

ASSESSMENT: NEUROPSYCHOLOGICAL TESTING OF ADULTS. CONSIDERATIONS FOR NEUROLOGISTS

Report of the Therapeutics and Technology Assessment Subcommittee of the
American Academy of Neurology

This report considers the use of neuropsychological assessment of adults for neurologists, including the appropriate application and limitations of neuropsychological testing, specific disorders where evaluation is pertinent, and issues surrounding neuropsychological consultation to neurologists. The report excludes neuropsychological testing in developmental disorders. The report was assembled from a review of the pertinent literature, opinions, and information from experts in the fields of Neurology and Neuropsychology and input from the Academy at large.

Diseases of the brain commonly produce changes in behavior, including impairment of cognitive abilities and production of neuropsychiatric symptoms. Knowledge of the presence and characteristics of these behavioral changes can aid in the diagnosis, management, and longitudinal care of patients with neurologic disease. Neuropsychological evaluation is one means of garnering quantitative information about behavioral changes in patients with known neurologic diseases or who are considered to be at risk for brain dysfunction.

Technical issues in neuropsychologic assessment. Neuropsychological evaluation can characterize cognitive and behavioral disturbances and may be helpful to the clinician in the course of diagnostic assessment, rehabilitation planning, or development of a management plan. Like other tests, neuropsychological assessments are of limited usefulness by themselves and must be interpreted in conjunction with other clinical, imaging, and laboratory information. Neuropsychological evaluations have the advantage of being objective, safe, portable, and relevant to the functional integrity of the brain.

Results of neuropsychological assessment must be considered in the context of the patient's age, education, socioeconomic status, and cultural background. These factors can affect test performance and condition the conclusions that can be inferred from the evaluation. In addition, issues involved in test construction such as the reliability, validity, and sensitivity of the assessment procedures have an impact on the conclusions that can be drawn from neuropsychological evaluations.¹

Neuropsychologic tests and neurologic function. Many widely used psychological tests were constructed before the emergence of much of the currently available information relating altered behavior to brain dysfunction. Commonly used instruments such as the Wechsler Adult Intelligence Scale (WAIS and its revised form WAIS-R)² and the Wechsler Memory Scale (WMS and its revised form WMS-R)³ were constructed without the specific intention of using them as instruments to assess brain function and detect brain disorders, but extensive experience with these instruments provides a basis for interpreting the tests in neurologic terms. The Halstead-Reitan Battery⁴ was developed specifically to detect "organic" dysfunction and differentiate between patients with and without brain damage (e.g., to distinguish "organic" from "functional" disorders). Differential diagnosis of neurologic disorders or precise delineation of the underlying neuronal systems affected was not intended. Newer tests designed in concert with evolving information regarding the mediation of behavior by specific structures or circuits provide greater insight into the integrity or disintegration of neurologic function. Most current neuropsychological assessment approaches use several of the traditional tests in combination with newer techniques developed specifically to evaluate neurocognitive activities and provide insight into brain function in different disease states.⁵

Test sensitivity. The ability to identify brain dysfunction varies greatly among tests and is determined both by the fidelity with which the test distinguishes normal from abnormal function and by the specific type of deficit that the patient exhibits. The WAIS-R, for example, has no memory subtests and is necessarily insensitive to memory-related deficiencies, whereas it has demonstrated sensitivity to disorders affecting visuospatial, calculation, and attentional abilities. In general, tests that are timed, requiring the patient to complete the test in a specified period, have greater sensitivity to diffuse or multifocal cerebral changes than untimed tests.¹ Availability of normative data and use of standardized administration procedures allow neuropsychological evaluation to be more sensitive than unstructured mental status testing in the detection of mild cognitive disturbances.

Test reliability. Reliability of tests refers to the consistency with which the same information is obtained if the test is given by different examiners (interrater reliability), by the same examiner on more than one occasion (intrarater reliability), or to the same patient on different days (test-retest reliability). Internal consistency and test-retest reliability are very high for the WAIS-R² and slightly lower, but still in the acceptable range, for the WMS-R.³ Test-retest reliability data are available almost exclusively for repeated testing within short periods of time; only a few studies have addressed the long-term reliability of neuropsychological assessments in stable patients.⁶ Reliability for memory tests is consistently lower than for other types of neuropsychological tests. Ideally, tests used in neuropsychological assessment should have demonstrated reliability; when reliability information is not available, the clinician must bear in mind that conclusions drawn from the tests may be more variable than is desirable.

Test validity. The validity of tests used in the assessment of cognitive function must also be known. There are several types of validity regarding neuropsychological tests, including construct validity (do memory tests assess memory?), concurrent validity (do new tests come to the same conclusions as established tests?), localization validity (do test results localize focal lesions?), diagnostic validity (do tests accurately diagnose disease?), and ecologic validity (do test results predict real-life performance?). Standardized tests widely used in neuropsychological assessment have demonstrated construct validity. For example, the WMS assesses verbal and nonverbal aspects of memory. Newly introduced tests should be shown to have concurrent validity before data derived from them are accepted. Localization validity has made considerable strides in the recent past, and some types of specific neuropsychological tests have relatively precise anatomic correlates. More basic cognitive processes (e.g., color vision) have better localization correlates than more complex processes (e.g., memory, abstraction), but it is the latter that are usually of more interest to clinicians.⁷ Neurologic examination and neuroimaging are intended to provide localizing information and are usually superior to neuropsychological testing for localizing focal brain lesions; the purpose of neuropsychological assessment is to provide information on cognitive deficits and capacities. No neuropsychological tests have been shown to have consistent diagnostic validity. Some tests accurately distinguish between two or three diseases when samples of patients with these diseases are assessed,⁸ but no study has shown that neuropsychological tests have positive predictive value when patients with a wide variety of disorders are tested. Even when focal lesions of different types involve similar brain regions, they often produce substantially different manifestations that would impede deriving etiologically specific conclusions from the test data.⁹ Neuropsychological tests have been shown to have high validity for distinguishing between abnormal and normal performance but have little capacity for distinguishing among different causes of performance impairment.

There has been limited attention to the relationships between neuropsychological test performance and functional capacity in activities of daily living, occupational competence, or success in returning to school. A few studies have addressed this type of validity. For example, Henderson and colleagues¹⁰ showed that deficits on a clock-drawing task correlated with wandering behavior in patients with Alzheimer's disease. In general, however, there has been inadequate exploration of the ecologic validity of neuropsychological test results, and extrapolation from test findings to disturbances in activities of daily living should be done with restraint. Tentative inferences from the neuropsychological assessment concerning the individual's return to home, work, or school should be based on a formulation that includes other factors affecting prognosis such as the patient's age, premorbid abilities, associated neuro-psychiatric conditions, coexisting physical disabilities, and presence of seizures.¹

Effects of aging on neuropsychological performance. Aging affects several domains of neuropsychological function, including fluid intellectual abilities, complex attentional processes, some aspects of memory, psychomotor speed, accessing word knowledge, visuospatial skills, some forms of abstract reasoning, and complex problem-solving.¹¹⁻¹³ Agestratified norms exist for most widely used instruments, although patients in the extremes of old age (above age 75) are often underrepresented in the normative sample, making interpretation of test results in very old patients more difficult. Interpretation of tests without normative data must be done with caution; patients may inappropriately be considered to be impaired on the basis of normal age-related changes.

Effects of education on neuropsychological performance. Education has a marked effect on neuropsychological test performance. For example, the cutoff for "normal" performance on the Mini-Mental State Examination may vary by as much as eight points depending on the individual's educational level.¹⁴ The clock-drawing test, widely used in clinical screening, is also affected by low education.¹⁵ Education-specific normative data are not available for most tests, and interpretation of test results in individuals with unusually high or low levels of education must be done with caution.

Ethnicity and cultural influences on neuropsychological assessment. Ethnicity and cultural background are important factors in interpreting test performance.¹¹ Most tests have been constructed by members of the majority

culture and reflect their standards and experience. Minority members may score lower on some tasks due to unfamiliarity with test-taking and dissimilarities in cultural experiences and expectations. When patients are not native English speakers and are tested in English, they are at a disadvantage on tests of verbal skills. Almost none of the standardized instruments have adequate normative data for minority individuals. Culture-fair tests constructed for studies by the World Health Organization may be superior to conventional assessments in evaluating individuals not of the majority culture,¹⁶ but these have not yet had widespread use. These factors must be taken into account when interpreting the results of neuropsychological assessment.

Effects of gender on neuropsychological performance. Gender has consistent but minor effects on neuropsychological assessment. Women tend to perform better on tests of verbal memory than men,⁸ and some studies suggest that men evidence more decline than women on most neuropsychological tests in the course of normal aging.¹¹ Few tests provide normative data stratified by gender to account for these differences. Gender effects are of modest magnitude compared with the influences of age and education on neuropsychological test performance.

Effects of psychiatric disorders on neuropsychological testing. Neuropsychiatric disorders may profoundly affect neuropsychological performance. Anxiety, depression, psychosis, apathy, and irritability all have an impact on the patient's ability to cooperate with testing and may directly affect cognition. Anxiety and depression impair performance on effort-demanding tests and have less effect on tests of over-learned skills. Memory complaints are common manifestations of depressive disorders, and severe depression is commonly accompanied by psychomotor slowing, impaired attention, decreased cognitive flexibility, and poor retrieval memory.^{12,17-19} Although groups of demented and depressed patients can be distinguished by neuropsychological tests, the predictive power of test performance for individual patients is modest, with 10 to 30% of depressed patients classified as demented.^{20,21} Information from the clinical assessment, historical anamnesis, and response to treatment may all be required to distinguish these two disorders, and, in some cases, both disorders may be present simultaneously.

Effects of substance abuse on neuropsychological performance. Substance abuse also adversely affects cognition and performance on neuropsychological tests. Chronic alcoholism is associated with deterioration in abstraction, visuospatial skills, and problem-solving abilities.²² A history of excessive substance use must be sought and integrated in the interpretation of neuropsychological test data. This is particularly important in the evaluation of patients with histories of head trauma because trauma is more common among those with substance abuse.²³

Neuropsychological assessment of specific neurologic disorders. Neurologic disorders of differing etiologies can have markedly different behavior ramifications, and the role of neuropsychological assessment in evaluating these conditions also varies.

Traumatic brain injury. Neuropsychological assessment is useful in the assessment of patients with traumatic brain injury (TBI) where it can aid in the detection of subtle deficits, provide information on outcome and prognosis, contribute to construction of directed rehabilitation strategies, and facilitate rehabilitation that leads to more functional independence.²⁴ In patients with severe TBI and those who are in the acute posttraumatic period, brief directed assessments are most useful. When recovery has largely plateaued, more detailed neuropsychological evaluation is appropriate to guide interventions and management. In patients with mild TBI, deficits are common but often recover. A few patients have chronic deficits that may be identified by neuropsychological testing.²⁵ A subgroup of patients has persistent deficits embedded in a complex clinical syndrome that includes chronic pain, anxiety, and depression. Deficits in these patients have multiple determinants.²⁶ Neuropsychological assessment in the rehabilitative setting is most useful when it informs the individual's specific rehabilitative program and identifies deficits that can be addressed or capacities that can be used to facilitate functional recovery and it is performed near the time of discharge to aid the physician and family with long-term planning.

Cerebrovascular disease. Neuropsychological assessment has little role in the assessment of patients with acute stroke. Severe deficits indicate a poor prognosis for recovery but are less predictive of outcome than tests of functional capacity. Neuropsychological assessment can be helpful in patients who have largely recovered but may still evidence cognitive impairment. Patients with deficits too subtle for detection on routine bedside testing may be shown to have memory, language, or executive function deficits that are important for vocational recommendations. In patients with more marked deficits, neuropsychological evaluation may guide rehabilitation and assist families in planning home management. In aphasic patients, for example, assessment can provide information on residual deficits and competencies in communication that are important for social and occupational reintegration.

Dementia. Neuropsychological assessment can aid in the assessment of patients with Alzheimer's disease and other dementias. It is particularly valuable in distinguishing between normal aging and mild dementias, such as

early Alzheimer's disease.²⁷⁻²⁹ Verbal and construction recall tests are consistently superior to other assessments in distinguishing between mild dementia and normal aging.³⁰⁻³² Neuropsychological testing is required for a diagnosis of Alzheimer's disease by the widely used research criteria of the National Institute of Neurological Diseases and Stroke-Alzheimer's Disease and Related Disorders Association,³³ and neuropsychological testing is currently the principal means of assessing the efficacy of drugs used to enhance cognition in dementia patients. Neuropsychological testing can assist in distinguishing among different types of dementia,^{34,35} but differential diagnosis requires additional historical and laboratory data and information from the neurologic examination and neuroimaging. Neuropsychological testing by itself, unbuttressed by other clinical information, does not distinguish among the many potential causes of intellectual impairment. In addition, traditional psychological instruments such as the WAIS-R are insensitive to the intellectual consequences of dysfunction of the basal ganglia, frontal lobes, and frontal-subcortical circuits. These structures mediate executive function, and assessment of executive function deficits requires specialized attention to both the patient's test scores and the strategies used to solve the problems posed.³⁶

Parkinson's disease. Neuropsychological assessment can be of value in Parkinson's disease when there is a question of subtle cognitive deficits that may be influencing occupational function, medication compliance, or suitability for tasks such as driving. Overt dementia can be established by the clinician, but detection of more subtle cognitive deficits and identification of executive function disturbances may require neuropsychological evaluation.³⁷

Human immunodeficiency virus encephalopathy. Neuropsychological testing has been applied extensively in the evaluation of patients who are seropositive for the human immunodeficiency virus (HIV). Neuropsychological deficits are not more common in seropositive asymptomatic individuals than in those who are seronegative, and routine neuropsychological assessment does not need to be performed in persons with HIV.³⁸ When HIV encephalopathy and cognitive deficits occur in the course of acquired immunodeficiency syndrome, however, there is an increased risk of rapid decline and death.³⁹ Documentation of suspected deficits thus has prognostic significance and may influence the decision to use zidovudine or other antiviral agents.

Multiple sclerosis. The frequency of cognitive deficits in MS is underestimated on the basis of routine clinical assessment. Peyser et al.⁴⁰ demonstrated that approximately half of the patients being followed in an MS clinic were cognitively impaired, and in half of these patients the cognitive deficits were unsuspected. Impaired cognition in MS correlates with reduced occupational success, poorer social engagement, sexual dysfunction, impaired activities of daily living, and psychopathology.⁴¹ Thus, neuropsychological evaluation can provide prognostic information of potential utility in management planning.

Epilepsy. Neuropsychological testing is particularly valuable in the presurgical evaluation of patients with epilepsy who are being considered for temporal lobectomy. Cognitive assessment performed when the hemisphere to be operated on is anesthetized in the course of Wada testing (intracarotid amobarbital) reveals the cognitive integrity of the remaining hemisphere and lateralized representation of specific cognitive capacities.⁴² Language testing during the Wada test is used to help plan surgical approaches, guide the extent of the resection, and determine if surgery should be performed under local anesthesia to allow cortical language mapping.⁴² Memory impairment after intracarotid amobarbital injection ipsilateral to the planned temporal lobectomy suggests that the patient is at increased risk for significant postoperative memory deficits.⁴³ Wada test results should not be considered as absolute indicators of brain integrity or dysfunction because some test-retest variability has been demonstrated. Wada testing is indicated in patients as young as 10 years of age and has been used in those as young as 5 years of age.

Neurotoxic exposure. Exposure to neurotoxic substances often results first in complaints of poor concentration, impaired attention, and abnormal memory. Comprehensive assessment of those at risk for neurotoxic disorders (agricultural workers, persons exposed to solvents and other industrial agents, laboratory workers, painters) includes neuropsychological testing with special attention to evaluation of functions relevant to any known domain-specific effects of the suspected agent.⁴⁴ Neuropsychological tests are also sensitive to the effects of chronic alcohol use.²² Neuropsychological assessment may play a useful role in determining the presence and extent of such changes and contribute to planning a comprehensive rehabilitation program.

Chronic pain. Neuropsychological testing is most useful in patients with chronic pain when it assesses personality and mood. Cognitive assessment is necessary only if the patient shows evidence of intellectual disturbances after discontinuation of pain-relieving and psychotropic medications. Personality profiles of the Minnesota Multiphasic Personality Inventory (MMPI) predict treatment response. This has been best documented in patients with low back pain.⁴⁵⁻⁴⁷ The hysteria, anxiety, and depression sub-scales of the MMPI may provide useful information, and the validity scale may help identify patients with marked defensiveness or malingering. The

MMPI cannot aid in identifying the source or pathophysiology of pain and should not be used by itself to develop an approach to the chronic pain patient. The MMPI-II is more ethnically and culturally unbiased than the original MMPI.

Personality assessment in patients with neurologic disease. Personality tests are often used to augment neuropsychological assessment. Traditional personality assessments such as the MMPI should be interpreted with caution in patients with identified or suspected brain disorders. They were not constructed with the intent of detecting brain dysfunction, and the normative data were generated with individuals without known cerebral pathology. Patients with neurologic disorders may have unusual sensory or motor experiences that will be interpreted as “schizophrenic” or they may make behavioral adjustments to their diseases that would be labeled “schizoid” or “antisocial” in nondisabled individuals. The behavioral and personality changes that occur in patients with frontal lobe or temporal lobe pathology are not readily characterized by responses to standard personality inventories.⁴⁸

Forensic applications of neuropsychological assessment. Neuropsychological documentation is critical in cases where litigation concerns the presence of cognitive impairment. Standardized procedures should be used whether the case involves plaintiff injury or defendant responsibility. Courts have become increasingly oriented toward expert testimony, and standardized information and neuropsychological data have a distinct advantage in this setting.⁴⁹ Neuropsychological information is subject to intensive scrutiny in forensic proceedings and can be successfully challenged if it is overinterpreted, obtained during the acute phase of an injury or when the patient is taking medications that might affect performance, ignores the presence of depression or anxiety when the tests were performed, or fails to take premorbid characteristics, developmental irregularities, and substance abuse into account.

Malingering. Malingering is often considered in patients suing for damages and complaining of intellectual impairment. There is no established neuropsychological profile diagnostic of malingering, but inconsistencies in performance (e.g., failing easy items while succeeding at hard ones), deviations from the performance typical of patients with brain injury (e.g., not exhibiting recency effects on list learning), poorer than expected performance on tests assessing vocabulary or reading that tend to be preserved in neurologic conditions, and the attitude of the patient toward failure may suggest the presence of malingering.

Summary. In general, neuropsychological assessment is most useful in patients with more subtle deficits. It is also useful for detecting deficits in patients with particularly high premorbid intelligence levels⁵⁰ in which bedside-type clinical testing may be insensitive to mild alterations. Neuropsychological testing has an important role in patients undergoing epilepsy surgery and can provide useful rehabilitative guidance in patients recovering from TBI and stroke and prognostic information for patients with HIV.

Neuropsychological consultations. Neuropsychological assessment has several potential advantages over bedside mental status testing that make it useful in specific circumstances.^{1,51} First, administration and scoring are standardized. Second, reliability and validity have been determined for most neuropsychological tests. Third, normative values are available for most widely used tests. Fourth, knowledge of measurement error facilitates detection of change over time when patients are assessed repeatedly. Fifth, test scores can be meaningfully compared over time and among different patients.

Neuropsychological consultation may be obtained by the clinician when (1) there are only mild or questionable deficits on mental status testing and more precise evaluation is needed to establish the presence of abnormalities or distinguish them from changes that may occur with normal aging; (2) there is a need to quantify the patient's deficits, particularly when the information will be useful in predicting or following the course of a disorder (recovery or decline); (3) when there is a need to characterize the strengths and weaknesses of a patient as part of constructing a management or rehabilitation plan or when making recommendations about returning to school or work; (4) when the neuropsychologist can provide the specific rehabilitation or other therapeutic services required; (5) when neuropsychological data can provide a more comprehensive profile of function that, when buttressed with clinical, laboratory, and imaging data, may assist in diagnosis; (6) when the patient is being considered for epilepsy surgery; and (7) when there is litigation that concerns the patient's cognitive status. Neuropsychological assessment is not intended to provide a diagnosis or to indicate the precise localization of a focal brain lesion.

Neuropsychological evaluations should be commensurate in extent with the question being asked and the state of the patient. Severely demented patients or patients in the acute phases of stroke or trauma, for example, should have brief and targeted assessments. More extensive evaluations may be required for patients with mild deficits; patients about to return home, enter rehabilitation programs, or desiring to re-enter occupations or school;

or patients in whom the information is being sought to assist in diagnosis. Detailed testing tends to overidentify cognitive impairments, and referring clinicians should be aware that neuropsychological testing will often provide an exaggerated estimate of the possibility of brain dysfunction.⁵² Overall, the pattern of neuropsychological test results and the strategies used by the patient to solve problems are more important than the scores on any particular test in arriving at an interpretation of the patient's cognitive status.

Neuropsychological assessments should flexibly respond to the question being asked by the clinician. The severity of the patient's deficits, the nature of the brain disorder (e.g., stroke, degenerative), the characteristics of the clinical syndrome (e.g., whether an aphasia is present), the age of the patient, associated physical limitations or neuropsychiatric disorders (depression, anxiety), effects of medication, distractibility, motivation, history of developmental disabilities, history of substance abuse, and the planned use of the information should all condition the choice of tests to be administered and their interpretation. The table shows tests typically used to assess

Table Tests commonly used to assess the major domains of neuropsychological function

Neuropsychological domain	Neuropsychological test
Attention	Digit span
Letter cancellation	
Trails A test	
Language	Boston Naming Test
Boston Diagnostic Aphasia Examination	
Western Aphasia Battery	
Verbal Fluency	
Memory	Wechsler Memory Scale
Rey Auditory Verbal Learning Test	
Visuospatial skills	California Verbal Learning Test Rey-Osterrieth Complex Figure Block design subtest of WAIS-R
Executive function	Wisconsin Card Sort Test Stroop Test Trails B test
Intelligence	WAIS-R Wechsler Intelligence Scale for Children New Adult Reading Test
Motor speed	Finger Tapping Grooved Pegboard
Educational Achievement	Wide Range Achievement Test

Not all tests are used with each patient; a selection of tests is made to best characterize the patient's strengths and weaknesses and answer the referring question.

WAIS-R = Wechsler Adult Intelligence Test-Revised.

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specific domains of neuropsychological function. Assessment or re-evaluation merely for the sake of charting the course of the illness or recovery is generally unwarranted.

Neuropsychological reports should contain the numerical data (e.g., percentile of performance corrected for age and education) and the neuropsychologist's interpretation of the information. Some clinicians have substantial neuropsychological expertise, and raw data should be made available on request. Brevity in reporting often serves the clinician better than an extended narrative.

Assessment of neuropsychiatric disorders that bear on test performance should be provided by the neuropsychologist as part of a comprehensive assessment. Depression and anxiety are common in patients with neurologic disorders and should be evaluated with rating scales, inventories, or structured interviews. Neuropsychological assessments by themselves are insufficient as a basis for decisions regarding medical therapy and recommendations concerning specific medical tests to be ordered (i.e., CT, EEG) or pharmacologic agents (i.e., antidepressants, anticonvulsants) to be used and should not be expected or provided as part of the neuropsychological assessment.

Clinicians must be cognizant of the fact that there is great variability in the training of individuals providing neuropsychological consultation. Those with training, experience, and demonstrated competence are best qualified. For example, individuals can be certified by the American Board of Clinical Neuropsychology or the American Board of Professional Neuropsychology, hold a doctoral degree in Psychology from an accredited institution, complete postdoctoral training in a neuropsychology training program, or hold a professional license.⁵³ Direct experience with whether the assessments are useful and well informed provide the basis for judging the individual's competence and usefulness as a consultant. Administration of test batteries that are too long or too short to answer the specified questions, failure to recognize the limitations of neuropsychological tests (especially with regard to localization and diagnosis), administration of inappropriate tests or tests without proper standardization, and preparation of unhelpful reports are indications of inadequate preparation.^{51,53} In addition, in some cases, neuropsychological tests are administered by a technician for later interpretation by a neuropsychologist. Technicians may be less likely to identify spurious data or to modify their procedures to optimize information collection, and this may lead to interpretive errors.¹ Clinicians should be aware of whether technicians are in use in the neuropsychological laboratories to which they refer. Finally, the clinician must recognize the limited reliability or unestablished validity of some tests (discussed previously).

Clinicians should perform their own mental status examination on patients before referral to a neuropsychologist, and many clinicians have expertise in the administration of basic questionnaires.⁵⁴⁻⁵⁶ These screening tests, however have substantial false-negative rates, failing to detect subtle cognitive changes, and cannot substitute for neuropsychological assessment in answering many of the consultation questions discussed above.⁵⁷ This initial assessment guides the questions to be asked of the neuropsychologist. The referring clinician should be as specific as possible regarding the questions to be answered.

Executive summary. Most neuropsychological tests have established validity and reliability, and the information garnered from them can be regarded with confidence when the tests are administered using the prescribed method and interpreted by an individual with competence and experience. Neuropsychological evaluation is usually able to distinguish between normal and abnormal but cannot determine the cause of neurologic diseases. Lesion localization should be inferred with caution on the basis of neuropsychological test results. Neuropsychological assessment is particularly valuable in patients with subtle deficits and provides less unique information when used with severely impaired patients. Neuropsychological testing is critical in patients undergoing epilepsy surgery and can be useful in management planning in patients with suspected dementia, MS, Parkinson's disease, TBI, stroke, and HIV encephalopathy. Neuropsychological referrals should be specific and guided by preliminary mental status assessment by the clinician. Neuropsychological consultation should focus on the referring question and should not provide specific medical recommendations.

Rating. *Established.* Neuropsychological assessment is accepted as appropriate by the practicing medical community for the indications and under the conditions described here. There is class II evidence for these specific conditions, and a type A recommendation is made with the restrictions noted above.

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Note. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

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