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Fundamentals of Neuropsychological Evaluation for the Life Care Planner and Case Manager

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Abstract. *For life care planners and case managers working with clients with brain injury, a neuropsychological evaluation can be an invaluable tool in assessing sequelae of the brain injury as well as the long-term impact of the brain injury on the client's functional status. This article provides an introduction to neuropsychological evaluation, including what tests commonly are included in an evaluation, when an evaluation is best administered, how to identify a competent neuropsychologist, and how certain factors can affect the accuracy and validity of the test results.*

Introduction

Life care planners (LCP) and case managers (CM) commonly are asked to estimate the long-term care needs of patients with catastrophic injuries and diseases such as acquired brain injury, spinal cord injury, cerebral infarct, aneurysm, and other central nervous system (CNS) compromising conditions. Whether the neurologic compromise exists as a primary diagnosis or as a co-morbid condition with other catastrophic diagnoses, it is essential that the LCP and CM understand the sequelae of the brain impairment and the long-term impact those sequelae will have on the patient's functional status. To that end, a neuropsychological evaluation is commonly requested and the LCP and CM enter into a collaboration with the neuropsychologist. The purpose of this collaboration is to delineate the nature and extent of the cognitive and behavioral impairment due to the neurologic compromise so as to ascertain the impact these impairments will have on the patient's daily functioning on a short and long-term basis. For this collaboration to be optimally effective, the LCP and CM must be a good consumer of the product that the neuropsychologist produces; hence this article is designed to provide the LCP and CM with the fundamentals of neuropsychological evaluation. Specifically, the objectives of this article are to help the LCP and CM:

- understand what a neuropsychological evaluation is;
- understand what tests are included in a neuropsychological examination;
- understand when it is best to administer a neuropsychological evaluation in terms of timing and under what testing circumstances should the test be administered;
- understand the standard training and credentials that a competent neuropsychologist should have; and

- understand how certain factors can affect the accuracy and validity of the test results so that the test results can be interpreted with the appropriate levels of caution.

This article is designed to be a practical introduction to neuropsychological evaluation. For a more comprehensive treatise on the topic, the reader is directed to a seminal text by Muriel Lezak, entitled *Neuropsychological Assessment*, Third Edition (Lezak, M., 1995). There are also other scholarly and useful works on this topic by Spreen and Strauss (1998), Snyder and Nussbaum (1998), Andrews (2001), Rains (2002) as well as Heilman and Valenstein's (2003) classic work on clinical neuropsychology which is now in its fourth edition.

What is a Neuropsychological Evaluation and What Does it Encompass?

A neuropsychological evaluation is an assessment of the relationship between brain functioning and behavior; that is, it is an attempt to assess how the individual's brain is affecting their behavior The evaluation provides a comprehensive description of cognition (i.e., general intelligence, attention, concentration, speech production, language comprehension, memory, concept-formation, judgment, problem-solving, planning and organizational skills, and abstract reasoning), perceptual and motor skills, academic skills, mood, behavior, and personality. Each of these functional domains has a different set of tasks that must be thoroughly assessed using a set of standardized tests and procedures that one can systematically employ. However, the acuity and severity of the patient's injuries will determine the extent to which any or all of the standardized tests can be administered. For example, a patient who is barely out of coma and lying in a bed cannot be administered tests in the same fashion as someone six months post injury who is sitting in a neuropsychologist's office. The evaluation is not physically invasive, and there should be no significant discomfort other than the frustration occasionally encountered from an inability to perform one or more tasks. The evaluation generally takes six to eight hours of one-on-one contact, but that can vary depending upon the degree of the patient's impairment and the level of fatigue being experienced. The testing may occur all in one day, or it may be spread over a longer period depending upon patient tolerance or the availability of the neuropsychologist. In general, a patient should be scheduled so as to obtain a comprehensive picture of their functional status with minimal contamination from fatigue and exhaustion.

Report Content and Test Selection

The reporting style and the tests selected for neuropsychological evaluations are not all the same. The fact is that there are as many styles of reports as there are people writing them, and the degree of confidence one can have in the report varies with the competency of the professional preparing it. Although there are exceptions which will be discussed later in this article, in general, a neuropsychological evaluation should use standardized tests for assessment; that is, tests that have been statistically normed across specific populations and have high degrees of reliability and validity. Most of the individual tests used by neuropsychologists have undergone extensive psychometric review of their validity and reliability (Mitrushina, Boone, & D'Elia, 1999). Additionally, however, neuropsychologists may use a more comprehensive set of tests that measure a broad spectrum of cognitive, behavioral and motor-sensory functions, called "neuropsychological batteries." These

batteries are complex sets of tests that are integrated into, and standardized as, a unit. Oftentimes, specific norms are developed as well for the entire battery of tests. They commonly provide standardized scores for each functional domain (e.g. attention, memory, speech, motor functioning, etc.) as well as a more global impairment rating. There are also neuropsychological tests that are standardized as individual subtests, and these are administered and scored individually.

Selected comprehensive neuropsychological test batteries:

Among the various batteries currently being published, the authors suggest that perhaps the most widely known are the Halstead-Reitan Neuropsychological Battery (HRNB), the Luria Nebraska Neuropsychological Battery (LNNB), the Repeatable Battery for Assessment of Neuropsychological Status (RBANS), the Kaplan Baycrest Neurocognitive Assessment (KBNA), and the newly published Neuropsychological Assessment Battery (NAB). Of these comprehensive batteries, the HRNB, the NAB, the RBANS, and the KBNA have reasonably current and comprehensive norms (Heaton, Miller, Taylor, & Grant, 2004; Stern & White, 2003; Randolph, 1998; Leach, Kaplan, Rewilak, Richards, & Proulx, 2000), while the LNNB's norms are predominantly from 1984. There are also computer administered batteries (the Cambridge Neuropsychological Test Automated Battery, Cogtest, MicroCog version 2.4, The Colorado Neuropsychological Battery, etc.) as well as shortened batteries that are used as screening tools to determine whether a more comprehensive evaluation is needed (for example, Cognistat: The Neurobehavioral Cognitive Status Examination). The computer-based tests have the advantage of having a relatively brief administration and scoring time compared to the other batteries and, as a result, are frequently used in outpatient clinic and office settings. Whether computer administration also results in a loss of relevant qualitative clinical information due to a reduction of interpersonal interchange between the patient and the neuropsychologist is open to question. As with all tests and batteries, if the conclusions from the computerized neuropsychological testing are based solely on the results from test scores, it is recommended that the reader review the data on the test's normative samples (commonly listed in the battery's manual) in order to ensure that the patient's diagnosis is adequately represented (for example, a patient with a primary diagnosis of traumatic brain injury/TBI probably should not have his or her scores compared to scores from patients with Alzheimer's disease).

Use of discrete neuropsychological tests:

Tests of Motor Speed:

These tests (The Finger Tapping Test and Grooved Pegboard Test from the HRNB and the Finger Touch items from the LNNB) measure both fine motor dexterity and motor speed.

Arousal and Attention:

Arousal, attention, and concentration are fundamental cognitive processes upon which all higher level functional systems rely, and assessment of their status is critical for an accurate understanding of cognitive functioning. For example, if someone appears awake and responsive but cannot attend to a visual constructional task for more than a fraction of a

second, it is highly unlikely that person will perform well on that task, even though the patient's visual-constructional skills are intact. Measures of attention and concentration that are commonly used are Digit Span forward and backward, letter and digit cancellation tasks (e.g., the Visual Search and Attention Test; the Ruff 2 & 7 Selective Attention Test), Trail Making Test Part A, and The Paced Auditory Serial Addition Test. There are also several computer-based continuous performance tests used to assess sustained attention; for example, the Conners Continuous Performance Test-II (CPT-II), the Integrated Visual and Auditory continuous performance test (IVA), and the Test of Variables of Attention (TOVA). In addition to determining whether an attention problem is present, these tests can also provide more detailed scores of Omission Errors, Average Reaction Time, Perceptual Sensitivity (d'), Commission Errors, Overall Average Reaction Time, and the Standard Error of Reaction Time for Hits that allow the neuropsychologist to understand how the patient is attempting to compensate for an attention problem.

Assessment of memory functioning is necessarily multifaceted as memory is not a singular concept. Neuropsychological test reports may contain any of a number of terms to describe aspects of memory functioning, including immediate memory, procedural memory, episodic memory, working memory, serial memory, semantic memory, logical memory, verbal memory, spatial memory, visual memory, short term memory, long term memory, or remote memory. Tests frequently administered to asses the most salient aspects of memory functioning are the Wechsler Memory Scale III (WMS-III), the California Verbal Learning Test-II (CVLT-II), The Rey Auditory Verbal Learning Test (RAVLT), the Rey Complex Figure Test and Recognition Trial (RCFT), and the Memory Assessment Scale (MAS). The WMS-III and MAS both provide measures of semantic and visual memory, but the WMS-III has the more recent norms. Of those tests used to assess episodic memory (learning lists of names, items, tasks, etc.), the RAVLT and the CVLT-II both provide multiple standard scores for the various aspects of episodic memory. However, the CVLT-II has more recent and more comprehensive norms and it also provides a measure of malingering, a central issue in neuropsychological testing that will be discussed later.

Tests of VisualSpatial Skills:

Visual-spatial skills refer to the ability to analyze and interpret 2 and 3 dimensional visual and tactile cues and to generate 2 and 3 dimensional shapes. These skills are predominantly controlled by the right hemisphere. Input from visual and tactile cues allow us to perceive our physical environment and to identify where we are in relationship to it. This complex set of skills also allows us to construct shapes and forms such as maps, art, sculpture, structures, etc. When an individual's visual-spatial skills are impaired, they may find themselves unable to find their way in a well-known environment; to read a map; to follow a flow chart; to organize their desk or closet; or to construct a simple box. A comprehensive assessment of visual-spatial skills should include both 2 and 3 dimensional tasks as well as a measure of immediate and delayed recall. One of the most widely used tests of visual-spatial functioning is The Rey Complex Figure Test (RCFT). This test has both a spatial, constructional component as well as measures of immediate and delayed recall. The Memory Assessment Scale (MAS) and Wechsler Memory Scale-III (WMS-III) also assess visual memory and simple visual constructional abilities, but the complexity of the stimuli would appear to be somewhat less challenging, especially for a premorbidly bright individual. In addition, the norms for the MAS are not as current as the WMS-III or the RCFT. The Tactual Performance Test (TPT), a

subtest of the HRNB, assesses spatial skills in the absence of visual cues. A commonly used subtest from the WAIS-III, Block Design, examines the ability to create 2 dimensional shapes using 3 dimensional blocks. The Visual scale from the LNNB assesses visual-spatial skills by gradually increasing task complexity; that is, from reading and drawing clock faces to imagining or conceptually rotating 2 and 3 dimensional shapes. And the Benton series of visual-spatial tests examines an individual's skills across tests by increasing the task complexity and cognitive demands; for example, analyzing lines and angles (Judgment of Line Orientation Test), followed by comparing more complex forms and shapes (Visual Form Discrimination Test), and finally analyzing and identifying human faces (Facial Recognition Test). These are only a selected few of the many tests used to assess visual-spatial skills in a neuropsychological evaluation, and all major neuropsychological batteries have subtests to assess these skills. As mentioned previously, it is recommended that all selected tests have updated norms and standardized scores.

Tests of Executive Functioning:

The concept "Executive Function" refers to a set of skills that includes the ability for organization, planning, problem-solving, judgment, concept formation, abstract reasoning, inhibition, cognitive flexibility, set shifting, category generation, etc. These are the higher level skills which, in conjunction with memory and attention, allow us to perform the complex tasks of daily living, from planning a meal for the family to completing a graduate degree. They are associated with functioning of the bilateral frontal lobes, especially the orbital frontal cortex, and every neuropsychological evaluation should include some measure of these complex skills. Individual tests commonly used to assess one or more of these functions include: The Wisconsin Card Sorting Test (WCST) and the Category Test from the HRNB for concept formation and cognitive flexibility; the Stroop Color-Word Test (cognitive flexibility and inhibition), Trail Making Test, Part B (set shifting; i.e., the ability to shift back and forth between stimuli); the Similarities, Comprehension, and Matrix Reasoning subtests from the WAIS-III (verbal and non-verbal abstract reasoning and judgment); and Verbal Fluency and Figural Fluency tests (initiation, planning, set shifting, and divergent thinking). The recently published Delis and Kaplan Executive Functioning System is a well-normed set of tasks designed to comprehensively assess the various components of executive functioning and may be used in lieu of one or more of the individual executive function tests.

Tests of Intelligence:

These are measures of global intellectual ability comprised of subtests that assess separate cognitive skills as well as larger verbal and non-verbal domains. The standard intelligence test for adults in use today is the Wechsler Adult Intelligence Scale- III (WAIS-III). It is normed for ages 16 through 80 and consists of 14 subtests, 4 index scores, and 3 IQ scores. The Stanford-Binet intelligence Scales (SB5), currently in its 5th edition, assesses five factors—Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual-Spatial Processing, and Working Memory, and, like the WAIS-III, allows the evaluator to compare verbal and nonverbal performance. Although less widely used with adults than the WAIS-III, the Stanford-Binet can be used as an alternative should the WAIS-III have been administered just prior to the current evaluation and the patient needs a separate measure of general intelligence. There are also several measures of non-verbal intelligence that are occasionally used with non-

English speaking or language impaired patients, the Comprehensive Test of Non-Verbal Intelligence (CTONI) and The Leiter International Performance Scale-Revised (Leiter-R). The CTONI is normed for ages 6 through 90, but the Leiter-R has an age ceiling of 20 years-11 months. However, it must be kept in mind that, although these tests are highly correlated to the WAIS and Stanford-Binet non-verbal IQ scores, they do not necessarily assess identical cognitive domains nor do they have any measures of verbal abilities.

Measures of Reading Skill and Educational Achievement:

The majority of neuropsychological tests, especially those assessing memory and higher level cognitive skills, are normed on subjects who read at least at the 6th grade level. If the neuropsychologist does not know whether the patient is able to read at the appropriate level, then it will be difficult to know whether low test performance is due to brain impairment or simply poor reading skills. Therefore, some measure of reading skills should be included in the evaluation; for example, the Wechsler Test of Adult Reading (WTAR), the New Adult Reading Test (NART), or the Reading subtest from the Wide Range Achievement Test-3 (WRAT-3). More comprehensive educational batteries like the Wechsler Individual Achievement Test-II (WIAT-II) or the Woodcock-Johnson-Revised (WJ-R) can also be administered, but they are lengthy and generally only given in select instances.

Assessment of Malingering:

Malingering of cognitive dysfunction is an intentional exaggeration or fabrication of cognitive deficits for purposes of secondary gain (financial, cultural, or legal), and is especially salient when patients are involved in workers' compensation or third party liability claims. Virtually every comprehensive neuropsychological evaluation includes at least one formal standardized measure of malingering such as the Portland Digit Recognition Test (PDRT), the Test of Memory Malingering (TOMM), or the Validity Indicator Profile (VIP) as well as an analysis of patterns of individual test performance that reflect tendencies towards malingering. The lack of inclusion of a measure of malingering in a comprehensive evaluation should raise questions in the mind of the reader as to the validity of the conclusions drawn.

Cultural and Language Barriers:

Neuropsychological tests used in the United States are generally standardized on subjects for whom American English is a first language. As immigrant populations and their native languages continue to increase in number, the validity of using many neuropsychological tests in the assessment of cognitive functioning becomes seriously problematic (Nell, 1999; Ponton & Leon-Carrion, 2001). This is especially true for the more verbally-based tests like the WAIS-III Verbal subtests, WRAT-3 Reading, WTAR, Verbal Fluency Test, etc., but may also be true for visual-spatial tests for immigrants from countries whose written language is radically different from Western languages (Hebrew, Arabic, Chinese, Japanese, etc.). In an attempt to circumvent the language issues, some neuropsychologists have had test instructions and items simply translated into the patient's language without recognizing that such a change very likely invalidates the standardized norms for the test. Under those circumstances, any attempt to use normative tables to determine standardized scores would not be considered valid and conclusions drawn from those scores would be considered suspect. (There is a small subset of tests that have been standardized on non-English speaking populations. For these

tests, the issue of the need to verify the recency and scope of the normative data is the same as with all tests.). When an assessment must be done despite the concern relative to cultural bias, neuropsychologists may depend heavily upon attention and concentration measures, which tend to be less impacted by culture and language differences and upon interviews with family members to gain insight into the patient's premorbid capabilities and how closely those capabilities align with their current functioning. The neuropsychologist may also want to talk to the patient's employer concerning job requirements with the intent of developing a program or assessment strategy that could reliably simulate the skills required.

How, then, should a LCP or CM proceed when a person who does not have English as a first language is suspected as having a brain injury? First, if at all possible, select a neuropsychologist who is fluent in the patient's language. If that is not possible, then a medical professional who is fluent in the language should serve as an interpreter. Second, performance on any task where language and/or cultural bias could affect that performance must be interpreted 'qualitatively', with minimal reference to the test norms. Third, because such a qualitative analysis is difficult and relies heavily upon the neuropsychologist's expertise, a board certified neuropsychologist should either perform the evaluation (the preferred approach) or should serve as a consultant to the psychologist who is fluent in the language to assist in interpretation of the data. Fourth, personality testing (MMPI-II, MCMI-3, depression and anxiety scales, etc.) with immigrant populations should be considered highly suspect, is rarely considered valid given the cultural biases inherent in these tests, and generally should not be performed.

Board Certification in Neuropsychology:

The authors of this article have alluded to board certification as an important factor in selecting a neuropsychologist. In the field of psychology, having a PhD in either psychology or neuropsychology, along with a state license, allows an individual to practice within the scope of that license. It is assumed that the practicing psychologist will only provide those services to the public for which they have training and expertise. Unlike medicine where it is generally expected that every physician will select an area of expertise for which s/he will seek specialized training and undergo area specific exams to obtain board certification (for example, internal medicine, neurosurgery, radiology, etc.), in the field of psychology, although board specialization does exist, there is no common consensus or expectation that the general population of psychologists should pursue it. As a result, many psychologists state that they can provide neuropsychological assessments. Unfortunately, the ordinary consumer has no way to judge whether a given psychologist has sufficient expertise to render a thorough and competent exam, especially in complex cases; for example, in a premorbidly bright patient who is on psychoactive medications and may also have a mild brain injury; or for a bilingual patient for whom English is a second language; or for someone who is severely brain damaged and has limited ability to communicate. To address this issue, the American Psychological Association (APA) and the American Board of Professional Psychology (ABPP) developed a rigorous certification process and have established the American Board of Clinical Neuropsychology (ABCN). Those neuropsychologists who have obtained this credential are considered optimally qualified to perform competent, comprehensive neuropsychological evaluations. There is also a second board certification organization (ABPN), sponsored by a national organization of neuropsychologists, that also requires applicants submit to a certification process. However, this board is not related to ABPP or to ABCN. If the LCP or

CM wants external validation as to the neuropsychologist's degree of expertise, it would be recommended that they select someone who has been granted board certification in the subspecialty of clinical neuropsychology. There are two web sites which can be accessed, one is for the ABPP (www.abpp.org, once at the web site, select the specific discipline, clinical neuropsychology, and then search by state for those who are board certified), and the other is for the ABPN (www.abpn.com) where you can also search by state. The authors of this article acknowledge that there are a number of very competent non-board certified neuropsychologists who have the requisite training and experience to perform excellent neuropsychological assessments. However, we have stressed board certification because it is the most reliable way for a new consumer to identify competent neuropsychologists who have undergone careful review by their peers.

When is a neuropsychological evaluation indicated and how often can they be done?

The simple answer is that whenever there is suspicion of some brain-based impairment in cognitive functioning, a neuropsychological evaluation screening assessment is indicated. Referrals are typically made to diagnose or rule out problems, or to measure the impact of cerebral dysfunction on the person's cognitive and behavioral functioning. Specific conditions that are typically measured or assessed in a neuropsychological evaluation are traumatic brain injury or suspected brain injury, stroke, exposure to neurotoxic chemicals, chronic substance abuse, and developmental learning problems in the school setting, attention deficit disorders, psychiatric or neuropsychiatric problems, and seizure disorders. It is also reasonable to request an evaluation when sequelae from chronic or acute medical conditions or from their treatment are negatively impacting the patient's cognitive functioning; for example, in Multiple Sclerosis, Parkinson's Disease, Lupus Erythematous, and in Huntington's Disease, or from some types of chemotherapy.

With respect to the timing of neuropsychological testing, for the mild to moderate patient with brain injury, a screening evaluation to establish base line scores can be done within six to 12 hours post-brain injury. Testing can then be repeated using parallel tasks (i.e., those that assess the same functional skills without incurring practice effects) at 7 days, 14 days, 30 days, and again at 6 months and 12 months to develop a recovery curve. In patients with a severe brain injury, it can, at times, be important to document that the person was unable to complete the test at a specific point in time, and later to also document when the person was first able to actually complete the comprehensive evaluation. For these patients during their initial stay in the acute hospital, and possibly even at time of transition to rehabilitation, the Galveston Orientation and Amnesia Test (GOAT), a standardized test, can be used to assess whether the person is in a state of post-traumatic amnesia; i.e., a period when retention and carry over of new information is poor. Knowing whether the patient can adequately retain and recall information can guide the treating team on setting expectations and treatment goals. For patients who are no longer in post-traumatic amnesia but who are still hospitalized and in need of serial testing, the neuropsychologist can administer the RBANS bedside screening battery which provides normative data across multiple cognitive domains.

Finally, as a LCP or CM you are a 'consumer' of neuropsychological evaluations and have every right to hold the neuropsychologist accountable for the results that they produce to you. There is a text entitled, *The Consumer Oriented Neuropsychology Report,* edited by Amengol et al., (2001) that we refer to you. One approach that can ensure the neuropsychologist is held accountable for his/her evaluation is for the LCP or CM to enumerate specific questions to be

addressed in the report. And although the choice of tests that will be administered to answer those and other questions is, to a great extent, a function of who the neuropsychologist is and their professional experience, the consumer (LCP and CM) can have a reasonable expectation that the neuropsychologist will address the specific questions posed. Additionally, the consumer has the right to request that the neuropsychologist delineate basis on which the conclusions are being drawn (data from test results, clinical judgment, normative data, etc.). In sum, it is important to view the neuropsychological evaluation as a collaboration between the LCP or CM and the neuropsychologist to achieve the best possible outcome for your patient in determining their needs.

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Editor's Note. As an addendum to the previous article, the Neuropsychologist Questions below are a helpful tool for the life care planner to use in coordinating a referral for neuropsychological evaluation and/or collaborating with the neuropsychologist to determine the client's future, functional needs.

Neuropsychologist Questions

In addition to the standard evaluation report, add the following as appropriate.

1. Please describe, in layman terms, the damage to the brain.
2. Please describe the effects of the incident on the client's ability to function.
3. Please provide an opinion to the following topics:
    a. Intelligence level? (include pre- vs. post-incident if able)
    b. Personality style with regard to the workplace and home?
    c. Stamina level?
    d. Functional limitations and assets?
    e. Ability for education/training?
    f. Vocational implications - style of learning?
    g. Level of insight into present functioning?
    h. Ability to compensate for deficits?
    i. Ability to initiate action?
    j. Memory impairments (short-term, long-term, auditory, visual, etc.)?
    k. Ability to identify and correct errors?
    l. Recommendations for compensation strategies?
    m. Need for companion or attendant care both as child and as adult? Include projected # of hours per day as child and adult.
    n. What considerations related to aging with a disability need to be included?

4. What is the proposed treatment plan, including frequency and duration both now and expected over lifetime?
    a. Counseling (individual and family)?
    b. Cognitive therapy?
    c. Re-evaluations?
    d. Referral to others? (e.g., physicians)
    e. Other?

5. Include cost per session or hour as well as for any re-evaluations recommended in question #4.

With contribution from Debra E. Berens, MS, CRC, CCM, CLCP