CHAPTER 3

Neuropsychological Assessment for Treatment Planning and Research

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Neuropsychological evaluation has a relatively brief but impressive history as a diagnostic method to assess for the presence of brain dysfunction, as well as to assist in describing the nature of that dysfunction. Over the last 30 years, neuropsychological evaluations have played an increasingly important role with a variety of patient populations. These evaluations, for example, are still the principal means of diagnosing dementia, particularly in the early stages (McKhan et al., 1984). They are also a valuable and, in some cases, necessary means for diagnosing and describing the various cognitive and academic problems associated with developmental disorders such as learning disabilities (Rourke, 1989).

Neuropsychological evaluations have traditionally used a psychometric approach and determined the presence of brain impairment on the basis of deviation from the expected performance with reference to appropriate normative data. The determination of brain impairment is based on deviation of patients' performance on standardized psychometric tests from the expected level of performance for their particular demographic group. Clinical research in this area developed along these lines, with an emphasis on improving the normative base of psychometric testing. More recently, this has included developing a common normative base for various age and education cohorts (e.g., Halstead–Reitan Battery, Wechsler Adult Intelligence Scale—III (WAIS-

III), Wechsler MEMORY Scale—III (WMS-III), Mayo Older Adult Normative Studies). The nature of possible brain dysfunction (e.g., cortical vs. subcortical dementia) can be further used to determine the underlying nature of the pathology. All of this work has helped to improve the efficacy of neuropsychological evaluations in determining the presence of brain dysfunction.

A NEW VENUE

With the rise of postacute brain injury rehabilitation in the 1970s and 1980s, a new venue was created for neuropsychologists to apply their testing acumen. In this setting, neuropsychological evaluations were used for different purposes. They were now required to determine an individual's pattern and level of *disability*, and not simply to comment upon *impairment* resulting from the brain damage. The emphasis of the evaluation in these settings was to identify realistic treatment goals and assess patients' capacity to benefit from treatment (Lezak, 1987). In order to accomplish this task, it was necessary to shift away from strictly diagnostically oriented neuropsychological assessment toward a more functional approach.

In our experience, it is very common for neuropsychologists to confuse level of *impairment* with level of *disability*. The International Classification of Impairments, Disabilities and Handicaps (ICIDH; World Health Organization, 1987) provides definitions of "impairment," "disability," and "handicap." The most recent edition (ICIDH-2) has exchanged the terms "activity" for "disability" and "participation" for "handicap" (World Health Organization, 1997):

- *Impairment* is an abnormality in a physical or mental function.
- *Disability/activity* is a limitation in performance of an activity because of impairment.
- *Handicap/participation* is a loss of social-role function because of a disability.

In postacute brain injury rehabilitation settings, neuropsychologists are asked to describe the effects of brain injury in terms of disability and handicap rather than impaired mental function alone. In these settings—which provide services primarily to persons with well-documented, moderate to severe brain injury—the diagnosis and neurological parameters of the injury itself have typically already been identified by other means (such as neuroimaging studies) and by other measures of injury severity (such as length of coma, length of posttraumatic amnesia, Glas-

gow Coma Scale score). In the postacute setting, using impaired test performance to characterize brain dysfunction adds information about the nature and severity of the injury but contributes little to the diagnostic evaluation.

The level of impairment in mental functions caused by brain injury is not the focus of treatment and intervention in these settings. Instead, the level of disability associated with brain injury is the focus of treatment. For example, a neuropsychological evaluation may identify memory impairment due to brain injury. Memory impairment itself may or may not justify further intervention. Some individuals accommodate to and learn to compensate for mild memory dysfunction easily, without professional assistance. The need for professional intervention depends on whether this impairment results in a change in valued activities in day-to-day life for individuals, in other words, whether or not their brain injury is associated with disability. The nature of that change (or disability) also determines the nature of those interventions.

SCOPE OF TESTING

Tests were developed based upon their ability to detect brain dysfunction within certain parameters. Neuropsychological evaluation conducted for the purpose of determining brain impairment typically includes assessment of several categories of mental functions. Generally accepted major categories of mental functions to be assessed are listed in Table 3.1 (Lezak, 1995).

In North America, neuropsychology has traditionally focused on psychometric testing used for diagnostic purposes. The emphasis has been on developing tests that can be demonstrated both to detect brain dysfunction (sensitivity) and describe the nature and scope of that dysfunction (specificity). Specificity has most often been assessed in terms of specific neurological diagnoses. However, patterns of cognitive impairment (e.g., learning disabilities) have also served as the basis for evaluating the specificity of

TABLE 3.1. Major Categories of Mental Function Included in Neuropsychological Evaluations (Lezak, 1995)

1. Orientation and attention	5. Construction
2. Perception	6. Concept formation and reasoning
3. Memory	7. Executive functions
4. Verbal and language functions	8. Motor/sensory abilities

psychometric tests and test batteries. This approach, however, does not necessarily capture factors that have the most significant relationship to level of disability. The assessment of brain dysfunction depends on a test's ability to assess the integrity of brain structures. In contrast, assessment of disability focuses on the impact of a particular mental dysfunction on an individual's ability to perform an activity.

Self-awareness is an example of a mental function that typically is not included in diagnostic models of neuropsychological assessment. Since impaired self-awareness has recently been found to be present in approximately 25% of a normal adult population (Kruger & Dunning, 1999), the presence of impaired self-awareness following brain injury may not by itself be a valid indication of acquired brain dysfunction. Impaired self-awareness, however, is believed to result from brain injury (McGlynn & Schachter, 1989). Moreover, impaired self-awareness has been shown to be a major factor in determining the extent to which patients benefit from therapy (Prigatano & Fordyce, 1986) and a significant predictor of functional outcomes such as level of employment (Sherer et al., 1998).

Crosson and colleagues (1989) argued that clinical interventions in the postacute phase of brain injury rehabilitation are likely to be ineffective unless the level of self-awareness is accurately assessed. Specifically, level of self-awareness determines directly the degree to which patients are able to generalize gains made in treatment to other settings, and in so doing enables the therapist to determine the nature of interventions necessary to assist patients in achieving their highest level of functioning.

Sherer, Oden, Bergoff, Levin, and High (1998) describe several methods for assessing self-awareness, including (1) direct clinician ratings, (2) differences between patient and family ratings of abilities, (3) differences between patient and clinician ratings of abilities, and (4) differences between patient self-ratings and objective test performance. In instances in which differences between patient and staff or family ratings are to be used, scales have been developed that allow the clinician to assess accurately what constitutes a significant difference in ratings between patients and others (e.g., Malec, Machulda, & Moessner, 1997; Sherer et al., 1999).

Without attention to self-awareness, interventions may still result in improvements within the confines of the treatment setting and appear to be useful to the patient. Such improvements, however, will quite likely be ineffective in generalizing to behavior change that helps survivors of brain injury function better in day-to-day life (Gordon, 1987). Thus, while a neuropsychological assessment that does not assess self-awareness may be useful in detecting brain dysfunction and the pattern of cognitive

dysfunction, it will be incomplete in assessing for level of disability and need for intervention following brain injury.

Although an appraisal of self-awareness may be critical to rehabilitation and intervention planning, differentiating between pre- and postmorbid disability is not necessary. In some situations, distinguishing the kind and level of disability that has resulted from a brain injury or illness is important, for instance, in legal consultations or consultations related to disability determination. However, in many cases, distinctions between pre- and postinjury cognitive, personality, emotional, and social functioning cannot be made confidently. In such cases, interventions based on an assessment of the patient's current psychological strengths and liabilities can proceed with a possibility of success. In still other cases, appraisal of preinjury functioning becomes confounded by impaired self-awareness. In these cases, when a patient's inaccurate attributions of the cause of his or her deficits interfere with treatment, identifying and clarifying the source of neuropsychological impairment with the patient may become critical for successful intervention. Some examples of such cases include patients who resist using compensation techniques for brain-injury-related memory problems because they inaccurately believe that their "memory has never been very good," or those who excuse preinjury, long-standing, maladaptive interpersonal behavior on the basis of their brain injury.

NEW SCOPE AND FOCUS

Evaluation of mood state, personality, motivation, and other psychological factors is often viewed as not essential to address many of the referrals for assessment of brain function. When assessed, these factors are often measured for the purpose of determining the degree to which they interfere with the validity of the evaluation. However, a lack of attention to other psychological factors in the neuropsychological evaluation may result in an inadequate assessment of disability. An approach that focuses solely on assessment of various cognitive domains has been criticized as leading to a lack of environmental validity and to difficulty in generalizing the results of testing to "real-world" situations (Sbordone, 1997). For example, significant behavioral disturbance often results from orbitofrontal injury and has a profound impact on an individual's ability to function independently in society. While this alteration in behavior is typically quite obvious in an unstructured and unsupervised environment, it is often underestimated in neuropsychological testing alone. This not only can lead to incorrectly describing the patient as hav-

ing a lesser degree of brain impairment than is actually the case (false negative), but it also underestimates the level of disability following brain injury, leading to many unexpected problems in community, family, and vocational reintegration.

Similarly, neuropsychological assessment of someone who is highly anxious or has questionable motivation will likely not provide a valid measure of brain dysfunction. Since there is nothing neurologically wrong with this individual, a diagnostic neuropsychologist may feel limited to confirming the absence of brain dysfunction for the patient. At the extreme, using neuropsychological evaluations solely to determine the presence of brain dysfunction, while neglecting to address other psychological and emotional issues that are identified during the course of testing, has been described as unethical behavior (Binder & Thompson, 1995). For the neuropsychologist working in postacute brain injury rehabilitation settings, a comprehensive assessment of cognitive, emotional, personality, and interpersonal factors is an essential part of effective treatment planning.

Brain injury survivors may experience severe levels of anxiety and depression due to difficulties in coping with the often devastating effects of their injuries and illnesses. There is general consensus that in addition to the benefits of interventions targeting cognitive and behavioral impairments, supportive counseling and psychotherapy are very useful to assist patients and their families in improving mood, coping, and adjusting to significant changes in life circumstances (National Institutes of Health Consensus Development Panel, 1999). A neuropsychological evaluation can assist in assessment of these many factors and determine whether such interventions may be of benefit to the patient.

The malingering patient is not an appropriate candidate for neuropsychological treatment—and typically is not interested in such intervention. Perhaps because we work in a rehabilitative setting in which most patients are applying for treatment, our patients whose neuropsychological disability cannot be clearly attributed to brain dysfunction are rarely simple malingerers. It would be a gross oversimplification to define "malingering" as neuropsychological disability in the absence of a clear indication of neurocognitive impairment. Such disability most often results from a complex interaction of emotional, psychological, personality, and interpersonal factors, and—very possibly—higher order and executive cognitive functions that are not sensitively assessed by currently available psychometric procedures.

It is not surprising that models of functioning in individuals following brain injury, proposed by neuropsychologists working from a viewpoint of disability, are highly complex and include multiple, interacting

variables to explain behavior following brain injury (Kay, Newman, Cavallo, Ezrachi, & Resnick, 1992; Ruff, Camenzuli, & Mueller, 1996). These models include not only cognitive status but also a variety of personality, emotional, and environmental factors. Together, these factors account for the wide variability in long-term patient outcome that is otherwise confusing when viewed simply in terms of whether brain dysfunction is present.

A neuropsychological evaluation is uniquely able to assess a wide variety of mental and psychological functions in medical and rehabilitative settings. Moreover, with their background in research design, methodology, and behavioral theory, neuropsychologists are uniquely positioned to conceptualize the multiple factors that interact to affect outcome in these cases (Johnston, Keith, & Hinderer, 1992). This is true whether or not the level of functioning the individual displays can be directly related to brain dysfunction.

Multiple factors beyond what can directly be attributed to brain dysfunction may affect test performance. The factors to be assessed, however, need to go beyond the categories of mental status typically included in the neuropsychological evaluations described earlier. Members of a consensus conference on neuropsychological rehabilitation discussed several topics related to these concerns, including use of neuropsychological evaluations to predict functional outcome such as employment (Bergquist et al., 1994). Unlike developers of the template for neuropsychological evaluations that focused on assessment of impairment (as shown in Table 3.1), this group attempted to develop a template that captures the information needed from a neuropsychological evaluation for assessment of level of functioning (Table 3.2).

The complete assessment of the impact of these factors on mental function cannot be limited

TABLE 3.2. Major Areas to Be Assessed in a Neuropsychological Assessment When Planning for Intervention. (Bergquist et al., 1994)

1. Self-awareness of strengths and deficits
2. Compensation for cognitive, physical, and emotional deficits
3. Self-esteem and self-confidence
4. Extent of agreement between skill levels and personal/vocational goals
5. Constructive vocational and personal relationships
6. The need for environmental accommodations to achieve an effective match with the patient's specific cognitive, physical, and psychosocial needs

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to neurocognitive testing. By changing the focus and the scope of how neuropsychological evaluations have traditionally been conducted, this evaluation can uniquely capture important information related to the effects of brain injury on day-to-day functioning and, in so doing, more completely describe the level of disability following brain injury.

Self-Awareness

We have already described methods to assess self-awareness. Assessment of most other areas described in Table 3.2 uses methods that require either observing the individual directly in real-life or simulated real-life environments, or obtaining such observational information from family, friends, or others who have the opportunity to observe the patient's functioning in real-life environments.

Disability

Several functional scales have been developed that measure disability due to a medical condition or illness. Hall (1992) provides a review of scales commonly used in inpatient settings to measure disability due to brain injury. However, these scales focus on more basic activities and physical status, and often do not capture the nature of disability present in ambulatory brain injured populations in the postacute phase.

Crewe and Dijkers (1995) review a variety of scales used with disabled populations, including several suited to outpatient settings that assess functional changes due to brain injury. Of these, the Mayo–Portland Adaptability Inventory (MPAI; Malec et al., 1997), the Craig Handicap Assessment and Reporting Technique (CHART; Whiteneck, Charlifue, Gerhart, Overholser, & Richardson, 1992), and the Community Integration Questionnaire (CIQ; Willer, Rosenthal, Kreutzer, Gordon, & Rempel, 1993) seem to capture many of the activity and participation changes often present in individuals with brain injury in the postacute phase of recovery. These scales have demonstrated reliability and validity. The Web site of the Center for Outcome Measurement of Brain Injury (COMBI; *www.tbims.org/combi*) provides extensive information about psychometric and other properties of these and other scales that are useful in brain injury rehabilitation. Unfortunately, these scales are not familiar to most neuropsychologists and are most often used in rehabilitation settings as part of an overall team assessment. As we argue later, a team approach provides the best means of assessment in patients with this injury.

Compensation

Evaluating compensation for cognitive, physical, and emotional deficits, of course, requires identification of such deficits through neuropsychological, psychological, rehabilitation, or other types of formal assessments. However, evaluation in this functional domain also requires identifying methods that persons use to manage such impairments. Such compensation techniques for cognitive deficits may include calendars, notebooks, and personal digital assistants, as well as systems of prompts and cues that depend on other people. Emotional coping techniques may include both overlearned, internalized coping responses and systems such as "time out" that require assistance from other people. Physical compensation methods include orthoses, prostheses, and modifications of the physical environment.

Self-Esteem and Self-Confidence

These characteristics are best assessed as part of comprehensive clinical interview and observation of the patient. Limited self-awareness and defenses may interfere with accurate self-reporting of negative self-statements that nonetheless obviously interfere in actual behavioral performance settings. Congruence between goals and abilities, probably also best assessed behaviorally, is an aspect of self-awareness that goes beyond a verbal reporting of strengths and weaknesses to include the capacity to use information about strengths and weaknesses in selecting activities and making plans. Crosson and colleagues (1989) describe this as the *anticipatory* level of self-awareness.

Relationships and Environmental Accommodations

The last two items in Table 3.2 describe assessment at the level of handicap (participation). Relationships in home, community, and vocational settings can have dramatic effects on either minimizing or maximizing the translation of disability into handicap. Assessing environmental accommodations refers to the previously mentioned systems of prompts, cues, coaching, support, and physical modifications that increase the patient's ability to participate in home and community settings. Particularly in the area of handicap, it is difficult to obtain a complete and accurate assessment on the basis of a single interview or evaluation, even if information from multiple informants is obtained. Ongoing interaction, observation, and reporting that involve the patient, significant others, and involved professionals are usually required to develop an

understanding of relationships and environmental factors that either reduce or enhance community participation.

ISSUES OF TRAINING

We have previously discussed the limitations in training of psychologists, including neuropsychologists, at both the doctoral and postdoctoral levels, to conduct interventions such as cognitive rehabilitation (Bergquist & Malec, 1997). Similarly, traditional training of neuropsychologists has not necessarily conferred either the skills or practical experience to conduct neuropsychological assessments in such a manner that they can be used to develop an appropriate treatment plan.

The recent Houston Conference on Specialty Education and Training in Clinical Neuropsychology arrived at a consensus on what training is necessary for the practice of clinical neuropsychology (Houston Conference, 1998). Tables 3.3 and 3.4 outline the knowledge base and skills, respectively, necessary for proficiency in this field. It is encouraging that skills related to treatment and intervention, as well as general knowledge of intervention techniques, are included in this document.

As formulated, however, these guidelines do not ensure that training includes developing competence in issues related to disability. As we have argued, a broader understanding of disability that includes not only impaired mental status but also other psychological and environmental factors is necessary in order to assess accurately the impact of brain injury on day-to-day functioning. In fact, there is little in the professional literature that describes specific procedures for disability assessment in neuropsychology or how to use neuropsychological assessments appropriately to design treatment programs to intervene with disability. Training in increasingly sophisticated methods of testing and measurement of impairments following brain injury is not a substitute for developing an understanding of issues related to adaptive functioning and disability following brain injury.

It appears to be a common aspiration of contemporary students in neuropsychology at the present time to identify new testing procedures with sufficient ecological validity to predict disability and handicap accurately. However, this assessment paradigm (i.e., laboratory testing) may simply be the wrong methodology for estimating disability and handicap. Other approaches to assessment may be more productive. Such assessment methodologies would focus on evaluation of the individuals undertaking activities in which they may experience disability as well as the introduction of methods or assistance that might be expected to minimize disability. A similar approach to the assessment of handicap

TABLE 3.3. Knowledge Base in Clinical Neuropsychology (Houston Conference, 1998)

A. Generic psychology core
1. Statistics and methodology
2. Learning, cognition, and perception
3. Social psychology and personality
4. Biological basis of behavior
5. Lifespan development
6. Cultural and individual differences and diversity

B. Generic clinical core
1. Psychopathology
2. Psychometric theory
3. Interview and assessment techniques
4. Intervention techniques
5. Professional ethics

C. Foundations for the study of brain–behavior relationships
1. Functional neuroanatomy
2. Neurological and relative disorders, including their ideology, pathology, course, and treatment
3. Non-neurological conditions affecting central nervous system functioning
4. Neuroimaging and other neurodiagnostic techniques
5. Neurochemistry of behavior (e.g., psychopharmacology)
6. Neuropsychology of behavior

D. Foundations for the practice of clinical neuropsychology
1. Specialized neuropsychological assessment techniques
2. Specialized neuropsychological intervention techniques
3. Research design and analysis in neuropsychology
4. Professional issues and ethics in neuropsychology
5. Practical implications of neuropsychological conditions

would be to evaluate the individual environments that both limit participation and maximize participation. Like classic behavioral assessment, these assessment methodologies for neuropsychology intertwine evaluation and treatment (Malec & Lemsky, 1995). As disabilities and handicaps are better identified, interventions can be implemented that test the validity of the assessment and whether the interventions diminish the identified disabilities and handicaps.

Many training programs continue to focus on developing skills in assessment of brain dysfunction. This is not surprising in a field whose origins and primary focus have been on assessment of brain–behavior relationships and detection of brain impairment. At the current state-of-the-art, training in disability issues probably needs to occur experientially rather than didactically. It is not possible, for instance, to provide a well-defined methodology or rulebook for such assessments. Potentially constructive approaches, based on principles described here, can be de-

TABLE 3.4. Skills in Clinical Neuropsychology (Houston Conference, 1998)

A.	Assessment
	1. Information gathering
	2. History taking
	3. Selection of tests and measures
	4. Administration of tests and measures
	5. Interpretations and diagnosis
	6. Treatment planning
	7. Report writing
	8. Provision of feedback
	9. Recognition of multicultural issues
B.	Treatment and interventions
	1. Identification of intervention targets
	2. Specification of intervention needs
	3. Formulation of an intervention plan
	4. Implementation of the plan
	5. Monitoring and adjustment to the plan as needed
	6. Assessment of the outcome
	7. Recognition of multicultural issues
C.	Consultation
	1. Effective basic communication
	2. Determination and clarification of referral sources
	3. Education of referral sources regarding Neuro Life Neuropsychological Services
	4. Communication of evaluation results and recommendation
	5. Education of patients and families regarding services and disorders
D.	Research
	1. Selection of appropriate research topics
	2. Review of relevant literature
	3. Design of research
	4. Execution of research
	5. Monitoring of progress
	6. Evaluation of outcome
	7. Communication of results
E.	Teaching and supervision
	1. Methods of effective teaching
	2. Plan and design of courses and curricula
	3. Use of effective educational technologies
	4. Use of effective supervision methodologies

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om greater experience in settings that conduct assessment and treatment to address disability following brain injury. As an example from another area of clinical practice, numerous psychologists are well skilled in assessment of personality and emotional function. Expertise in assessment without practical experience in conducting psychotherapy does not en-

sure that the practitioner will be an effective therapist. As mentioned previously, classic behavioral assessment may serve as a model for neuropsychological assessment in which both evaluation and therapy complement each other for the benefit of the patient.

Two case examples illustrate how knowledge, of testing procedures and clinical techniques alone are insufficient to ensure that a clinician is properly trained to conduct work in this area. These cases also illustrate the importance of behavioral observation and analysis in a disability assessment.

CASE 1

Joe, a 50-year-old male, underwent surgical resection of a right frontal area arterial venous malformation after developing seizures. The surgery was successful but involved resection of significant portions of frontal cortex. Joe underwent a course of inpatient rehabilitation followed by outpatient therapy for several weeks. Despite this therapy, he continued to have a variety of neurocognitive impairments, including impaired memory, poor attention span, and executive dysfunction, that affected his ability to function independently and return to his position in the health care field as an occupational therapist. Because of these continuing problems, he was referred to a specialized brain injury rehabilitation program and underwent a comprehensive team evaluation. The team recommended that Joe be enrolled in a postacute outpatient rehabilitation program, focusing on long-term goals of independent living, and return to work.

Joe started the rehabilitation program about 12 months after his initial neurosurgery. He was very compliant and cooperative in the program and, to the best of his ability, completed everything asked of him. He did not question the assessment of therapists in the program that he indeed had problems with memory and other cognitive functions, and that the various compensatory techniques he developed were helping him to function more independently. At the same time, it became increasingly clear that Joe was a very passive individual who avoided conflict at all costs and was hesitant to offer his opinion if it was in disagreement with others. Nonetheless, he was making progress, reflected in his reliably implementing compensation strategies and applying them in real-life settings.

After 6 months, Joe graduated from the treatment program and continued to receive intermittent follow-up. At that time, he discontinued using his compensation techniques, and his level of functioning quickly decreased. When he was seen for follow-up, Joe indicated that while he was receiving daily treatment in the program, his principal reason for working hard and being so compliant was to please the therapists he worked with and avoid any conflict.

At the same time, Joe had never felt that he was as impaired as others had indicated. As a result, Joe did not believe he needed the various compensatory strategies he had been using. When away from the day-to-day structure of the treatment program, he no longer kept up with the routines he had developed and did not consistently apply the various compensatory strategies he had used effectively in the program.

This case illustrates how a patient's dependence on interpersonal cueing and reinforcement was a critical element in the maintenance of compensation techniques. It is unclear in this case to what degree Joe's dependent style predated or was created, or enhanced his brain injury. For treatment planning, determining the source of this habitual behavior was not nearly as consequential as the identification of this important source of motivation for the patient. His exquisite compliance during treatment might have been a clue to the team that approval from others was an important reinforcer for his behavior that should have been included in the long-term plan for maintenance of behaviors learned in the program. Without the benefit of hindsight, the patient's dependence was not identified until follow-up. It became clear that Joe needed environmental interventions and a clear support system to provide sufficient interpersonal cueing and support to use reliably techniques that he developed in the program to compensate for cognitive problems.

CASE 2

Sally is a 28-year-old female who suffered a severe traumatic brain injury, followed by a 2-week coma and a prolonged, acute hospital and rehabilitation stay. She eventually gained independence in activities of daily living. She was married at the time of her injury, and her husband was very supportive during her recovery. Their marriage remained relatively stable. Prior to her injury, she had been a nursing supervisor with a very good work history in an ICU in a major medical center. About 2 years after her injury, Sally and her husband had a child, for whose care she was primarily responsible during the daytime. Her husband helped with caring for their child on evenings and weekends. From reports of her family, she was a highly responsible and caring parent to her child. She had returned to school to take graduate-level classes in nursing. She had taken a total of three courses, one at a time, and received A's in all three. She desired to return to work as a nursing supervisor and was referred for a neuropsychological evaluation by the state vocational rehabilitation counselor who had been working with her for some time to help determine whether the vocational plan was appropriate.

The results of a neuropsychological evaluation identified average to high-average intelligence, good language skills, and low-aver-

age visuospatial and executive functions. Her attention span and speed of mentation were mildly impaired. While her complex attention was mildly impaired, her memory retention was impaired more severely. Based upon comparison of ratings of her level of functioning, made independently by Sally and her husband, she seemed to have an accurate appraisal of her own level of functioning and areas of impairment.

Based upon the results of testing alone, it seemed that Sally would likely have difficulty living independently, let alone caring for a toddler and doing well in graduate-level course work. Extensive discussions with her husband and the vocational counselor revealed that Sally had always been a very organized and driven individual, and that these basic character traits remained largely unchanged following her injury. By using a variety of compensatory techniques that she had developed through a course of outpatient therapy, Sally was able to function effectively well beyond what would be expected from her level of cognitive function alone.

These two case studies illustrate that while knowledge of testing procedures and clinical techniques is important to performing a useful assessment, this alone would not allow the clinician working on these two cases to make accurate predictions regarding individual levels of performance. Behavioral analysis of habitual traits that may or may not have been affected by brain injury assisted in developing a more accurate appreciation of these patients' strengths and disabilities.

The experience of following a patient about whom one has made specific predictions regarding long-term functioning and likely response to treatment can be quite humbling. It is this kind of experience, however, that produces an appreciation of the limitations of using test scores alone to predict functional outcome and of information that may be helpful in making such predictions more accurately. Observing how an assessed individual responds to various modes of treatment and actually functions over time in important daily activities is the most important teaching tool we know to gain competence in this area.

NEUROPSYCHOLOGICAL EVALUATION AS PART OF A TEAM EVALUATION

If conducted appropriately, a neuropsychological evaluation provides a wide range of valuable information that can contribute to developing and implementing a treatment plan. A neuropsychological evaluation by itself, however, does not typically assess a patient's performance of specific, valued activities. For example, while impaired performance in one or more mental functions may affect a patient's ability to manage his or

her checkbook, performing this activity is typically not assessed directly in such an evaluation. Moreover, in most rehabilitation settings, a neuropsychologist is not the most qualified professional to perform such an assessment.

Occupational therapists or other rehabilitation specialists who work in brain injury rehabilitation settings routinely assess such activities. Their training and expertise provide a framework to analyze various salient components of tasks. In order to develop an appropriate treatment plan for an individual who is experiencing difficulty with checkbook management following brain injury, for instance, there needs to be an understanding of both the difficulties with performing this activity and the impairments in mental status that contribute to this problem.

Impairments in one or more mental functions, including, for example, attention/concentration, visual scanning, arithmetic skills, memory, and reading, may result in problems with checkbook management. Impaired self-awareness determines the degree to which patients will independently generalize to everyday life what they have gained from the treatment setting. Determining whether inability to perform checkbook management is due to poor computational skill or poor scanning will lead to different approaches to intervention and result in the development of different compensatory skills. Describing the nature of a brain injury survivor's difficulties with managing a checkbook, along with detailing his or her neurocognitive, emotional, and motivational function, will provide the most comprehensive assessment of the problem and likely lead to the most effective treatment.

Working together, the neuropsychologist and other rehabilitation therapists can provide a more comprehensive assessment of problem areas. In our experience, an interdisciplinary team approach to rehabilitation of individuals disabled following brain injury results in the most effective rehabilitation plan and treatment (Malec, Schafer, & Jacket, 1992). This team approach is more than simply having several different rehabilitation professionals work on the individual problem areas in which each has the greatest expertise. Instead, this approach involves using a team of individuals working in concert toward achieving one or more of the patient's functional goals (e.g., returning to work), with the ultimate purpose of helping him or her achieve the highest level of functioning.

To be effective and complete, evaluation for possible treatment following brain injury needs to be done by a treatment team, with all parties working with the survivor of brain injury and the survivor him- or herself working as well. This task may seem daunting, but published general guidelines have outlined the areas that need to be assessed for such an evaluation to be complete. The Brain Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Med-

TABLE 3.5. Six Area Traumatic Brain Injury Assessment System (6A-TBIAS; American Congress of Rehabilitation Medicine, 1998; Revised 2001)

Area I: Etiology/pathology

A. Severity, specified by one or more of the following:
   1. Alteration or loss of consciousness
   2. Posttraumatic amnesia
   3. Glasgow Coma Scale
   4. Presence of injury-related intracranial abnormalities on neurodiagnostic studies
   5. Acute complications affecting cerebral functioning (e.g., hypotension, hypoxemia)

B. Chronicity (i.e., time since injury)

C. Treatment history/access to treatment

Area II: Preinjury status (Cushman & Sherer, 1995; Wade, 1992)

A. Preinjury medical diagnoses, including prior brain injury(ies), psychiatric disorders, substance abuse disorders, or developmental disorders (e.g., ADHD)

B. Functional status (e.g., mobility, activities of daily living)

C. Living independence (i.e., level of supervision or support)

D. Years of education

E. Employment status
   1. Professional/technical versus skilled versus semi- or unskilled
   2. Duration of episodes of unemployment

F. History of criminal convictions

G. History of physical or sexual abuse/trauma

H. Personality/coping style

I. Family roles

J. Social support system
   1. Extent
   2. Satisfaction
   3. Social roles

K. Gender

L. Age at injury

Area III: Injury/illness-related medical conditions

A. Systems
   1. Neurological, including autonomic
   2. Musculoskeletal
   3. Immunological
   4. Endocrinological
   5. Cardiovascular
   6. Other (e.g., vestibular)

B. Medication effects, therapeutic versus undesired side effects

C. Other conditions
   1. Sleep disorders
   2. Pain disorders
   3. Sexual dysfunction
   4. Psychiatric, including psychogenic conditions, malingering

(*continued*)

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TABLE 3.5. (*continued*)

Area IV: Impairments

(any loss or abnormality of psychological, physiological, or anatomical structure or function [World Health Organization, 1987]) secondary to I, II, and III

A. Sensory–perceptual
B. Motor
C. Emotional
D. Behavioral
E. Cognitive, including language
F. Other somatic (as defined by *Guides to the Evaluation of Permanent Impairment)*

Area V: Disability

(any restriction or lack, resulting from an impairment, of ability to perform an activity in the manner or within the range considered normal for a human being [World Health Organization, 1987; Cushman & Sherer, 1995; Wade, 1992]) as assessed by:

A. Patient
B. Family/significant others
C. Professionals

Area VI: Handicap

(a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal, depending on age, sex, and social and cultural factors, for that individual [World Health Organization, 1987; Cushman & Sherer, 1995; Wade, 1992])

A. Indicators
   1. Living independence
   2. Vocational activity
   3. Avocational activity
   4. Psychosocial adjustment
   5. Quality of life
B. Influences
   1. Physical, environmental
   2. Social, attitudinal
   3. Financial
   4. Legal
   5. Social support
   6. Stress

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BIAS), which includes the major areas that need attention when conducting a comprehensive assessment (Table 3.5). Although 6A-TBIAS was developed specifically for the assessment of persons with traumatic brain injury, it can be applied with minimal modification to other types of acquired brain injury.

Note that even a thorough neuropsychological evaluation will not

assess all six areas. Furthermore, a more traditional evaluation focused on assessment of brain dysfunction will cover only one of these six areas (Impairment). A larger, integrated team assessment, in contrast, can provide a more complete assessment of major aspects of all six areas related to functioning after brain injury. In this manner, a treatment plan with realistic and attainable treatment goals can be created that ultimately leads to the highest level of functioning for the survivor of brain injury.

SUMMARY

Neuropsychological evaluation is a tool with a long history of both diagnosing brain injury and describing the nature of brain dysfunction. With the rise of new forms of rehabilitation, there is the promise that the increasing number of individuals who survive severe brain injury will also be able to function at increasingly higher levels, as measured by independent living and returning to work. By documenting complex changes in brain function, neuropsychological evaluations are a very valuable tool in determining both the effects of brain injury and the needs of individuals following brain injury, and in contributing to the formulation of a comprehensive treatment plan. To accomplish this effectively, neuropsychological services need to expand beyond the impairment model of assessment to a model that also assesses level of disability. This will mean a broader conceptual and clinical view, both in the focus of the evaluation and the scope of the tests and other evaluation procedures employed by neuropsychologists. By using models of assessment that incorporate this broader focus, and by providing students as well as clinicians with appropriate training in these new models, clinical neuropsychology can make this shift. In so doing, it is more likely that our profession will best meet the needs of our patients and allow them to benefit from treatment and maximize their level of functioning and independence.

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