a specific job. Identification of how therapeutic activities and compensation techniques are important for return to a specific job also increases the relevance of these activities for participants and their motivation. The CBIR program provides a safety net for individuals during initial work trials. Because of ISA, many CBIR participants overestimate their work skills and fail to appreciate the way disabilities secondary to TBI will interfere with their return to work. In many cases, no amount of discussion, feedback, and simulation in a clinical setting will convince these individuals that they may be unable to successfully perform in a job that they held previously. In such cases, a work trial in which the individual has the opportunity to try themselves out in a job very similar to their previous or desired job is the only way to help them to improve their self-awareness.

The risk of such work trials is that the participant will be demoralized and even become

Table 4 Fundamental features and key elements of resource facilitation

Fundamental features		
• Resource facilitator to assist in developing:	• Early intervention	• Family/significant others, employer, and coworker education
– Self-directed plan	• Work/independent living trials	• Medical, rehabilitative, independent living, and vocational intervention
– Network of medical center and community services	• Temporary or long-term supports and coaching	
Key elements		
• Develop a comprehensive plan that addresses a range of issues:	• Focus early on community and vocational reintegration	• Provide reasonable accommodations before placement
– Sleep and nutrition	• Identify residual impairments that may interfere with vocational reintegration and refer for appropriate medical rehabilitation services	
– Fatigue and activity tolerance	• Integrate real-life goals with rehabilitation therapy goals	• Provide education to family/significant others, employers, coworkers, and community service providers
– Mood		
– Substance use	• Use real-life and on-the-job evaluations to gather the best information about a person's skills and need for further training	• Provide coaching and training for individual served to become their own advocate
– Cognitive limitations and compensation		
– Social-communication needs	• Provide appropriate support during evaluations	• Clearly identify a resource person to contact for questions and concerns
– Social and physical environment		
• Provide a smooth transition from medical to community-based services	• Provide continued training and support after placement including coaching and extended real-life trials	• Provide regular, frequent follow-up after placement
• Facilitate communication among family/significant others, community agency and volunteer services, and medical rehabilitation services to develop a team approach		

depressed by their failure to be successful on the work trial. However, if skillfully and supportively managed by the team, these experiences can be critical to developing more accurate self-awareness. The team's job is to help the participant see failure in a work trial as a learning experience rather than as a failure experience. The team helps the participant analyze what features of the job presented insurmountable obstacles and what features were within their competencies, and then steers further job search toward occupations in which the participant can use his or her strengths and minimize his or her weaknesses. In many cases, several brief work trials of 1–2 weeks are required in order to develop sufficient self-awareness and assist the participant to find a niche in the world of work where he or she can be successful.

Work and Independent Living Trials

Practice in real life situations is critical to successful outcomes for CBIR in most cases. These trials allow participants to assess their abilities in a concrete way. Because of cognitive impairments in abstraction and generalization, many CBIR participants are unable to recognize how their disabilities will interfere with community integration in a conceptual way. They have to experience the consequences of their disabilities in real world settings. As mentioned previously, these supported trials can be developed to assist participants to become more aware of their strengths and weaknesses in the world of work. Supported trials can also be developed to identify assets and limitations in independent living,

including use of transportation, shopping, and leisure time activities. No matter what the setting, the goal of these real life trials is to allow the participant to try themselves out and see for themselves whether they are up to the tasks required.

This is not, however, a matter of "throwing them in at the deep end and seeing if they can swim." To the contrary, real life trials are carefully orchestrated so that the participant indeed has to accomplish the tasks required in the setting with limited assistance but also has support from one or more members of the CBIR team to help them avoid any disastrous consequences. The CBIR team's role is also to help participants identify their successes and failures and use these observations to be more successful. A better appreciation of assets and limitations in various real life settings should also lead to (1) identification of required environmental adaptations, (2) more focused therapy in areas where this may be helpful to improve success, (3) identification of required social and community supports, and (4) development of more realistic goals.

Family/Close Others Involvement and Intervention

A supportive family or well-established social support network can be an unparalleled resource for the CBIR participant in approaching the goal of community reintegration. On the other hand, an unsupportive or dysfunctional family or support system can be an unparalleled liability. Some CBIR programs require involvement of a family member or close other. However, it is probably better advised to do an evaluation of the family prior to making a decision regarding their level of involvement. Sander et al. [34] reported that 25–33 % of families with a member who has a brain injury are experiencing significant dysfunction at the time of their injury, regardless of socioeconomic background. This finding indicates that not all the distress that families experience after TBI is in reaction to the injury. In a substantial minority of cases, family distress is also due to factors that predate the injury and may be longstanding. Such families may need more intensive intervention than the typical education and support that is provided to close others as part of rehabilitation. Families with longstanding and complex pathology will require intensive and specialized family intervention. If these very dysfunctional families are not receptive to intervention to address issues that will markedly interfere with the participant's rehabilitation, the best strategy may be to help the participant extract themselves from the dysfunctional family system and assume a more independent lifestyle.

In other cases, participants from very healthy families may be at an age (late adolescence/early adulthood) in which they were already moving toward a lifestyle that was more independent of their family of origin. These individuals were in a process of *separation and individuation* as they began to assume the role of an independent and self-sufficient adult. However, their injuries cast them back into a more dependent role in the family. In some cases, this more dependent role may be necessary and because of severe disabilities, the individual will always need to be dependent on someone else, like a family member. Parents of young adults with TBI may reassume the role of care-giving parent for a period of time. In these cases, stress will re-emerge as the parents age and enter a time of life where they are no longer able to care for their child because of their own health problems and associated disabilities. In such cases where long-term dependency and support is projected for the person with TBI, planning should begin early for transitioning care to someone else as the parents age.

In other cases, late adolescents and young adults may realistically choose to continue to pursue their quest for independent adulthood despite the disabilities that resulted from TBI, and may request that their families of origin not be involved in the rehabilitation process—even though their families may very much want to be involved. The wishes of the participant must be respected in such cases; however, counseling with the family and participant to make this process of separation and individuation a healthy and supportive one is recommended.

In cases in which a spouse needs to assume a caregiver role with a previously independent adult, the relationship may be severely strained. Counseling for the spouse may assist them in coping and with decision-making regarding whether they can realistically assume this role. In some cases, a mutually satisfying marital relationship can continue; however, in others, the best choice may be for the care-giving role to be transferred to someone else.

As can be seen from the preceding discussion, involvement of family and close others in CBIR can involve a complicated decision-making process, requiring consideration of multiple factors. Members of the CBIR team may disagree among themselves regarding the level of involvement that is appropriate in a given case. As in all aspects of CBIR care, the goal is for rehabilitation team members to come to consensus along with the participant and family/close other on this issue and to support each other in pursuing the agreed upon plan. More detailed information on the role of the family in rehabilitation can be found in the chapter by Sander in this volume.

Environmental Assists and Modifications

Adjustments to or enhancements of the physical and social environments in which the participant will live and work can include (1) external aids, (2) cues and prompts, (3) interpersonal supports, and (4) alterations that improve accessibility and engagement. These types of interventions are highly individualized and are limited only by the creativity of the therapist in identifying environmental modifications that are both acceptable and helpful to the participant. External aids, for instance, may include a notebook or day planner to assist memory or a smartphone or other electronic device to accomplish the same thing. Generally, electronic aids are most helpful to individuals who have used these devices prior to their injuries and are familiar with the procedures involved in their operation. To the contrary, participants who do not have previous experience with electronic aids are likely to find them frustrating.

At a less complex level, a system of prompts and cues to remind participants of routine activities, or even a more general reminder to "stop and think," will help participants stay on track as they move through their day. The rule of thumb in developing a system of cues and prompts is that "less is more." That is, a small number of carefully considered cues or prompts may be extremely helpful; whereas, a large number will be overwhelming. Other people (e.g., family members and close others, co-workers) can be enlisted to provide prompts, reminders, and coaching to the participant. In enlisting the support of other people, their roles should be clearly specified and they should be given the message that they can assist the participant but are not responsible for the participant. Being able to occasionally receive a reminder or a bit of coaching from a co-worker can be critical to a person with TBI's success in a job. However, if the person with TBI becomes very dependent on the co-worker, this will decrease the value of the person with TBI as an employee and run the risk of creating a sense of burden for the co-worker.

Common accessibility modifications (e.g., large print, ramps, ergonomic seating) that improve accessibility for individuals with physical limitations may also apply to individuals with TBI who not uncommonly have also experienced physical injury, disability, or chronic pain. Just as importantly, the environment should be carefully examined for features that may be distracting or create discomfort for the person with TBI, such as bright or distracting lighting, a high level of ambient noise, and unpredictable changes in the amount of movement and stimulation. Elimination or reduction of such environmental features can greatly enhance the person with TBI's ability to function in that environment.

Medication

Psychoactive mediations can be helpful to progress in CBIR. A thorough review of the application and effectiveness of such medications is beyond the scope of this chapter. The interested reader is referred to chapters by Meythaler [35] and Arciniegas [36, 37] in *Brain Injury Medicine*.

Briefly, stimulant medications increase alertness, attention, and speed of processing. These medications can be helpful in cases in which attention and arousal are reduced or unreliable, as well as with participants with reduced initiation. Modern antidepressants (selective serotonin reuptake inhibitors; SSRIs) can be effective in moderating depression as well as other types of emotional distress, i.e., anxiety, anger. Other medications that have been found helpful in reducing anger and aggressiveness are amantadine and carbamazepine (an anticonvulsant). Trazodone hydrochloride and zolpidem are frequently prescribed to restore a regular sleep cycle. Regular sleep with complete sleep cycles is important to optimal cognitive functioning. Medications to support memory performance may be trialed in individual cases but, in this author's experience, results have been disappointing in most cases. Most medications have not been carefully studied as specifically applied to participants with TBI, and consequently, clear guidelines for their use with this population are not available. For this reason, a physician who is experienced in managing medications for people with TBI should supervise the use of these medications.

In this author's opinion, medications such as these are best used to support a rehabilitation process rather than as circumscribed treatments. For instance, an SSRI may help a participant with TBI and depression to experience less emotional distress, sleep better, and find the energy to participate in rehabilitation and cognitive-behavioral psychotherapy. However, learning active coping skills and increasing their involvement with other people and in valued activities is critical for them to maintain emotional stability in the long run. Similarly, other types of medications may greatly assist participants to fully participate in a rehabilitation process but this is often only the first step toward helping them to learn ways to reduce or work around their disabilities in order to reengage with their communities.

Co-morbidities and Prevention

Substance abuse. Active substance abuse or dependence is a contraindication for CBIR since a substance abuse disorder creates a marked barrier to a participant's ability to participate in and benefit from a rehabilitation process. Alcohol is the most commonly abused substance in the United States. Participants who have a history of alcohol or other substance abuse may effectively participate in CBIR if they are simultaneously engaged in a substance abuse program to support their sobriety or have completed such a program and continue to maintain sobriety. Participants without a history of a substance abuse or dependence will benefit from education about the appropriate use of alcohol and other drugs including prescription medications as part of CBIR (see Corrigan [38] for more detailed information about methods for increasing awareness of and addressing substance abuse issues after TBI).

Mental health. Psychiatric illnesses, particularly depressive and anxiety disorders, are another relatively frequent co-morbidity for CBIR participants. These disorders may have been present prior to or develop after injury. Psychiatric medications are best managed in such cases by a neuropsychiatrist or other physician who is familiar in working with people with TBI. The development of psychological coping skills and supported reengagement in valued activities in the community are features of CBIR that will be of particular benefit to individuals with co-morbid mood disorders. All CBIR participants and involved family/close others will benefit from education about the signs of mental health problems and appropriate actions to be taken if these signs appear.

Wellness. CBIR participants may have a wide array of other co-morbid health conditions that are related or unrelated to their injuries. Common health risk factors in the general population, such as, hypertension and hypercholesterolemia, may be increased by physical inactivity and poor nutrition resulting from physical and cognitive impairments due to TBI. Masel and DeWitt [7] have described the management of TBI as a chronic illness including assisting the individual with TBI to develop a healthy lifestyle. Individuals with TBI frequently have increased difficulty communicating their health needs and concerns to healthcare

providers. CBIR programs include both (1) coaching participants about healthy lifestyles and communicating and addressing healthcare needs, and (2) assistance in developing a relationship with a primary healthcare team who can work effectively with the participant to manage their healthcare in the long term.

Monitoring/Measuring Outcomes

CBIR is a highly individualized process. While many components have a firm evidence base, developing the most effective array of these components for the individual participant remains as much an art as a science. For this reason, regular and consistent monitoring of individual participant progress as well as regularly evaluating the overall performance of the CBIR program for all participants is recommended. Such processes support the assessment of the effectiveness of the program for the individual participant and the program as a whole and lead to appropriate modifications to increase effectiveness. Two methods to assess participant progress and programmatic outcomes that have gained relatively broad endorsement are GAS and the Mayo-Portland Adaptability Inventory (MPAI-4).

GAS

GAS is a method that places individualized participant goals on a 5-point scale (see Table 5). By using the same scale for each goal and participant, progress can be compared across goals and participants, even though the goals themselves may be very different from each other. Using the 5-point GAS scale rather than a simple binary record of goal achievement, i.e., goal accomplished/not accomplished, allows participants to be recognized both for accomplishing a goal at a minimally acceptable level as well as "exceeding expectations."

Goal statements should be SMART, i.e., specific, measureable, attainable, realistic, and time-limited. Goals should also reflect achievements that are valued by the participant. The process of developing a set of GAS can itself be considered an intervention and, as such, dovetails nicely with GMT. The original GAS scaling ranged from −2 to +2 with zero indicating the expected level of outcome; however, many of our CBIR participants objected to the negative numbers so we rescaled using "positive" numbers as in Table 5. In scaling individual goals, we typically set "1" as the participant's level on admission to the program and "2" as the minimally acceptable level of achievement on the goal. The number of goals scaled should be relatively small. Using GAS to scale 3–5 goals per participant is recommended. Many other smaller step goals that contribute to achievement of the GAS goals will also need to be identified and monitored. These step goals are simply monitored as achieved or not achieved. Review of GAS and step goals weekly or every other week gives the participant, family/close

Table 5 GAS levels and examples

4 Much better than expected outcome
3 Better than expected outcome
2 Expected outcome
1 Less than expected outcome
0 Much less than expected outcome
GAS goal: participant routinely uses problem-solving and goal management strategies to solve problems in everyday life
4 Participant learns and uses problem-solving and goal management strategies in addressing life problems almost all the time independently
3 Participant learns and uses problem-solving and goal management strategies in addressing life problems about 75 % of the time independently
2 Participant learns and uses problem-solving and goal management strategies in addressing life problems 75 % of the time with prompting
1 Participant has not learned and does not use problem-solving and goal management strategies
0 Participant refuses to engage in systematic problem-solving
GAS Goal: Participant is in part-time paid employment with support
4 Participant works full-time for pay independently without support
3 Participant works part-time for pay independently without support
2 Participant works part-time for pay with intermittent support from work peers and vocational counselor
1 Participant is unemployed but interested in employment
0 Participant is unemployed and not interested in employment

other, and rehabilitation team a clear indication of where progress is being made in the primary targets for rehabilitation and where adjustments in the treatment program are needed to improve the rate of progress. Greater detail about GAS and its application is available elsewhere [39].

MPAI-4

The MPAI-4 is a rating scale, developed using classical and modern psychometric techniques, that includes the most common areas of disability and limitation that can occur after TBI. It is composed of three subscales measuring Ability, Adjustment and Participation (see Table 6). Its well-established psychometric measurement properties have supported its increasing use to evaluate post-hospital brain injury rehabilitation programs. The MPAI-4, a manual for its use, and foreign language translations are available for free download on the web site of the Center for Outcome Measurement in Brain Injury (COMBI; http://www.tbims.org/combi/mpai). Additional information about the psychometric development and properties of the MPAI-4 is available in the manual and other sources [40–42].

The MPAI-4 is not intended to be a comprehensive list of all possible sequelae of brain injury, since such a list would be so extensive that it would make the inventory impractical for clinical use. Rather, the MPAI-4 focuses on common sequelae that indicate the range of severity of disability after brain injury. The MPAI-4 is best completed by consensus of an evaluating rehabilitation team and provides a method for the team to come to agreement about the participant's profile of disabilities and limitations as they design the rehabilitation treatment plan. A recent article by Lexell et al. [43] shows how the MPAI-4 links to the International Classification of Functioning (ICF). The ICF provides lists of more specific abilities and activities that may become goals for rehabilitation after the general areas for intervention are identified using the MPAI-4. Program staff complete the MPAI-4 again when the participant is discharged. Some programs with more extended lengths of stay may have staff complete the inventory midway through the treatment process. The Participation Index provides a brief assessment of the primary goal of CBIR—community reintegration—that can be completed over the telephone [44]. The Participation Index is used by many programs for follow-up at 3, 6, and/or 12 months to assess the resilience of their outcomes. Examples of the use of the MPAI-4 for evaluations of various types of post-hospital programs can be found elsewhere [11, 12].

Table 6 Mayo-Portland adaptability index (MPAI-4) items and subscales

Ability index	Adjustment index	Participation index
Mobility	Anxiety	*Initiation*
Use of hands	Depression	*Social contact*
Audition	Irritability, anger, aggression	*Leisure activities*
Vision	Pain/headache	Self-care
Motor speech	Fatigue	Residence
Dizziness	Sensitivity to mild symptoms	Transportation
Verbal communication	Inappropriate social interaction	Employment
Nonverbal communication	Impaired self-awareness	Managing money
Memory	Family/significant relationships	
Attention/concentration	*Initiation*	
Fund of information	*Social contact*	
Novel problem-solving	*Leisure activities*	
Visuospatial abilities		

Italicized items contribute to both adjustment and participation indices

Case Example

A thorough presentation of the complexities and intricacies of a CBIR team working with an individual participant would require another full chapter, at a minimum. However, the case description in Table 7 and the treatment plan outline in Table 8 may give a flavor for how goals are prioritized in an interdisciplinary CBIR team evaluation and how individual and group interventions are designated to achieve these goals. Review of Table 8 will also reveal interventions targeted at developing or improving family, social, and environmental systems in addition to those offered directly to the participant. For some goals, the importance of practice and reinforcement throughout the program in the therapeutic milieu is highlighted, and, for other goals, this is extended to homework and practice outside the program.

The problem list in Table 8 is referenced to the MPAI-4 and the current status and goal level for each problem is designated using levels of the MPAI-4. In addition, four of the problem areas (novel problem-solving, social interaction, irritability, and employment) are designated for development of more specific GAS. Two of these GAS are used as examples in Table 5. These are areas that are believed to be of critical importance to the overall success of the program and for which the largest change is required. Development of these GAS in collaboration with the participant may take several weeks and, in the case example, will be an important intervention in and of itself to help develop the participant's self-awareness. In achieving all goals, numerous short-term step goals will be set on a daily and weekly basis.

Table 7 CBIR team evaluation summary

Shareen C. is a 29-year-old African-American woman who was injured in a motor vehicle accident approximately 3½ years ago. She was driving alone driving at the time of the accident when an approaching driver apparently lost control of his vehicle and hit Shareen head on. The other driver died in the crash. The patient was apparently in excellent health that time of the injury and has no prior history of significant medical conditions at the time of the accident and no a history of psychiatric or substance abuse disorders. Her brain injury was severe. Her initial Glasgow Coma Scale was 6. Posttraumatic amnesia of approximately 2 months was reported. Initial CT scan revealed contusions and small hematomas in the frontal lobes bilaterally; these did not require surgical intervention. MRI 2 years after her injury showed bilateral encephalomalacia in the frontal lobes and temporal poles bilaterally. In addition to her brain injury, the patient fractured her left lower extremity in the accident
She has history of a single seizure in the emergency room after her injury with no subsequent seizure history. She is on Tegretol for irritability and aggression; however her mother feels this has been minimally effective
The patient is a college-educated woman who was working as a communications specialist for a multinational corporation. She has never married. Her mother accompanied her to the evaluation and is her primary caregiver. Shareen's mother divorced her father when Shareen was 5 years old. Shareen has had no contact with her father since that time
An interdisciplinary rehabilitation evaluation reveals a number of sequelae to the patient's brain injury. Mild difficulty in ambulation is apparent associated with persistent left footdrop. However, this is remediated for most functional purposes with the use of a brace. This right-handed woman has mild fine motor impairment bilaterally which interferes with functional activities less than 25 % of the time. Motor speech is impaired. The patient is difficult to understand a minority of the time. However, language abilities are generally intact although the patient has occasional word finding problems. Nonverbal and pragmatic communication difficulties are apparent most of the time in everyday communication. The patient is hyperverbose, frequently interrupts others, and appears insensitive to the normal give-and-take of conversation. Attention and concentration are severely impaired on neuropsychometric testing and distractibility and inattention are also apparent in conversation and other everyday activities per the patient's mother. The patient's mother reports that she is no longer able to multitask. The patient also demonstrates severe new learning ability on neuropsychometric testing and her mother reports that she has difficulty retaining new information most of the time. Her general intelligence is in the lower end of the average range but appears to have declined given her educational and vocational history. Her general fund of information may be intact; however, her ability to access this information is not reliable. The patient demonstrates very significant impairment in abstract reasoning and problem-solving on neuropsychometric testing. Difficulty in managing new situations and problem-solving in everyday life is confirmed by the patient's mother. Although she has mild difficulty on complex visual spatial tasks, probably reflecting higher-order cognitive impairments noted previously, basic visual and visual perceptual abilities appear intact

Table 7 (continued)

There is no evidence of significant anxiety and depression; however, the patient's mother reports that she is frequently irritable and verbally aggressive when confronted with her disabilities. The patient has some awareness of the sequelae of her brain injury but does not appear to appreciate the way these disabilities may interfere in everyday life. For instance, she appears unaware of how her cognitive impairments interfere with return to work. She's convinced that she could return to work immediately. Social-communication impairments are also associated with inappropriate and disinhibited interpersonal behavior a majority of the time. Consequently, most of the patient's social interactions are problematic and other people appear to find many of her communications and manner mildly offensive. Although her mother remains very supportive, changes in the patient's interpersonal style are difficult for the mother to understand and are creating at least mild stress within their relationship. The mother describes her daughter as formerly a very goal-oriented and self-assured young woman who now appears to have "gone wild".
Difficulties in social interactions, disinhibition and cognitive difficulties have had a detrimental effect on the patient's social network. The friends she had prior to her accident currently have very limited contact with her. She had a close male friend prior to her injury; however, this relationship dissolved over the years subsequent to her injury. Her leisure interests and activities are virtually nonexistent. The patient is able to manage basic self-cares (feeding, grooming, toileting) with only an occasional prompt. However, she requires assistance in many more complex activities of daily living. She currently resides with her mother who takes primary responsibility for most cooking and other household chores. Shareen is unable to drive and cannot use public transportation without assistance; for instance, her mother is required to accompany her to doctors' appointments. The patient is currently unemployed. She is able to manage small financial transactions, such as, shopping for a few items. Her mother is her legal guardian and takes responsibility for managing the savings and investments that Shareen has from before her accident and for the settlement she received from the accident

Table 8 Treatment plan outline for Shareen C

Problem	Current status	Intervention	Goal level
Impaired ambulation	Mild problem but does *not* interfere with activities; uses assistive device	None	No further improvement expected
Impaired use of hands	Mild problem; interferes with activities 5–24 % of the time	None	No further improvement expected
Impaired motor speech	Mild problem; interferes with activities 5–24 % of the time	Individual speech therapy	Mild problem but does *not* interfere with activities
Impaired word finding	Mild problem but does *not* interfere with activities	None	No further improvement expected
Impaired novel problem-solving	Severe problem; interferes with activities more than 75 % of the time	Training in systematic problem-solving[a]	Mild problem; interferes with activities 5–24 % of the time
		Goal management training[a]	Develop GAS
		Engagement in GAS development process	
Impaired attention	Moderate problem; interferes with activities 25–75 % of the time	Attention process training[a, b]	Mild problem; interferes with activities 5–24 % of the time
Impaired memory	Moderate problem; interferes with activities 25–75 % of the time	Memory notebook development and training[a, b]	Mild problem; interferes with activities 5–24 % of the time
Impaired nonverbal and pragmatic communication skills	Moderate problem; interferes with activities 25–75 % of the time	Social-communication group[a]	Mild problem; interferes with activities 5–24 % of the time
Inappropriate social interaction	Moderate problem; interferes with activities 25–75 % of the time	Social communication group[a]	Mild problem but does *not* interfere with activities
			Develop GAS

(continued)

Table 8 (continued)

Problem	Current status	Intervention	Goal level
Irritability	Moderate problem; interferes with activities 25–75 % of the time	Neuropsychiatric evaluation for pharmacologic treatment	Mild problem but does *not* interfere with activities
		Group and individual anger management training[a]	Develop GAS
Needs occasional prompts from mother to complete self-cares	Mild problem but does *not* interfere with activities; dependent on mother for prompting	Individual OT to develop self-cuing system[b]	Mild problem but does *not* interfere with activities; independent with cuing system
Impaired self-awareness	Moderate problem; interferes with activities 25–75 % of the time	Patient/family education	Mild problem; interferes with activities 5–24 % of the time
		Self-awareness intervention[a]	
		Work trials	
Unable to live independently	Requires moderate assistance or supervision from others (25–75 % of the time)	Address cognitive, emotional, and social issues and transition to group home situation	Requires a little assistance or supervision from others (5–24 % of the time)
Unable to travel around town independently	Requires moderate assistance or supervision from others (25–75 % of the time); cannot drive	Training in limited use of public transportation	Requires a little assistance or supervision from others (5–24 % of the time); cannot drive
Limited social contact	No or rare involvement with others (less than 25 % of normal interaction for age)	Address emotional and social problems that are obstacles to new relationships	Mildly limited involvement with others (75–95 % of normal interaction for age)
		Social communication group[b]	Develop GAS
Limited leisure/ recreational activities	No or rare participation (less than 25 % of normal participation for age)	Leisure skills group[b]	Mildly limited participation (75–95 % of normal participation for age)
Unemployment	Unemployed	Individual vocational counseling	Full-time or part-time employment with support
		Resource facilitation	Develop GAS
		Work trials	
Unable to manage money independently	Requires a little help or supervision (5–24 % of the time) with large finances; independent with small purchases	Counseling with mother and daughter to develop long term plan for financial management support	No change in patient status expected
			Goal is to develop more viable, long term, external support system for participant in managing her financial affairs
Strained relationship with mother	Mild stress that interferes with family functioning 5–24 % of the time	Counseling/behavioral rehearsal with mother and daughter	Normal stress within family
		Training mother to prompt/ reinforce daughter's anger management and improved social interaction[b]	
		Transition to group home	

[a]Practice/reinforcement in other groups and therapeutic milieu
[b]Homework/practice outside of program with review in program

Progress toward goals will be evaluated formally at conferences that include the participant and her mother every other week and more frequently in team briefing/debriefing sessions. Goals and the treatment plan will be further modified and refined through these ongoing evaluations.

Conclusion

As can be seen from the methods and processes described in this chapter and in the brief case report, CBIR is a complex, multimodal, transdisciplinary intervention that addresses sequelae of TBI holistically and comprehensively. Not only are interventions implemented to reduce the impairments of the individual with TBI but also to modify family, social, and environmental systems in order to facilitate the participant's reentry into community life. Most of the individual interventions are supported by scientific study; however, the combination of these interventions is highly individualized depending on the needs and goals of the participant. Transdisciplinary teamwork and the development of the therapeutic alliance that are so critical to the success of CBIR are difficult to prescribe in detail or manualize. Consequently, CBIR is as much art as science and may remain so into the indefinite future.

Acknowledgement Preparation of this chapter was partially supported by the U.S. Department of Education National Institute on Disability and Rehabilitation Research (NIDRR) grant H133A120035.

References

1. Ben-Yishay, Y., & Diller, L. (1993). Cognitive remediation in traumatic brain injury: Update and issues. *Archives of Physical Medicine and Rehabilitation, 74*(2), 204–213.
2. Ben-Yishay, Y., & Prigatano, G. P. (1990). Cognitive remediation. In M. Rosenthal, E. R. Griffith, M. R. Bond, & J. D. Miller (Eds.), *Rehabilitation of the adult and child with traumatic brain injury* (pp. 393–400). Philadelphia: Davis.
3. Prigatano, G. P., Fordyce, D. J., Zeiner, H. K., Roueche, J. R., Pepping, M., & Wood, B. C. (1986). *Neuropsychological rehabilitation after brain injury*. Baltimore, MD: Johns Hopkins University.
4. Trexler, L. E., Diller, L., Gleuckauf, R., Anreiter, B., Ben-Yishay, Y. et al. (1994). *Consensus conference on the development of a multi-center study on the efficacy of neuropsychological rehabilitation*. June 1994, Zionsville, IN.
5. Ben-Yishay, Y., & Diller, L. (2011). *Handbook of holistic neuropsychological rehabilitation outpatient rehabilitation of traumatic brain injury*. New York: Oxford.
6. Malec, J. F., & Degiorgio, L. (2002). Characteristics of successful and unsuccessful completers of three postacute brain injury rehabilitation pathways. *Archives of Physical Medicine and Rehabilitation, 83*(12), 1759–1764.
7. Masel, B. E., & DeWitt, D. S. (2010). Traumatic brain injury: A disease process, not an event. *Journal of Neurotrauma, 27*(8), 1529–1540.
8. Bush, B. A., Novack, T. A., Malec, J. F., Stringer, A. Y., Millis, S., & Madan, A. (2003). Validation of a model for evaluating outcome after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 84*(12), 1803–1807.
9. Malec, J. F. (2001). Impact of comprehensive day treatment on societal participation for persons with acquired brain injury. *Archives of Physical Medicine and Rehabilitation, 82*, 885–894.
10. Novack, T. A., Bush, B. A., Meythaler, J. M., & Canupp, K. (2001). Outcome following traumatic brain injury: Contributions from premorbid, injury severity, and recovery variables. *Archives of Physical Medicine and Rehabilitation, 82*, 300–305.
11. Altman, I. M., Swick, S., Parrot, D., & Malec, J. F. (2010). Effectiveness of community-based rehabilitation after traumatic brain injury for 489 program completers compared with those precipitously discharged. *Archives of Physical Medicine and Rehabilitation, 91*, 1697–1704.
12. Eicher, V., Murphy, M. P., Murphy, T. F., & Malec, J. F. (2012). Progress assessed with the Mayo-Portland Adaptability Inventory through the OutcomeInfo system for 604 participants in four types of post-inpatient rehabilitation brain injury programs. *Archives of Physical Medicine and Rehabilitation, 93*, 100–107.
13. Raemer, D. B. (2009). Team-oriented medical simulation. In W. F. Dunn (Ed.), *Simulators in critical care and beyond*. Mt. Prospect, IL: Society for Critical Care Medicine.
14. Cailhol, L., Rodgers, R., Burnand, Y., Brunet, A., Damsa, C., & Andreoli, A. (2009). Therapeutic alliance in short-term supportive and psychodynamic psychotherapies: A necessary but not sufficient condition for outcome? *Psychiatry Research, 170*(2–3), 229–233.
15. Hewitt, J., Coffey, M., Hewitt, J., & Coffey, M. (2005). Therapeutic working relationships with people with schizophrenia: Literature review. *Journal of Advanced Nursing, 52*(5), 561–570.
16. Davis, L. C., Sander, A. M., Struchen, M. A., Sherer, M., Nakase-Richardson, R., & Malec, J. F. (2009).

Medical and psychosocial predictors of caregiver distress and perceived burden following traumatic brain injury. *The Journal of Head Trauma Rehabilitation, 24*(3), 145–154.
17. Evans, C. C., Sherer, M., Nakase-Richardson, R., Mani, T., & Irby, J. W. (2008). Evaluation of an interdisciplinary team intervention to improve therapeutic alliance in post-acute brain injury rehabilitation. *The Journal of Head Trauma Rehabilitation, 23*(5), 329–338.
18. Klonoff, P. S., Lamb, D. G., & Henderson, S. W. (2001). Outcomes from milieu-based neurorehabilitation at up to 11 years post-discharge. *Brain Injury, 15*(5), 413–428.
19. Cicerone, K. D., Dahlberg, C., Kalmar, K., Langenbahn, D. M., Malec, J. F., Bergquist, T. F., et al. (2000). Evidence-based cognitive rehabilitation: Recommendations for clinical practice. *Arch Phys Med Rehabil, 81*(12), 1596–1615.
20. Cicerone KD, Dahlberg C, Malec JF, Langenbahn DM, Felicetti T, Kneipp S, Ellmo W, Kalmar K, Giacino JT, Harley JP, Laatsch L, Morse PA, Catanese J (2005). Evidence based cognitive rehabilitation: updated review of the literature from 1998 through 2002. *Arch Phys Med Rehabil 86*, 1681–92.
21. Cicerone, K. D., Langenbahn, D. M., Braden, C., Malec, J. F., Kalmar, K., Fraas, M., et al. (2011). Evidence-based cognitive rehabilitation: Updated review of the literature from 2003 through 2008. *Archives of Physical Medicine and Rehabilitation, 92*, 519–530.
22. Haskins, E. C., Shapiro-Rosenbaum, A., Dams-Oconnor, K., et al. (2011). *Cognitive rehabilitation manual: Translating evidence-based recommendations into practice*. Reston, VA: American Congress of Rehabilitation Medicine.
23. Sohlberg, M. M., & Mateer, C. A. (1987). Effectiveness of an attention-training program. *Journal of Clinical and Experimental Neuropsychology, 9*, 117–130.
24. Sohlberg, M. M., & Mateer, C. A. (2001). *Cognitive rehabilitation: An integrative neuropsychological approach*. New York: Guilford.
25. Levine, B., Robertson, I. H., Clare, L., Carter, G., Hong, J., Wilson, B. A., et al. (2000). Rehabilitation of executive functioning: An experimental-clinical validation of goal management training. *Journal of the International Neuropsychological Society, 6*(3), 299–312.
26. Dahlberg, C. A., Cusick, C. P., Hawley, L. A., Newman, J. K., Morey, C. E., Harrison-Felix, C. L., et al. (2007). Treatment efficacy of social communication skills training after traumatic brain injury: A randomized treatment and deferred treatment controlled trial. *Archives of Physical Medicine and Rehabilitation, 88*(12), 1561–1573.
27. Cattelani, R., Zettin, M., & Zoccolotti, P. (2010). Rehabilitation treatments for adults with behavioral and psychosocial disorders following acquired brain injury: A systematic review. *Neuropsychology Review, 20*(1), 52–85.
28. Malec, J. F. (2005). Vocational rehabilitation. In W. M. High, A. M. Sander, M. A. Struchen, & K. A. Hart (Eds.), *Rehabilitation for traumatic brain injury*. New York: Oxford.
29. Van Velzen, J. M., Van Bennekom, C. A. M., Edelaar, M. J. A., Slutter, J. K., & Frings-Dresen, M. H. (2009). How many people return to work after acquired brain injury?: A systematic review. *Brain Injury, 23*, 473–488.
30. Malec, J. F., Buffington, A. L. H., Moessner, A. M., & Degiorgio, L. (2000). A medical/vocational case coordination system for persons with brain injury: An evaluation of employment outcomes. *Archives of Physical Medicine and Rehabilitation, 81*, 1007–1015.
31. Malec, J. F., & Moessner, A. M. (2006). Replicated positive results for the VCC model of vocational intervention after ABI within the social model of disability. *Brain Injury, 20*(3), 227–236.
32. Trexler, L. E., Trexler, L. C., Malec, J. F., Klyce, D., & Parrott, D. (2010). Prospective randomized controlled trial of resource facilitation on community participation and vocational outcome following brain injury. *The Journal of Head Trauma Rehabilitation, 25*(6), 440–446.
33. Buffington, A. (1997). The vocational rehabilitation continuum: Maximizing outcomes through bridging the gap from hospital to community-based services. *The Journal of Head Trauma Rehabilitation, 12*(5), 1–13.
34. Sander, A. M., Sherer, M., Malec, J. F., High, W. M., Thompson, R. N., Moessner, A. M., et al. (2003). Preinjury emotional and family functioning in caregivers of persons with traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 84*(2), 197–203.
35. Meythaler, J. (2012). Neuropharmacology. In N. D. Zasler, D. I. Katz, & R. D. Zafonte (Eds.), *Brain injury medicine* (2nd ed.). New York: Demos.
36. Arciniegas, D. (2012). Pharmacotherapy of cognitive impairment. In N. D. Zasler, D. I. Katz, & R. D. Zafonte (Eds.), *Brain injury medicine* (2nd ed.). New York: Demos.
37. Arciniegas, D. (2012). Pharmacotherapy of neuropsychiatric disturbance. In N. D. Zasler, D. I. Katz, & R. D. Zafonte (Eds.), *Brain injury medicine* (2nd ed.). New York: Demos.
38. Corrigan, J. (2012). Substance abuse. In N. D. Zasler, D. I. Katz, & R. D. Zafonte (Eds.), *Brain injury medicine* (2nd ed.). New York: Demos.
39. Malec, J. F. (1999). Goal attainment scaling in rehabilitation. *Neuropsychological Rehabilitation, 9*(3/4), 253–275.
40. Kean, J., Malec, J. F., Altman, I. M., & Swick, S. (2011). Rasch measurement analysis of the Mayo-Portland Adaptability Inventory (MPAI-4) in a community-based rehabilitation sample. *Journal of Neurotrauma, 28*, 745–753.
41. Malec, J. F., Kragness, M., Evans, R. W., Finlay, K. L., Kent, A., & Lezak, M. (2003). Further psychometric evaluation and revision of the Mayo-Portland Adaptability Inventory in a national sample. *The Journal of Head Trauma Rehabilitation, 18*(6), 479–492.

42. Malec, J. F., & Lezak, M. D. *Manual for the Mayo-Portland adaptability inventory* (2nd ed.). http://www.tbims.org/combi/mpai. Accessed March 24, 2014.
43. Lexell, J., Malec, J. F., & Jacobsson, L. L. (2012). Mapping the Mayo-Portland adaptability inventory to the international classification of functioning, disability, and health. *Journal of Rehabilitation Medicine, 44*, 65–72.
44. Malec, J. F. (2004). The Mayo-Portland Participation Index (M2PI): A brief and psychometrically-sound measure of brain injury outcome. *Archives of Physical Medicine and Rehabilitation, 85*, 1989–1996.
45. Malec, J. F., & Basford, J. S. (1996). Postacute brain injury rehabilitation. *Archives of Physical Medicine and Rehabilitation, 77*(2), 198–207.