Cigna Medical Coverage Policy

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Subject **Neuropsychological Testing**

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INSTRUCTIONS FOR USE

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Coverage Policy

Please refer to the applicable benefit plan to determine terms and conditions of coverage. Coverage of neuropsychological testing is generally subject to the provisions of the applicable medical benefit. Services for or in connection with an injury or illness arising out of, or in the course of, any employment for wage or profit are specifically excluded under many benefit plans. Therefore, treatment for metal toxicity that occurs as a result of occupational exposure is generally not covered.

Cigna covers neuropsychological testing as medically necessary when the information obtained will be used for clinical decision-making and there has been EITHER:

- a significant mental status change not due to a metabolic disorder that has not responded to treatment
- a significant behavioral change, significant memory loss or organic brain injury

and a reasonable suspicion of ANY of the following:

- brain tumor
- cerebral anoxic or hypoxic episode
- central nervous system (CNS) infection with presence of neurocognitive problems (e.g., herpes encephalitis, human immunodeficiency virus [HIV] infection, Lyme disease with CNS neurological involvement)

- dementia (e.g., Alzheimer's disease, vascular dementia, Lewy body dementia)
- demyelinating disease (e.g., multiple sclerosis)
- epilepsy and seizure disorders
- exposure to agents known to be associated with cerebral dysfunction (e.g., lead poisoning, intrathecal methotrexate, cranial irradiation)
- extrapyramidal disease (e.g., Parkinson's, Huntington's Disease)
- postconcussion syndrome
- stroke or cerebral vascular injury (e.g., brain aneurysm, subdural hematoma)
- moderate and severe traumatic brain injury

Cigna does not cover neuropsychological testing for ANY of the following because such testing is considered educational in nature and not medically necessary. Services that are considered primarily educational or training in nature or related to improving academic or work performance are not covered under many benefit plans (this list may not be all-inclusive):

- attention-deficit/hyperactivity disorder (ADHD) and disruptive behavior disorders (e.g., oppositional defiant disorder, conduct disorder)
- autism spectrum disorder (ASD)/pervasive developmental disorder (PDD)
- baseline assessment in absence of signs or symptoms (e.g., athletes pre-injury)
- chronic fatigue syndrome
- concussion
- developmental disability, developmental delay
- learning disability
- mental retardation
- migraine
- mild cognitive impairment
- psychiatric conditions (e.g., psychotic disorders, anxiety disorders, substance abuse, personality disorders, mood disorders)
- Tourette's syndrome
- when performed for screening purposes
- when performed primarily for educational purposes
- when performed in association with vocational counseling or training

Cigna does not cover computerized neuropsychological testing for any indication that does not require a physician, psychologist, or licensed mental health professional to provide interpretation and preparation of a report because it is considered it is considered experimental, investigational or unproven.

Cigna does not cover neuropsychological testing that is ordered strictly as a result of court-ordered services unless medical necessity criteria are otherwise met (see medical necessity criteria above).

General Background

Neuropsychological testing consists of the administration of a series of standardized assessments designed to objectively measure cognitive function. Neuropsychological testing is indicated when notable behavioral and/or cognitive changes have been associated with a history of moderate to severe head trauma or organic brain disease. This testing provides the basis for the conclusions regarding the neurocognitive effects of various medical disorders and aids in diagnosis. Making an assessment of preserved and compromised cognitive functions can also help to predict the effects of remediation. The testing results assist the clinician determine the scope and severity of cognitive impairments through a comparison of patient responses to established normative test values. The results of the testing may assist the clinician in developing a program or plan of care that is specific to the patient's needs, and determine appropriate adjustments to the patient's treatment.

Neuropsychological testing should be delayed until reversible medical or metabolic conditions that are adversely affecting the central nervous system (CNS) are corrected, when possible. Formal neuropsychological testing

should also be delayed until any acute changes have stabilized following trauma, infections, or metabolic or vascular insults to the CNS.

The information obtained from neuropsychological testing may have a role in the clinical management of certain medical disorders including but not limited to:

- brain tumor, including benign and malignant
- cerebral anoxic or hypoxic episode
- central nervous system (CNS) infection with presence of neurocognitive problems (e.g., herpes encephalitis, human immunodeficiency virus [HIV] infection, Lyme disease with CNS neurological involvement)
- dementia (e.g., Alzheimer's disease, vascular dementia, Lewy body dementia)
- demyelinating disease (e.g., multiple sclerosis)
- epilepsy and seizure disorders
- exposure to agents known to be associated with cerebral dysfunction (e.g., lead poisoning, intrathecal methotrexate, cranial irradiation)
- extrapyramidal disease (e.g., Parkinson's, Huntington's Disease)
- stroke or cerebral vascular injury (e.g., brain aneurysm, subdural hematoma)
- traumatic brain injury (including concussion with loss of consciousness)

Neuropsychological testing should only be performed by practitioners who are appropriately trained in administering and interpreting these tests.

The components of neuropsychological assessment include all of the following:

- assessment of higher cortical functions, which includes thought process and organization, reasoning and judgment
- assessment of attention, language, memory and problem-solving
- obtaining a developmental history, the history of medical disease, trauma and psychiatric illness, and the history of the person's cognitive decline and/or premorbid level of function

Neuropsychological tests and measures used for clinical purposes must meet standards for psychometric adequacy. These standards include (American Academy of Clinical Neuropsychology [AACN], 2007):

- acceptable levels of reliability
- demonstrated validity in relation to other tests and/or to brain status, including evidence that the test or measure assesses the process, ability, or trait it purports to assess
- normative standards that allow the clinician to evaluate the patient's scores in relation to relevant patient characteristics, such as age, gender, and socio-demographic or cultural/linguistic background

Neuropsychological testing differs from psychological testing in that neuropsychological testing measures higher cerebral functioning, which focuses on cognitive skills and abilities (i.e., language, memory and problem-solving), whereas psychological testing is designed to provide information about a patient's personality and emotional functioning. Types of psychological testing include self-reported questionnaires, rating scales (e.g., the Hamilton Depression Rating Scale), projective techniques (e.g., the Rorschach or Thematic Apperception Test [TAT]), and screening tests of cognitive function.

Testing Methods

A wide variety of neuropsychological tests are available. These tests have been validated, are reliable and sensitive, and have been standardized to a normative sample. Normative data provides information about the expected test performance of individuals within a particular group, which is often stratified based on age or level of education (O'Rourke, et al., 2012). The fundamental core neuropsychological assessment typically includes tests designed to measure attention, concentration, learning, memory, problem-solving, language function, and visual-spatial function.

The two basic approaches to testing include a fixed or a flexible battery. The fixed battery applies the same set of tests to all disorders requiring assessment. On the other hand, the flexible battery is more individualized to the specific aspects of cognitive function that are in question. The decision as to what type of battery to apply is typically made by the neuropsychologist after a history and preliminary assessment. Fixed neuropsychological testing batteries provide a standardized and broad approach to the assessment of cognitive function.

Consequently, a large amount of information is collected, but not all is pertinent, and the time required to apply the assessment is often excessive. The flexible battery on the other hand is able to be customized, requires less time, but is not as inclusive.

The most commonly used neuropsychological assessment battery is the Halstead-Reitan Battery. It includes six tests that measure multiple neurocognitive factors, such as abstract reasoning, memory and tactile/visual-spatial memory. The entire battery can take up to 12–15 hours to administer, without scoring and interpretation. Most qualified neuropsychologists, however, will apply the Halstead-Reitan in a flexible application, choosing specific tests based on the clinical questions to be addressed.

The average flexible neuropsychological testing battery requires approximately 5–10 hours to complete (including administration, scoring and interpretation). Other standardized fixed assessment batteries exist and are used as assessment tools in various circumstances. The following is a list of typical fixed batteries:

- Wechsler Adult Intelligence Scale-Revised (WAIS-R)
- Boston Diagnostic Aphasia Examination (BDAE)
- Rey Auditory Verbal Learning Test (RAVLT)
- Wisconsin Card Sorting Test (WCST)
- Rey Complex Figure Test

Computerized Neuropsychological Testing: Computerized neuropsychological testing is also referred to as automated or computer-based testing. This type of testing has been developed over the last 20 years (Schatz and Browndyke, 2002) as an alternative, or adjunct to, traditionally administered testing methods. There are features in computer-based testing that are absent in the traditional form of neuropsychological testing, including: timing of response latencies, automated analysis of response patterns, transfer of results to a database for further analysis, and the ease with which normative data can be collated or compared to existing databases (Schatz and Browndyke, 2002). Limitations to computer-based testing include, but may not be limited to: unfamiliarity with the equipment by the patient and the potential for inaccurate timing procedures. Some of the tests are a translation of existing standardized tests into a computerized administration (e.g., Wisconsin Card Sorting Test™) while others include the development of tests and test batteries of tests unique to the computer application (Wild, et al., 2008).

Many of the computer based tests were developed to evaluate the presence of mild cognitive impairment or for sports-related concussion. Some of the tests have been adapted for testing in the pediatric populations, including assessment for attention-deficit/hyperactivity disorder (ADHD) (Luciana, 2003). These tests are also used in the research setting.

Many computerized tests do not require a professional to interpret or to complete a report. The computer program provides an automatically generated report. The test may not involve a visit or evaluation by a neuropsychologist and may be administered by a non-skilled or unlicensed individual.

Examples of computerized testing include, but are not limited to:

- Mindstreams® Cognitive Health Assessment (NeuroTrax, Newark, NJ): This product is intended to provide an objective measurement of cognitive function parameters. An Assessment Report is available within seconds after testing, and contains a complete accounting of performance in the cognitive domains of memory, attention, executive function, visual spatial perception, verbal skills, motor planning, and information processing speed.
- Cambridge Neuropsychological Testing Automated Battery (CANTAB®) (Cambridge Cognition Ltd, Cambridge, UK): This test is a non-linguistic, and culturally blind and can be administered by a trained assistant. This test includes specialized batteries that deal with specific conditions including: CANTAB Alzheimer's, CANTAB ADHD, and CANTAB's Core Cognition battery.
- CNS Vital signs® (CNS Vital Signs LLC, Chapel Hill, NC): This test batteries for five domains: memory (verbal and visual recognition), psychomotor speed (i.e., finger tapping, symbol digit coding), reaction time, cognitive flexibility (shifting attention, Stroop paradigm), and complex attention. The program can be completed in 25-30 minutes, does not require an attendant to be present and the program will produce a report.

- Computer-Administered Neuropsychological Screen for Mild Cognitive Impairment (CANS-MCI®) (Screen, Inc. Seattle, WA): This test was developed as a screening instrument for detection of mild cognitive impairment. Tests include assessment of language, memory and executive function.

Additional computerized neuropsychological test batteries are used in management of concussions to facilitate decisions about safe return to play, work or school. These tests generally take about 15-25 minutes to complete. Examples of computerized testing used in evaluation of concussion include, but are not limited to:

- ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) (ImPACT Applications, Inc, Pittsburgh, PA): According to the vendor website the test can be administered by an athletic trainer, school nurse, athletic director, team coach, team doctor, or anyone trained to administer baseline testing. It takes approximately 20 minutes and a clinical report is provided by the program.
- Concussion Resolution Index (CRI). Headminder, Inc., New York, NY). This test takes approximately 25 minutes to complete. According to the vendor's website, the athlete's provider is ultimately responsible for the administration and interpretation of the CRI. An athlete's provider is the person responsible for that athlete's care and who requested the athlete take the CRI—this may be the athlete's certified athletic trainer, physician, or other health or sports professional. Providers may administer the test personally or assign another person to supervise the test administration. The report is provided by the program.
- Axon Sports Computerized Cognitive Assessment Tool (CCAT) (Axon Sports, Ltd, Wausau, WI): This test takes approximately 15 minutes to complete. According to the vendor website, a clinic nurse or receptionist or computer lab supervisor can assist in the testing. A report is generated by the program. In the frequently asked question section of the vendor's website, it states that the Axon Sports test is not a neuropsychological test—neuropsychological tests can be given and interpreted only by appropriately trained and registered neuropsychologist. Neuropsychological assessments are generally very detailed and can require anywhere from 1–12 hours to complete. The Axon Sports CCAT measures the speed and accuracy of different aspects of thinking: processing speed, attention, learning and working memory. This information is not used to diagnose any disorder.

Wild et al. (2008) conducted a systematic review of the status of computerized cognitive testing to detect cognitive decline in the aging population. Due to the heterogeneity across selected studies and test batteries, a quantitative meta-analysis was not possible. The study included review of 11 test batteries that were either developed to screen for cognitive decline in the elderly or have been applied to that indication. In all cases, published research was found that described psychometric properties of these tests. In slightly more than half the tests, normative data for elderly subjects were rated as less than adequate as a result of either small sample size or lack of data specific to older adults in a larger sample. It was noted that reliability data was typically presented in some form, although only three test batteries met the highest rating achieved by describing more than one type of reliability. Few of the batteries are fully self-administered—the tests ranged widely in the amount of interaction required of an examiner. One of the potential advantages of computerized tests is the flexibility in terms of immediate adjustment of performance levels.

The American Academy of Clinical Neuropsychology (AACN) and the National Academy of Neuropsychology (NAN) published joint position paper on appropriate standards and conventions for computerized neuropsychological assessment devices (CNADs) (Bauer, et al., 2012). The paper includes the following statements regarding CNADs:

- CNADs are subject to, and should meet, the same standards for the development and use of educational, psychological, and neuropsychological tests as are applied to examiner-administered tests.
- Developers of CNADs are expected to provide a clear definition of the intended end-user population, including a description of the competencies and skills necessary for effective and accurate use of the device and the data it provides.
- Test developers should provide users with sufficient technical information to insure that the local installation of a CNAD will produce data that can be accurately compared with that which exists in the test's normative database.
- CNADs are subject to the same standards and conventions of psychometric test development, including descriptions of reliability, validity, and clinical utility (accuracy and diagnostic validity), as are examiner-based measures.

- Professionals select scoring and interpretation services (including automated services) on the basis of evidence of the validity of the program and procedures as well as on other appropriate considerations
- Professionals retain responsibility for the appropriate application, interpretation, and use of assessment instruments, whether they score and interpret such tests themselves or use automated or other services.

Neuropsychological Testing in the Educational Setting
Neuropsychological testing is also used in educational settings to provide information regarding educational planning and determine appropriate classroom placement (Stebbins, 2007). The testing may be used to identify specific learning disabilities and developmental disabilities. These tests may aid in the identification of children with severe intellectual deficits, such as mental retardation.

Tourette's syndrome (TS) is a chronic tic disorder, with the onset in childhood and characterized by motor and vocal tics. This disorder is frequently accompanied by other conditions; with the three most common being attention deficit/hyperactivity disorder (ADHD), learning disabilities, and obsessive-compulsive disorder (Bagheri, et al., 1999). Neuropsychological testing may be utilized to identify the patient's cognitive strengths and weaknesses and allow the patient to reach his or her maximum academic potential (Jankovic, 2007). Neuropsychological testing is considered primarily educational in nature and not medically necessary when performed for the assessment and management of Tourette's syndrome. Guidelines published by the European Society for the Study of Tourette's Syndrome noted that the clinical usefulness of formal neuropsychological testing in children with TS has not been clearly established to date, and more neuropsychometric tools are appropriate, at present, only in research settings." (Cath, et al., 2011)

Neuropsychological testing is generally performed primarily for educational reasons when done in association with the management of ADHD and disruptive behavior disorders (e.g., oppositional defiant disorder, conduct disorder). Educational testing is usually provided by school systems under applicable state and federal rules. The standard for diagnosis of ADHD remains the clinical interview and assessment. There is no specific test that can confirm a diagnosis of ADHD. Neuropsychological testing may be useful in patients in whom diagnosis is difficult; when there is strong evidence of underlying neurological condition, and cognitive impairment secondary to another disorder is suspected (e.g., those with previous head injury [e.g., traumatic brain injury], alcohol-related cognitive deficits, early dementias or seizures). There is insufficient evidence to recommend neuropsychological evaluation for ADHD to be performed on a routine basis in the management of ADHD.

The autism spectrum disorders (ASD) are a range of complex behavioral disorders that are also referred to as pervasive developmental disorders (PDD). There is no specific test that can confirm a diagnosis of ASD. The evaluation must include clinical history which incorporates parental report, family history, pregnancy, neonatal and developmental history of the child and a clinical examination (Volkmar, et al., 1999; Tuchman, 2003; Filipek, et al., 2000 [reaffirmed 2010]). It has been proposed that neuropsychological testing be used in the assessment of ASD and to assist with the educational planning process. The medical necessity for the standard use of neuropsychological testing in the assessment and/or management of ASD is not supported in the medical literature.

The use of neuropsychological testing in these settings is primarily used for educational purposes and is not medically necessary for the treatment of the conditions.

Migraines
The published literature regarding the clinical utility of neuropsychological testing for patients with headaches and migraines is not conclusive. It has been suggested that there may be cognitive impairment with migraines, but studies have not been conclusive (O'Bryant, et al., 2006; Baars, et al., 2010).There is insufficient clinical evidence that demonstrates that neuropsychological testing is useful in clinical decision making or will improve management of these conditions.

Mild Cognitive Impairment (MCI)
MCI is a is a condition associated with impairments in understanding and memory not severe enough to be diagnosed as dementia, but more pronounced than those associated with normal aging (National Institute of Neurological Disorders and Stroke [NINDS], 2011). MCI is a classification of persons with memory impairment who are not demented (normal general cognitive function; intact activities of daily living). Patients with MCI should be identified and monitored for cognitive and functional decline due to their increased risk for subsequent

dementia (Petersen, et al., 2001). Neuropsychological testing for this condition does not impact clinical decision making.

Chronic Fatigue Syndrome
Chronic fatigue syndrome (CFS) can be a disabling illness characterized by persistent fatigue and associated myalgias, tender lymph nodes, arthralgias, chills, feverish feelings and postexertional malaise. Diagnosis of this syndrome is by exclusion with no definitive laboratory test or physical findings. Evaluation for this condition should include a detailed medical history, complete physical examination, including a mental status examination and a standard series of urine and blood laboratory tests to identify other possible causes of illness. The medical necessity for the use of neuropsychological testing in the assessment and/or management of chronic fatigue syndrome is not supported in the medical literature.

Baseline Assessment
A recent area of development for neuropsychological testing, in particular computerized testing, is baseline assessment, which is when the testing is performed in the in the absence of signs and/or symptoms for purposes of a later comparison. A use for baseline testing that is becoming prevalent is in the assessment and management of sports-related concussion (Schatz and Browndyke, 2002). In some contact sports, an athletic program may perform a baseline assessment of an individual's cognitive performance at the beginning of the season for purposes of later comparison in the event of an injury. When these tests are performed prior to injury, or in the absence of signs and/or symptoms, this use would not be considered medically necessary.

Concussion
A mild or minor traumatic brain injury (TBI) is a temporary and brief interruption of neurologic function after head trauma, and may involve a loss of consciousness. A concussion is a type of minor TBI usually caused by acceleration-deceleration or rotational injury to a freely mobile head, and is frequently associated with contact sports. Almost all-patients with minor TBI will have rapid and complete symptom resolution; with no long-term sequelae. The majority (80–90%) of concussions resolve in a short (7–10 day) period, although the recovery time frame may be longer in children and adolescents (McCrory, et al., 2013). Research indicates that up to 90% of concussions do not involve a loss of consciousness (LOC) (Center for Disease Control and Prevention [CDC], 2011).

The diagnosis of acute concussion involves the assessment of a range of domains, including clinical symptoms, physical signs, behavior, balance, sleep, and cognition, along with a detailed concussion history (McCrory, et al., 2009). The cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded program of exertion prior to medical clearance and return to play (when associated with sports injury). The majority of patients will recover spontaneously over several days (McCrory, et al., 2009). The individual should be completely symptom free at rest and with physical exertion (e.g., sprints, non-contact aerobic activity) and cognitive exertion (e.g., studying, schoolwork) prior to return to sports or recreational activities (CDC, 2011).

Past history of concussions is among the risk factors that can lead to a protracted period of recovery. The number and date(s) of prior concussions and the duration of symptoms for each injury should be assessed. The effects of multiple mild TBIs may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent mild traumatic brain injury (CDC, 2011).

Neuropsychological testing is increasingly being used in the area of sport-related concussion to assist in return to play decisions (McCrory, et al., 2009).The question as to whether or not such testing is associated with improved clinical outcomes is unclear (Kirkwood, et al., 2009). A review of the evidence for the clinical utility of a computerized test, ImPACT, reveals insufficient support to suggest that use of the test is associated with modified risk. The report concluded that “for evaluating and advising concussed athletes when to return to play, ImPACT test results should not be the determining factor (Mayers, et al., 2012).

The effects of multiple mild TBIs may be cumulative. Risk factors for protracted recovery or cumulative impact include past history of concussion, time to recovery, successive concussions with limited time in between insults, and the degree of biomechanical force associated with the trauma (CDC, 2011). Therefore, a thorough clinical review that includes the number and date(s) of prior concussions is essential to a good assessment.

Postconcussion Syndrome: A small percentage of patients may report persistent symptoms (e.g., headache, sensory sensitivity, memory or concentration difficulties, irritability, sleep disturbance, depression) for extended periods after trauma. These symptoms are referred to as postconcussion or postconcussive syndrome (Biros and Heegaard, 2009). The condition is defined in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition as three months' duration of three (or more) of the following symptoms: fatigue; disordered sleep; headache; vertigo/dizziness; irritability or aggressiveness; anxiety or depression; personality changes; and/or apathy (Halstead, et al., 2010). Patients with persistence of symptoms may need referral for neuropsychological testing (Cantu, et al., 2007).

Literature Review Neuropsychological Testing for Concussion: Although neuropsychological testing appears to be used in the assessment of sport-related concussion, the scientific literature is not conclusive regarding the clinical utility of this testing for evaluation and management of concussion. The published literature generally addresses the use of computerized testing for the assessment of sport-related concussion in the areas of baseline assessment and return-to-play decisions. The studies focus on a specific population and the results cannot be generalized to other populations. There is insufficient evidence that demonstrates the testing provides incremental value beyond the standard clinical assessment.

Resch, et al. (2013) conducted a cross-sectional cohort study of 91 healthy subjects to document test-retest reliability for the ImPACT neuropsychological test battery using two different clinically relevant time intervals. Both groups completed ImPACT forms 1, 2, and 3, which were delivered sequentially either at: one week intervals for group one (n=46) or at baseline, day 45, and day 50 for group two (n=45). Group two also completed the Green Word Memory Test (WMT) as a measure of effort. Intraclass correlation coefficients (ICCs) were calculated for the composite scores of ImPACT between time points. Repeated-measures analysis of variance was used to evaluate changes in ImPACT and WMT results over time. The ICC values for group one ranged from 0.261–0.878 for the four ImPACT composite scores. The ICC values for group two ranged from 0.374–0.756. In group one, ImPACT classified 37.0% and 46.0% of healthy participants as impaired at time points two and three, respectively. In group two, ImPACT classified 22.2% and 28.9% of healthy participants as impaired at time points two and three respectively. ImPACT misclassified 22% to 46% of healthy college-aged adult sample as impaired on one or more indices at one or both time points after baseline testing. The authors note that ImPACT had varying test-retest reliability on several metrics using different time frames for reassessment. This study included healthy subjects, rather than those with a head injury, and did not address clinical utility.

Thomas et al. (2011) performed a prospective non-controlled study using sixty subjects, aged 11-17, who presented to the emergency department (ED) immediately after a head injury. The study was designed to answer two questions: 1) is there a correlation between performance on a computer-based neurocognitive assessment (ImPACT) performed within 12 hours of head injury, and repeat assessments performed at least once, from three to ten days later; and 2) was the computerized test more sensitive to the identification of concussion severity when compared to two standard clinical grading scales. Post-concussive symptoms, outcomes, and complications were assessed via telephone follow-up for all subjects. Sixty patients completed phone follow-up and only 36 patients (60%), however, completed follow-up testing. The median follow-up testing interval was six days post-injury. Traditional concussion grading was reported to not correlate with neurocognitive deficits detected in the ED or at follow-up. The neurocognitive domains of verbal memory, processing speed, and reaction time, on the other hand, were reported to show a correlation, though a statistical threshold for certainty or a statistical correlation was not reported. At two weeks post-injury, 23 patients (41%) had not returned to normal activity. At six weeks, six patients (10%) still had not returned to normal activity. No correlation with return to normal activity was reported. The authors concluded that immediate computerized neuropsychological assessment in the ED can predict neurocognitive deficits seen in follow-up. They further postulated that this information may be used to individualize treatment decisions. Limitations of the study included the small sample size, lack of control group, lack of power to identify a correlation between three days post injury, lack of power to perform a subgroup analysis, incomplete statistical reporting, and lack of comparison to the traditional validated and normed clinical neuropsychological test assessment. The study did not allow, nor draw, conclusions regarding the clinical utility of the intervention.

Lau et al. (2011) conducted a prospective, cohort study (n=108) to evaluate the correlation between performance on computerized neurocognitive testing (ImPACT) in combination with clinical symptoms, with recovery from sports-relate concussion. Male, high-school, football athletes completed a computer-based neurocognitive test battery within 2.23 days of injury and were followed until returned to play, using international

guidelines. Athletes were grouped into protracted recovery (>14days; n=50) or short-recovery (≤14 days; n=58). Separate discriminant function analyses were performed using total symptom score on Post-Concussion Symptom Scale (PCSS), symptom clusters (migraine, cognitive, sleep, neuropsychiatric), and Immediate Post-concussion Assessment and Cognitive Testing neurocognitive scores (verbal memory, visual memory, reaction time, processing speed). Multiple discriminant function analyses revealed that the combination of four symptom clusters and four neurocognitive composite scores had the highest sensitivity (65.22%), specificity (80.36%), positive predictive value (73.17%), and negative predictive value (73.80%) in predicting protracted recovery. Discriminant function analyses of total symptoms on the Post-Concussion Symptom Scale alone had a sensitivity of 40.81%; specificity, 79.31%; positive predictive value, 62.50%; and negative predictive value, 61.33%. The four symptom clusters alone discriminant function analyses had a sensitivity of 46.94%; specificity, 77.20%; positive predictive value, 63.90%; and negative predictive value, 62.86%. Discriminant function analyses of the four computerized neurocognitive scores alone had a sensitivity of 53.20%; specificity, 75.44%; positive predictive value, 64.10%; and negative predictive value, 66.15%. The authors concluded that the use of computerized neurocognitive testing in conjunction with symptom clusters results improves sensitivity, specificity, positive predictive value, and negative predictive value for predicting protracted recovery compared with each used alone. Although the study appears to indicate that the use neuropsychological testing along with symptom assessment may assist in predicting recovery, the results are not robust and do not indicate that this testing should be used for this purpose. The test was not designed to, and did not, address clinical utility.

Maerlander et al. (2010) conducted a study that compared scores across three test batteries in 54 healthy male athletes. The three batteries included the ImPACT test, traditional neuropsychological tests, and several experimental measures used in the assessment of sports-related concussion. The findings concluded that convergent validity was demonstrated for four of the five ImPACT domain scores. However, two cognitive domains, sustained attention and auditory working memory, often compromised as a result of mild TBI did not show convergent validity. Affective symptoms correlated with performance on measures of attention and working memory. The authors concluded that in this healthy sample, the correlations between the domains covered by ImPACT and the neuropsychological battery supports ImPACT as a useful screening tool for assessing some of the cognitive factors related to mild TBI. They recommended, however, that other sources of data should be considered when identifying and managing concussions. Limitations of the study included its focus on reportedly healthy subjects, rather than those with a head injury, and small sample size. Further the study was not designed to, and did not, address clinical utility.

Broglio et al. (2007) utilized a repeated measures design in 118 healthy student volunteers to examine the test-retest reliability of three commercially available computer-based neurocognitive assessments using clinically relevant time frames. The participants completed the ImPACT, Concussion Sentinel, and Headminder Concussion Resolution Index tests on three days: baseline, day 45, and day 50. Each participant also completed the Green Memory and Concentration Test to evaluate effort. Intraclass correlation coefficients were calculated for all output scores generated by each computer program as an estimate of test-retest reliability. Findings included: the intraclass correlation coefficient estimates from baseline to day 45 assessments ranged from .15 to .39 on the ImPACT, .23 to .65 on the Concussion Sentinel, and .15 to .66 on the Concussion Resolution Index. The intraclass correlation coefficient estimates from the day 45 to day 50 assessments ranged from .39 to .61 on the ImPACT, .39 to .66 on the Concussion Sentinel, and .03 to .66 on the Concussion Resolution Index. Three contemporary computer-based concussion assessment programs evidenced low to moderate test-retest reliability coefficients. It was noted that that the findings do not appear to be due to suboptimal effort or other factors related to poor test performance, since persons identified by individual programs as having poor baseline data were excluded from the analyses. The authors note that until the psychometric properties of these tests can be clarified, clinicians should use a battery of evaluative measures when assessing concussion. Findings from multiple assessment techniques, such as self-reported symptoms, postural control, and neurocognitive performance, should be incorporated into a concussion assessment protocol. The authors concluded that the neurocognitive evaluation should continue to be part of a multifaceted concussion assessment program, with priority given to those scores showing the highest reliability. Limitations of the study included the lack of comparison to standardized and normed tests, its focus on reportedly healthy subjects, rather than those with a head injury, and small sample size. In addition, the study was not designed to, and did not, address clinical utility.

Schatz et al. (2005) reported on a retrospective study (N= 72) that examined the diagnostic utility of the composite scores of ImPACT and Post Concussion Symptom Scale scores (PCSS) in recently concussed high school athletes. The patients were tested within 72 hours of sustaining a concussion, and data were compared

to non-concussed high school athletes with no history of concussion (N= 66). Between-groups multivariate analysis of variance (MANOVA) revealed a significant multivariate effect of concussion on test performance (p<.001); univariate analysis revealed all six measures contributed to the between-groups differences. A discriminant function analyses was conducted to measure the ability of the five ImPACT composite scores, as well as the PCSS to classify concussion status. One discriminant function was identified that consisted of the Visual Memory, Processing Speed, and Impulse Control composite scores PCSS, which correctly classified 85.5% of the cases. Approximately 82% of participants in the concussion group and 89% of participants in the control group were correctly classified. Using the data, the sensitivity of ImPACT was 81.9%, and the specificity was 89.4%. The investigators concluded that as part of a formal concussion management program, ImPACT may be a useful tool for the assessment of the neurocognitive and neurobehavioral sequelae of concussion, and may also provide post-injury cognitive and symptom data that can assist a practitioner in making return to play decisions. Limitations of the study included its lack of comparison to standardized and normed tests, its small sample size, and retrospective design. Further the study was not designed to, and did not, address clinical utility.

Randolph et al. (2005) conducted a comprehensive literature review in order to assess the impact of neuropsychological testing in sports related concussion. The group included all prospective, controlled studies where the use of neuropsychological testing in sport-related concussion was used as a tool to manage clinical recovery. The group concluded that the degree of test variance after injury is often too subtle to detect statistically significant differences between groups, even during the acute phase of injury (i.e., one–three days post-injury). They concluded that the testing lacked adequate sensitivity or reliability to meet standard psychometric test criteria or clinical utility. They concluded further that it was unclear that testing showed adequate performance to detect impairment once concussion related symptoms, such as headache, had resolved. . Since no current guideline for the management of sport-related concussion allows a symptomatic player to return to sport, the incremental utility of neuropsychological testing remains questionable. The authors concluded that the incremental utility of neuropsychological testing is not demonstrated and recommended that concussion recovery should be monitored by means of standard clinical examination and subjective symptom checklists. They recommended further research in order to establish psychometric validity and clinical utility of the tests.

Repeat Testing
Repeat testing may be medically indicated when there is a significant change in behavior or medical condition and will affect treatment planning. Repeat testing for monitoring of a condition is not considered medically necessary unless it will impact clinical decision-making or level of care planning.

Neuropsychological Testing for Other Conditions
Neuropsychological testing is of limited value in any of the following conditions:

- When the patient has a substance abuse background and either of the following conditions apply:
  - The patient continues to use to an extent that would render test results inaccurate.
  - The patient is not yet 10 or more days post-detoxification.
- When the patient is on certain daily medications (e.g., mood-altering substances or beta-blockers) that may confound interpretation of results, and the drug effects have not been ruled out

There are situations when routine screening of individuals is performed, such as for the purpose of early detection of changes in cognition. The use of neuropsychological testing for screening purposes, in the absence of signs and symptoms, would be considered not medically necessary.

While neuropsychological testing is not indicated for psychiatric conditions, the testing may be used to evaluate the presence of cognitive impairments in patients with co-morbid disorders when the psychiatric conditions have been effectively treated.

Professional Societies/Organizations—Concussion

American Academy of Neurology (AAN): The AAN published updated evidence-based guidelines for evaluation and management of concussion in sports (Giza, et al., 2013). The guidelines are endorsed by the National Football League Players Association, the Child Neurology Society, the National Association of Emergency Medical Service Physicians, the National Association of School Psychologists, the National Athletic Trainers Association, and the Neurocritical Care Society. The guidelines include the following recommendations:

Regarding the question of diagnostic tools that are useful in identifying athletes suspected of having sustained concussion:

- The reference standard by which these tools were compared was a clinician-diagnosed concussion (by physician or certified athletic trainer). It was noted that none of these tools is intended to "rule out" concussion or to be a substitute for more thorough medical, neurologic, or neuropsychological evaluations.
- Regarding neuropsychological testing the guidelines note that, "Instruments for neuropsychological testing are divided into 2 types on the basis of their method of administration: paper-and-pencil and computer. Both types generally require a neuropsychologist for accurate interpretation, although they may be administered by a non-neuropsychologist. It is likely that neuropsychological testing of memory performance, reaction time, and speed of cognitive processing, regardless of whether administered by paper-and-pencil or computerized method, is useful in identifying the presence of concussion (sensitivity 71%–88% of athletes with concussion) (one Class II study; multiple Class III studies). There is insufficient evidence to support conclusions about the use of neuropsychological testing in identifying concussion in preadolescent age groups."

Recommendations related to assessment, diagnosis, and management of suspected concussion; and recommendations for management of diagnosed concussion (including acute management, return-to-play, and retirement):

- Regarding return-to-play (RTP) and concussion resolution: Clinical licensed health care providers (LHCPs) might use supplemental information, such as neurocognitive testing or other tools, to assist in determining concussion resolution. This may include but is not limited to resolution of symptoms as determined by standardized checklists and return to age-matched normative values or an individual's preinjury baseline performance on validated neurocognitive testing (Level C).
- Regarding retirement from play after multiple concussions:
  - LHCPs might refer professional athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments for neurologic and neuropsychological assessment (Level C).
  - LCHPs caring for amateur athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments might use formal neurologic/cognitive assessment to help guide retirement-from-play decisions (Level C).

Level C: Possibly effective, ineffective, or harmful (or possibly useful/predictive or not useful/predictive) for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)

American Academy of Orthopaedic Surgeons (AAOS): the AAOS published a consensus statement regarding concussion (mild traumatic brain injury) and the team physician (2005/2011). Regarding neuropsychological (NP) testing, the guidelines include:

- It is essential that the team physician understand:
  - NP testing is recommended as an aid to clinical decision-making but not a requirement for concussion management.
  - NP testing is one component of the evaluation process and should not be used as a stand-alone tool to diagnose, manage or make return-to-play decisions in concussion.
- It is desirable that the team physician understand:
  - The indications and limitations of neuropsychological testing.
  - Post-injury neuropsychological test data are more useful if compared to the athlete's pre-injury baseline.
  - It is unclear what type and content of test data are most valid and valuable.
  - Value of NP testing is enhanced when used as part of a multi-faceted assessment and treatment program.

American Academy of Pediatrics (AAP): The AAP published a clinical report regarding sport-related concussion in children and adolescents (Halstead, et al., 2010). Among the conclusions and guidance the report notes:

- Sport-related concussions are common in youth and high school sports. Limited data are available on concussions in grade school athletes, and further research is needed.
- Concussion has many signs and symptoms, some of which overlap, with other medical conditions. Loss of consciousness is uncommon and if it lasts longer than 30 seconds, it may indicate more significant intracranial injury.
- Results of structural neuroimaging, such as CT or MRI, generally are normal with a concussion.
- Neuropsychological testing can be helpful to provide objective data to athletes and their families after a concussion. Neuropsychological testing is one tool in the complete management of a sport-related concussion and alone does not make a diagnosis or determine when return to play is appropriate.
- Athletes with concussion should rest, both physically and cognitively, until their symptoms have resolved both at rest and with exertion. Teachers and school administrators should work with students to modify workloads to avoid exacerbation of symptoms.
- The signs and symptoms of a concussion typically resolve in seven to ten days in the majority of cases. Some athletes, however, may take weeks to months to recover.
- Any pediatric or adolescent athlete who sustains a concussion should be evaluated by a health care professional, ideally a physician with experience in concussion management, and receive medical clearance before returning to play.
- Pediatric and adolescent athletes should never return to play while symptomatic at rest or with exertion. Athletes also should not be returned to play on the same day of the concussion, even if they become asymptomatic. The recovery course is longer for younger athletes than for college and professional athletes, and a more conservative approach to return to play is warranted.
- The long-term effects of concussion are still relatively unknown, and further longitudinal research is needed to offer further guidance to athletes of all ages.
- Education about sport-related concussion is integral to helping improve awareness, recognition, and management.
- The safety and efficacy of medications in the management of sport-related concussion has not been established.
- Retirement from contact or collision sports may be necessary for the athlete with a history of multiple concussions or with long symptomatic courses after his or her concussion.
- New evidence-based protocols for the diagnosis and management of concussion should be incorporated into pediatric training modules and competencies.

American Medical Society for Sports Medicine (AMSSM): the AMSSM published a position statement regarding concussion in sport (Harmon, et al., 2013). The statement is endorsed by the National Trainers' Athletic Association and the American College of Sports Medicine.

Recommendations for diagnosis of concussion include:

- Concussion remains a clinical diagnosis ideally made by a healthcare provider familiar with the athlete and knowledgeable in the recognition and evaluation of concussion.
- Graded symptom checklists provide an objective tool for assessing a variety of symptoms related to concussions, while also tracking the severity of those symptoms over serial evaluations.
- Standardized assessment tools provide a helpful structure for the evaluation of concussion, although limited validation of these assessment tools is available.

Recommendations for sideline evaluation and management of concussion include (Strength of recommendation C*):

- Any athlete suspected of having a concussion should be stopped from playing and assessed by a licensed healthcare provider trained in the evaluation and management of concussions.
- Recognition and initial assessment of a concussion should be guided by a symptoms checklist, cognitive evaluation (including orientation, past and immediate memory, new learning and concentration), balance tests and further neurological physical examination.
- While standardized sideline tests are a useful framework for examination, the sensitivity, specificity, validity and reliability of these tests among different age groups, cultural groups and settings is largely undefined. Their practical usefulness with or without an individual baseline test is also largely unknown.
- Balance disturbance is a specific indicator of a concussion, but not very sensitive. Balance testing on the sideline may be substantially different than baseline tests because of differences in shoe/cleat-type or surface, use of ankle tape or braces, or the presence of other lower extremity injury.

- There is no same day return-to-play for an athlete diagnosed with a concussion.
- Athletes suspected or diagnosed with a concussion should be monitored for deteriorating physical or mental status.

Recommendations regarding neuropsychological testing include (Strength of recommendation C*):

- Neuropsychological (NP) tests are an objective measure of brain–behavior relationships and are more sensitive for subtle cognitive impairment than clinical exam.
- Most concussions can be managed appropriately without the use of NP testing.
- Computerized neuropsychological (CNP) testing should be interpreted by healthcare professionals trained and familiar with the type of test and the individual test limitations, including a knowledgeable assessment of the reliable change index, baseline variability and false-positive and false negative rates.
- Paper and pencil NP tests can be more comprehensive, test different domains and assess for other conditions which may masquerade as or complicate assessment of concussion.
- NP testing should be used only as part of a comprehensive concussion management strategy and should not be used in isolation.
- The ideal timing, frequency and type of NP testing have not been determined.
- In some cases, properly administered and interpreted NP testing provides an added value to assess cognitive function and recovery in the management of sports concussions.
- It is unknown if use of NP testing in the management of sports concussion helps prevent recurrent concussion, catastrophic injury or long term complications.
- Comprehensive NP evaluation is helpful in the post-concussion management of athletes with persistent symptoms or complicated courses.

*Strength-of-recommendation taxonomy
Strength of recommendation and basis for recommendation:
A: Consistent, good-quality patient-oriented evidence
B: Inconsistent or limited-quality patient-oriented evidence
C: Consensus, disease-oriented evidence, usual practice, expert opinion or case series for studies of diagnosis, treatment, prevention or screening

The 4th International Conference on Concussion in Sport: A consensus statement on concussion in sport was published by this conference (McCrory, et al., 2013). The guidelines include:

- The majority (80–90%) of concussions resolve in a short (7–10 day) period, although the recovery time frame may be longer in children and adolescents
- The cornerstone of concussion management is physical and cognitive rest until the acute symptoms resolve and then a graded program of exertion prior to medical clearance and return to play.

Regarding neuropsychological assessment, the guidelines include the following:

- The application of neuropsychological (NP) testing in concussion has been shown to be of clinical value and contributes significant information in concussion evaluation
- NP assessment should not be the sole basis of management decisions. It should be seen as an aid to the clinical decision-making process in conjunction with a range of assessments of different clinical domains and investigational results.
- Formal NP testing is not required for all athletes, however when this is considered necessary then it should ideally be performed by a trained neuropsychologist
- NP testing may be used to assist return to play decisions and is typically performed when an athlete is clinically asymptomatic, however NP assessment may add important information in the early stages following injury
- There may be particular situations where testing is performed early to assist in determining aspects of management e.g., return to school in a pediatric athlete. This is usually best determined in consultation with a trained neuropsychologist
- Baseline NP testing was considered by the panel and was not felt to be required as a mandatory aspect of every assessment, however may be helpful or add useful information to the overall interpretation of these tests. At present, there is insufficient evidence to recommend the widespread routine use of baseline neuropsychological testing.

These are consensus guidelines and it is not clear whether these conclusions are based on a methodologically rigorous systematic evaluation of the published evidence. The guidelines do not address the incremental clinical value of neuropsychological testing on health outcomes compared to the information that is available from clinical assessment. The guidelines do not address the clinical utility of testing once the symptoms have resolved. The clinical value that is referred to in the guidelines is related to sport concussion and return-to-play. The guidelines do not appear to demonstrate the clinical validity of neuropsychological testing for the evaluation of concussion.

Professional Societies/Organizations—Other Conditions
American Academy of Child and Adolescent Psychiatry (AACAP): The AACAP published practice parameters for the assessment and treatment of children and adolescents with ADHD (Pliszka, et al., 2007). Regarding neuropsychological testing the parameters note that this testing is not required as part of a routine assessment for ADHD, but may be indicated by the findings of the standard psychological assessment.

American Academy of Neurology (AAN): The Quality Standards Subcommittee of the AAN published an evidence-based review: Practice parameter: early detection of dementia: mild cognitive impairment. The recommendations include (Petersen, et al., 2001):

- Neuropsychologic batteries are useful instruments in identifying patients with dementia, particularly when administered to an increased-risk (by virtue of memory impairment) population. Those neuropsychologic instruments that emphasize memory function are most useful.
- Interview-based techniques may be considered in identifying patients with dementia, particularly when administered to a population at increased risk of cognitive impairment.

In a practice parameter update on the evaluation and management of driving risk in dementia, the AAN states that there is insufficient evidence to recommend neuropsychological testing to predict driving capability among patients with dementia (Iverson et al. 2010).

American Psychiatric Association: The American Psychiatric Association published practice guidelines for the psychiatric evaluation of adults. The following notations were made in the guidelines regarding neuropsychological testing (American Psychiatric Association, 2006/2011):

- The testing has a broad range of application, but the decision to order neuropsychological testing for an individual patient remains a matter of clinical judgment.
- The testing may be requested when cognitive deficits are suspected or there is a need to grade for severity or progression of deficits over time.
- The testing can be helpful in distinguishing between cognitive disorders and malingering or factitious disorders. When patients present later in life with the new onset of psychosis or mood disorder accompanied by cognitive deficits, neuropsychological testing may also be helpful in distinguishing dementia from other psychiatric syndromes.

The American Psychiatric Association published practice guidelines for treatment of patients with Alzheimer's Disease and other dementias (American Psychiatric Association, 2007). The guidelines note that:

- Neuropsychological testing may help in deciding whether a patient with subtle or atypical symptoms actually has dementia as well as in more thoroughly characterizing an unusual symptom picture.
- Testing may help to characterize the extent of cognitive impairment, to distinguish among the types of dementias, and to establish baseline cognitive function.
- Testing may also help identify strengths and weaknesses that could guide expectations for the patient, direct interventions to improve overall function, assist with communication, and inform capacity determinations.

The guidelines notes that mild cognitive impairment is a term used to represent a variety of mild cognitive syndromes manifested by a modest but detectable decline in cognitive function in the setting of largely intact functional status (American Psychiatric Association, 2007). There are a variety of research definitions for mild cognitive impairment, but there is no consensus on the optimal definition. The most widely accepted definition requires the following:

- subjective cognitive complaints
- evidence of objective deficits in cognitive function based on age- and education-adjusted norms on standardized neuropsychological tests
- intact daily functioning,

- evidence of cognitive decline from a prior level
- evidence of not meeting the criteria for dementia

The American Psychiatric Association's position statement on HIV-related neuropsychiatric findings and associated impairments (American Psychiatric Association, 2003), notes that, "Psychiatrists should be aware of the neuropsychological manifestations of HIV and the importance of providing patients with or referring patients for further assessment and treatment when patients show signs of clinically significant neuropsychological impairment."

American Psychological Association: the American Psychological Association published updated guidelines for the evaluation of dementia and age-related cognitive change (American Psychological Association, 2011). The guidelines include the following regarding neuropsychological testing for this condition:

- Neuropsychological evaluation and cognitive testing remain among the most effective differential diagnostic methods in discriminating pathophysiological dementia from age-related cognitive decline, cognitive difficulties that are depression-related, and other related disorders
- Comprehensive neuropsychological evaluations for dementia and cognitive change include tests of multiple cognitive domains, typically including memory, attention, perceptual and motor skills, language, visuospatial abilities, reasoning, and executive functions. Measures of mood and personality may be relevant in many cases. Psychologists are encouraged to refer to current compendia resources and the clinical research literature in selecting assessment instruments.
- Technology assisted assessments (e.g., computer administered cognitive batteries, tele-health visits) are rapidly advancing but appropriate psychometric properties and normative data are nascent. These technologies may have significant advantages for older persons with limited mobility or health-care access, but may also disadvantage older persons with limited experience and expertise interacting with technology.
- Psychologists are encouraged to use standardized, reliable, and valid tests. Whether traditional or technology-assisted, appropriate tests have normative data for the age range of the person being assessed and are suitable for the individual's ethnicity, race, and educational background. In particular, the positive and negative predictive values of the instruments are considered when selecting tests for dementia, cognitive impairment, and age-related cognitive change. Furthermore, testing instruments should be sensitive to subtle changes in cognitive function over time.

European Federation of Neurological Societies (EFNS): The EFNS published guidelines for the diagnosis and management of Alzheimer's disease (Hort, et al., 2010). The guidelines note that, "Quantitative neuropsychological testing should be made in patients with questionable or very early Alzheimer's disease (AD)" (Level B).

Level B rating: (established as probably useful/predictive or not useful/predictive) requires at least one convincing class II study or overwhelming class III evidence.

International Society for Hepatic Encephalopathy and Nitrogen Metabolism (ISHEN): A guideline prepared by the Commission on Neuropsychological Assessment of Hepatic Encephalopathy appointed by the ISHEN states that neuropsychological testing is an established methodology for quantifying cognitive impairment due to various forms of encephalopathy, including low-grade or minimal hepatic encephalopathy (Randolph, 2009).

National Institute for Health and Clinical Excellence (NICE) (United Kingdom [UK]): NICE published clinical guidelines for diagnosis and management of the epilepsies in adults and children (2012). Regarding neuropsychological assessment, the guidelines note that

- Neuropsychological assessment should be considered in children, young people and adults in whom it is important to evaluate learning disabilities and cognitive dysfunction, particularly in regard to language and memory.
- Referral for a neuropsychological assessment is indicated:
  - when a child, young person or adult with epilepsy is having educational or occupational difficulties
  - when an MRI has identified abnormalities in cognitively important brain regions
  - when a child, young person or adult complains of memory or other cognitive deficits and/or cognitive decline

NICE published guidelines for dementia (2012). The guidelines note, “Formal neuropsychological testing should form part of the assessment in cases of mild or questionable dementia.”

U.S. Preventive Services Task Force (USPSTF): The USPSTF published a statement regarding screening for dementia. The statement concluded that the evidence is insufficient to recommend for or against routine screening for dementia in older adults (USPSTF, 2003).

Summary
Neuropsychological testing is used to assess cognitive function and to quantify the neurocognitive effects of various medical disorders and/or head trauma-related conditions. Though neuropsychological testing is not a diagnostic tool when used alone, it may assist the clinician in diagnosing certain conditions, such as dementia. Testing may also help to develop learning and training programs based on impairment, predict the level of potential remediation, and may be used to make placement decisions. It has not otherwise been shown to be effective to guide treatment or monitor treatment progress. The clinical utility of traditional or computerized neuropsychological testing in concussion, including sports related concussion, is unproven. The published literature generally addresses the use of computerized testing for baseline and post injury assessment for sport-related concussion to aid in return to play decisions. The evidence is not of sufficient quantity and quality to demonstrate that its use adds incremental clinical value to clinical assessment.

Coding/Billing Information

Note: 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement
3) ICD-10-CM Diagnosis Codes are for informational purposes only and are not effective until 10/01/2014

Covered when medically necessary:

CPT®* Codes	Description
96116	Neurobehavioral status exam (clinical assessment of thinking, reasoning and judgment, eg, acquired knowledge, attention, language, memory, planning and problem solving, and visual spatial abilities), per hour of the psychologist’s or physician’s time, both the face-to-face time with the patient and time interpreting test results and preparing the report
96118	Neuropsychological testing (eg, Halstead-Reitan Neuropsychological Battery, Wechsler Memory Scales and Wisconsin Card Sorting Test), per hour of the psychologist’s or physician’s time, both face-to-face time administering tests to the patient and time interpreting these test results and preparing the report
96119	Neuropsychological testing (eg, Halstead-Reitan Neuropsychological Battery, Wechsler Memory Scales and Wisconsin Card Sorting Test), with qualified health care professional interpretation and report, administered by technician, per hour of technician time, face-to-face
96120	Neuropsychological testing (eg, Wisconsin Card Sorting Test), administered by a computer, with qualified health care professional interpretation and report

ICD-9-CM Diagnosis Codes	Description
013.60-013.66	Tuberculous encephalitis or myelitis
036.1	Meningococcal encephalitis
042	Human immunodeficiency virus [HIV] disease
046.0-046.9	Slow virus infections and prion diseases of central nervous system

048	Other enterovirus diseases of central nervous system
049.8	Other specified non-arthropod-borne viral diseases of central nervous system
049.9	Unspecified non-arthropod-borne viral diseases of central nervous system
054.3	Herpetic meningoencephalitis
056.01	Encephalomyelitis due to rubella
062.0-062.9	Mosquito-borne viral encephalitis
063.0-063.9	Tick-borne viral encephalitis
064	Viral encephalitis transmitted by other and unspecified arthropods
066.41	West-nile virus with encephalitis
072.2	Mumps encephalitis
080-088.9	Rickettsioses and other arthropod-borne diseases
090.41	Congenital syphilitic encephalitis
094.81	Syphilitis encephailitis
130.0	Meningoencephalitis due to toxoplasmosis
137.1	Late effects of central nervous system tuberculosis
138	Late effects of acute poliomyelitis
139.0	Late effects of viral encephalitis
191.0 – 191.9	Malignant neoplasm of brain
192.0 – 192.9	Malignant neoplasm of other and unspecified parts of nervous system
198.3	Secondary malignant neoplasm of other specified sites, brain and spinal cord
225.0	Benign neoplasm of brain and other parts of nervous system, brain
237.5	Neoplasm of uncertain behavior of endocrine gland and nervous system, brain and spinal cord
239.6	Neoplasm of unspecified nature, brain
290.0	Senile dementia, uncomplicated
290.10-290.13	Presenile dementia
290.20-290.21	Senile dementia with delusional or depressive features
290.3	Senile dementia with delirium
290.40-290.43	Vascular dementia
294.0	Amnestic disorder in conditions classified elsewhere
294.10	Dementia in conditions classified elsewhere without behavioral disturbance
294.11	Dementia in conditions classified elsewhere with behavioral disturbance
294.20	Dementia, unspecified, without behavioral disturbance
294.21	Dementia, unspecified, with behavioral disturbance
310.2	Postconcussion syndrome
310.89	Other specified nonpsychotic mental disorders following organic brain damage
320.0 – 320.9	Bacterial meningitis
323.01	Encephalitis and encephalomyelitis in viral diseases classified elsewhere
323.1	Encephalitis, myelitis, and encephalomyelitis in rickettsial diseases classified elsewhere
323.2	Encephalitis, myelitis and encephalomyelitis in protozoal diseases classified elsewhere
323.41	Other encephalitis and encephalomyelitis due to infection classified elsewhere
323.51	Encephalitis and encephalomyelitis following immunization procedures
323.62	Other postinfectious encephalitis and encephalomyelitis
323.71	Toxic encephalitis and encephalomyelitis
323.81	Other causes of encephalitis and encephalomyelitis
323.9	Unspecified cause of encephalitis, myelitis, and encephalomyelitis
331.0	Alzheimer’s disease
331.11	Pick’s disease
331.19	Other frontotemporal dementia
331.2	Senile degeneration of the brain
331.3	Communicating hydrocephalus

331.4	Obstructive hydrocephalus
331.6	Corticobasal degeneration
331.7	Cerebral degeneration in diseases classified elsewhere
331.81	Reye's syndrome
331.82	Dementia with Lewy bodies
331.89	Other cerebral degeneration
331.9	Cerebral degeneration, unspecified
332.0 – 332.1	Parkinson's disease
333.0	Other degenerative diseases of the basal ganglia
333.4	Huntington's chorea
333.5	Other choreas
340	Multiple sclerosis
341.8	Other demyelinating diseases of central nervous system
341.9	Unspecified demyelinating disease of central nervous system
345.00-345.91	Epilepsy and recurrent seizures
348.1	Anoxic brain damage
348.30	Encephalopathy, unspecified
348.39	Other encephalopathy
349.9	Unspecified disorders of nervous system
430	Subarachnoid hemorrhage
431	Intracerebral hemorrhage
432.0-432.9	Other and unspecified intracranial hemorrhage
434.01	Occlusion of cerebral arteries, cerebral thrombosis with cerebral infarction
434.11	Occlusion of cerebral arteries, cerebral embolism with cerebral infarction
434.91	Occlusion of cerebral arteries, cerebral artery occlusion, unspecified with cerebral infarction
438.0	Late effects of cerebrovascular disease; cognitive deficits
438.89	Other late effects of cerebrovascular disease
742.9	Unspecified anomaly of brain, spinal cord, and nervous system
747.81	Congenital anomalies of cerebrovascular system
780.33	Post traumatic seizures
780.39	Other convulsions
780.93	Other general symptoms, memory loss
799.01	Other ill-defined and unknown causes of morbidity and mortality; asphyxia
799.02	Other ill-defined and unknown causes of morbidity and mortality; hypoxemia
800.10-800.49†	Fracture of vault of skull, closed
800.60-800.99†	Fracture of vault of skull, open
801.10-801.49†	Fracture of base of skull, closed
801.60-801.99†	Fracture of base of skull, open
803.10-803.49†	Other and unqualified skull fracture, closed
803.60-803.99†	Other and unqualified skull fracture, open
804.10-804.49†	Multiple fractures involving skull or face with other bones, closed
804.60-804.99†	Multiple fractures involving skull or face with other bones, open
851.00-851.99†	Cerebral laceration and contusion
852.00-852.59†	Subarachnoid, subdural, and extradural hemorrhage, following injury

853.00-853.19†	Other and unspecified intracranial hemorrhage following injury
854.00 – 854.19†	Intracranial injury of other and unspecified nature
907.0	Late effect of intracranial injury without mention of skull fracture
909.2	Late effects of radiation
990	Effects of radiation, unspecified
997.01	Central nervous system complication
997.02	Iatrogenic cerebrovascular infarction or hemorrhage

†**Note: Coverage will not be provided for any diagnosis in this range that is reported with a fifth digit of "5" (with prolonged [more than 24 hours] loss of consciousness, without return to pre-existing conscious level).**

ICD-10-CM Diagnosis Codes (Effective 10/01/14)	Description
A17.82	Tuberculous meningoencephalitis
A17.83	Tuberculous neuritis
A39.81	Meningococcal encephalitis
A44.0-A44.9	Systemic bartonellosis
A50.42	Late congenital syphilitic encephalitis
A52.14	Late syphilitic encephalitis
A75.0-A75.9	Typhus fever
A77.0-A77.9	Spotted fever (tick-borne rickettsioses)
A78	Q fever
A79.0 – A79.9	Other rickettsioses
A81.00-A81.9	Atypical virus infections of the central nervous system caused by prions
A83.0-A83.9	Mosquito-borne viral encephalitis
A84.0-A84.9	Tick-borne viral encephalitis
A85.0-A85.8	Other viral encephalitis, not elsewhere classified
A86	Unspecified viral encephalitis
A88.0	Enteroviral exanthematous fever [Boston exanthem]
A88.8	Other specified viral infections of central nervous system
A89	Unspecified viral infection of central nervous system
A92.31	West Nile virus infection with encephalitis
B00.4	Herpesviral encephalitis
B06.01	Rubella encephalitis
B20	Human immunodeficiency virus [HIV] disease
B26.2	Mumps encephalitis
B50.0-B50.9	Plasmodium falciparum malaria
B51.0-B51.9	Plasmodium vivax malaria
B52.0-B52.9	Plasmodium malariae malaria
B53.0	Plasmodium ovale malaria
B53.1	Malaria due to simian plasmodia
B53.8	Other malaria, not elsewhere classified
B54	Unspecified malaria
B55.0-B55.9	Leishmaniasis
B56.0-B56.9	African trypanosomiasis
B57.40-B57.49	Chagas' disease (chronic) with nervous system involvement
B58.2	Toxoplasma meningoencephalitis

B60.0	Babesiosis
B60.8	Other specified protozoal diseases
B64	Unspecified protozoal disease
B90.0	Sequelae of central nervous system tuberculosis
B91	Sequelae of poliomyelitis
B94.1	Sequelae of viral encephalitis
C70.0-C70.9	Malignant neoplasm of meninges
C71.0-C71.9	Malignant neoplasm of brain
C72.0-C72.9	Malignant neoplasm of spinal cord, cranial nerves and other parts of central nervous system
C79.31	Secondary malignant neoplasm of brain
C79.32	Secondary malignant neoplasm of cerebral meninges
D33.0-D33.9	Benign neoplasm of brain and other parts of central nervous system
D42.0	Neoplasm of uncertain behavior of cerebral meninges
D43.0-D43.9	Neoplasm of uncertain behavior of brain and central nervous system
D49.6	Neoplasm of unspecified behavior of brain
F01.50-F01.51	Vascular dementia
F02.80-F02.81	Dementia in other diseases classified elsewhere
F03.90-F03.91	Unspecified dementia
F04	Amnestic disorder due to known physiological condition
F07.81	Postconcussional syndrome
F07.89	Other personality and behavioral disorders due to known physiological condition
G00.0-G09	Bacterial meningitis, not elsewhere classified
G10	Huntington's disease
G13.8	Systemic atrophy primarily affecting central nervous system in other diseases classified elsewhere
G14	Postpolio syndrome
G20	Parkinson's disease
G21.11	Neuroleptic induced parkinsonism
G21.9	Other drug induced secondary parkinsonism
G21.2	Secondary parkinsonism due to other external agents
G21.3	Postencephalitic parkinsonism
G21.4	Vascular parkinsonism
G21.8	Other secondary parkinsonism
G21.9	Secondary parkinsonism, unspecified
G23.0	Hallervorden-Spatz disease
G23.1	Progressive supranuclear ophthalmoplegia [Steele-Richardson-Olszewski]
G23.2	Striatonigral degeneration
G23.8	Other specified degenerative diseases of basal ganglia
G23.9	Degenerative disease of basal ganglia, unspecified
G30.0-G30.9	Alzheimer's disease
G31.01	Pick's disease
G31.09	Other frontotemporal dementia
G31.1	Senile degeneration of brain, not elsewhere classified
G31.2	Degeneration of nervous system due to alcohol
G31.83	Dementia with Lewy bodies
G31.89	Other specified degenerative diseases of nervous system
G31.9	Degenerative disease of nervous system, unspecified
G35	Multiple sclerosis
G36.1	Acute and subacute hemorrhagic leukoencephalitis [Hurst]
G36.8	Other specified acute disseminated demyelination
G36.9	Acute disseminated demyelination, unspecified

G37.0	Diffuse sclerosis of central nervous system
G37.1	Central demyelination of corpus callosum
G37.2	Central pontine myelinolysis
G37.4	Subacute necrotizing myelitis of central nervous system
G37.8	Other specified demyelinating diseases of central nervous system
G37.9	Demyelinating disease of central nervous system, unspecified
G40.001-G40.019	Localization-related (focal) (partial) idiopathic epilepsy and epileptic syndromes with seizures of localized onset
G40.101-G40.119	Localization-related (focal) (partial) symptomatic epilepsy and epileptic syndromes with simple partial seizures
G40.201-G40.219	Localization-related (focal) (partial) symptomatic epilepsy and epileptic syndromes with complex partial seizures
G40.301-G40.319	Generalized idiopathic epilepsy and epileptic syndromes
G40.A01-G40.A19	Absence epileptic syndrome
G40.401-G40.419	Other generalized epilepsy and epileptic syndromes
G40.501-G40.509	Epileptic seizures related to external causes
G40.801-G40.804	Other epilepsy
G40.811-G40.814	Lennox-Gastaut syndrome
G40.89	Other seizures
G40.901-G40.919	Epilepsy, unspecified
G91.1	Obstructive hydrocephalus
G91.3	Post-traumatic hydrocephalus, unspecified
G91.4	Hydrocephalus in diseases classified elsewhere
G91.8	Other hydrocephalus
G91.9	Hydrocephalus, unspecified
G92	Toxic encephalopathy
G93.1	Anoxic brain damage, not elsewhere classified
G93.40	Encephalopathy, unspecified
G93.49	Other encephalopathy
G93.7	Reye's syndrome
G94	Other disorders of brain in diseases classified elsewhere
G96.9	Disorder of central nervous system, unspecified
G97.2	Intracranial hypotension following ventricular shunting
G97.31-G97.32	Intraoperative hemorrhage and hematoma of a nervous system organ or structure complicating a procedure
G97.81	Other intraoperative complications of nervous system
G97.82	Other postprocedural complications and disorders of nervous system
I60.00-I60.9	Nontraumatic subarachnoid hemorrhage
I61.0-I61.9	Nontraumatic intracerebral hemorrhage
I62.00-I62.9	Nontraumatic intracranial hemorrhage
I63.00-I63.9	Cerebral infarction
I67.3	Progressive vascular leukoencephalopathy
I69.01	Cognitive deficits following nontraumatic subarachnoid hemorrhage
I69.11	Cognitive deficits following nontraumatic intracerebral hemorrhage
I69.21	Cognitive deficits following other nontraumatic intracranial hemorrhage
I69.31	Cognitive deficits following cerebral infarction
I69.81	Cognitive deficits following other cerebrovascular disease
I69.91	Cognitive deficits following unspecified cerebrovascular disease
I97.810-	Intraoperative cerebrovascular infarction during surgery

I97.811	
I97.820-I97.821	Postprocedural cerebrovascular infarction during surgery
Q04.9	Congenital malformation of brain, unspecified
Q06.9	Congenital malformation of spinal cord, unspecified
Q07.9	Congenital malformation of nervous system, unspecified
Q28.2	Arteriovenous malformation of cerebral vessels
Q28.3	Other malformations of cerebral vessels
R09.01	Asphyxia
R09.02	Hypoxemia
R41.1	Anterograde amnesia
R41.2	Retrograde amnesia
R41.3	Other amnesia
R56.1	Post traumatic seizures
R56.9	Unspecified convulsions
S06.1X1S	Traumatic cerebral edema with loss of consciousness of 30 minutes or less, sequela
S06.1X2S	Traumatic cerebral edema with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.1X3S	Traumatic cerebral edema with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.1X4S	Traumatic cerebral edema with loss of consciousness of 6 hours to 24 hours, sequela
S06.1X5S	Traumatic cerebral edema with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.1X6S	Traumatic cerebral edema with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.1X9S	Traumatic cerebral edema with loss of consciousness of any duration, sequela
S06.2X1S	Diffuse traumatic brain injury with loss of consciousness of 30 minutes or less, sequela
S06.2X2S	Diffuse traumatic brain injury with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.2X3S	Diffuse traumatic brain injury with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.2X4S	Diffuse traumatic brain injury with loss of consciousness of 6 hours to 24 hours, sequela
S06.2X5S	Diffuse traumatic brain injury with loss of consciousness greater than 24 hours with return to pre-existing consciousness levels, sequela
S06.2X6S	Diffuse traumatic brain injury with loss of consciousness greater than 24 hours without return to pre-existing consciousness levels, sequela
S06.2X9S	Diffuse traumatic brain injury with loss of consciousness of unspecified duration, sequela
S06.301S	Unspecified focal traumatic brain injury with loss of consciousness of 30 minutes or less, sequela
S06.302S	Unspecified focal traumatic brain injury with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.303S	Unspecified focal traumatic brain injury with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.304S	Unspecified focal traumatic brain injury with loss of consciousness of 6 hours to 24 hours, sequela
S06.305S	Unspecified focal traumatic brain injury with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.306S	Unspecified focal traumatic brain injury with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.309S	Unspecified focal traumatic brain injury with loss of consciousness of unspecified

	duration, sequela
S06.311S	Contusion and laceration of right cerebrum with loss of consciousness of 30 minutes or less, sequela
S06.312S	Contusion and laceration of right cerebrum with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.313S	Contusion and laceration of right cerebrum with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.314S	Contusion and laceration of right cerebrum with loss of consciousness greater than 24 hours sequela
S06.315S	Contusion and laceration of right cerebrum with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.316S	Contusion and laceration of right cerebrum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.319S	Contusion and laceration of right cerebrum, with loss of consciousness of unspecified duration, sequela
S06.321S	Contusion and laceration of left cerebrum with loss of consciousness of 30 minutes or less, sequela
S06.322S	Contusion and laceration of left cerebrum with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.323S	Contusion and laceration of left cerebrum with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.324S	Contusion and laceration of left cerebrum with loss of consciousness greater than 24 hours sequela
S06.325S	Contusion and laceration of left cerebrum with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.326S	Contusion and laceration of left cerebrum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.329S	Contusion and laceration of left cerebrum, with loss of consciousness of unspecified duration, sequela
S06.331S	Contusion and laceration of cerebrum unspecified with loss of consciousness of 30 minutes or less, sequela
S06.332S	Contusion and laceration of cerebrum unspecified with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.333S	Contusion and laceration of cerebrum unspecified with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.334S	Contusion and laceration of cerebrum unspecified with loss of consciousness greater than 24 hours sequela
S06.335S	Contusion and laceration of cerebrum unspecified with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.336S	Traumatic hemorrhage of right cerebrum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.339S	Traumatic hemorrhage of right cerebrum, with loss of consciousness of unspecified duration, sequela
S06.341S	Traumatic hemorrhage of right cerebrum with loss of consciousness of 30 minutes or less, sequela
S06.342S	Traumatic hemorrhage of right cerebrum with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.343S	Traumatic hemorrhage of right cerebrum with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.344S	Traumatic hemorrhage of right cerebrum with loss of consciousness greater than 24 hours sequela
S06.345S	Traumatic hemorrhage of right cerebrum with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela

S06.346S	Traumatic hemorrhage of right cerebrum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.349S	Traumatic hemorrhage of right cerebrum with loss of consciousness of unspecified duration, sequela
S06.351S	Traumatic hemorrhage of left cerebrum with loss of consciousness of 30 minutes or less, sequela
S06.352S	Traumatic hemorrhage of left cerebrum with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.353S	Traumatic hemorrhage of left cerebrum with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.354S	Traumatic hemorrhage of left cerebrum with loss of consciousness greater than 24 hours sequela
S06.355S	Traumatic hemorrhage of left cerebrum with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.356S	Traumatic hemorrhage of left cerebrum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.359S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness of unspecified duration, sequela
S06.361S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness of 30 minutes or less, sequela
S06.362S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.363S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.364S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness greater than 24 hours sequela
S06.365S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.366S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.369S	Traumatic hemorrhage of cerebrum, unspecified with loss of consciousness of unspecified duration, sequela
S06.371S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness of 30 minutes or less, sequela
S06.372S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.373S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.374S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness greater than 24 hours sequela
S06.375S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.376S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.379S	Contusion, laceration and hemorrhage of cerebellum with loss of consciousness of unspecified duration, sequela
S06.381S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness of 30 minutes or less, sequela
S06.382S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.383S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.384S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness

	greater than 24 hours sequela
S06.385S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.386S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.389S	Contusion, laceration and hemorrhage of brainstem with loss of consciousness of unspecified duration, sequela
S06.4X1S	Epidural hemorrhage with loss of consciousness of 30 minutes or less, sequela
S06.4X2S	Epidural hemorrhage with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.4X3S	Epidural hemorrhage with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.4X4S	Epidural hemorrhage with loss of consciousness greater than 24 hours sequela
S06.4X5S	Epidural hemorrhage with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.4X6S	Epidural hemorrhage with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.4X9S	Epidural hemorrhage with loss of consciousness of unspecified duration, sequela
S06.5X1S	Traumatic subdural hemorrhage with loss of consciousness of 30 minutes or less, sequela
S06.5X2S	Traumatic subdural hemorrhage with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.5X3S	Traumatic subdural hemorrhage with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.5X4S	Traumatic subdural hemorrhage with loss of consciousness greater than 24 hours sequela
S06.5X5S	Traumatic subdural hemorrhage with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.5X6S	Traumatic subdural hemorrhage with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.5X9S	Traumatic subdural hemorrhage with loss of consciousness of unspecified duration, sequela
S06.6X1S	Traumatic subarachnoid hemorrhage with loss of consciousness of 30 minutes or less, sequela
S06.6X2S	Traumatic subarachnoid hemorrhage with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.6X3S	Traumatic subarachnoid hemorrhage with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.6X4S	Traumatic subarachnoid hemorrhage with loss of consciousness greater than 24 hours sequela
S06.6X5S	Traumatic subarachnoid hemorrhage with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.6X6S	Traumatic subarachnoid hemorrhage with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.6X9S	Traumatic subarachnoid hemorrhage with loss of consciousness of unspecified duration, sequela
S06.811S	Other specified intracranial injuries with loss of consciousness of 30 minutes or less, sequela
S06.812S	Other specified intracranial injuries with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.813S	Other specified intracranial injuries with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.814S	Other specified intracranial injuries with loss of consciousness greater than 24 hours sequela

S06.815S	Other specified intracranial injuries with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.816S	Other specified intracranial injuries with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.819S	Unspecified intracranial injuries with loss of consciousness of unspecified duration, sequela
S06.9X1S	Unspecified intracranial injury with loss of consciousness of 30 minutes or less, sequela
S06.9X2S	Unspecified intracranial injury with loss of consciousness of 31 minutes to 59 minutes, sequela
S06.9X3S	Unspecified intracranial injury with loss of consciousness of 1 hour to 5 hours 59 minutes, sequela
S06.9X4S	Unspecified intracranial injury with loss of consciousness greater than 24 hours sequela
S06.9X5S	Unspecified intracranial injury with loss of consciousness greater than 24 hours with return to pre-existing consciousness level, sequela
S06.9X6S	Unspecified intracranial injury with loss of consciousness greater than 24 hours without return to pre-existing consciousness level with patient surviving, sequela
S06.9X9s	Unspecified intracranial injury with loss of consciousness of unspecified duration, sequela
T66.XXXS	Radiation sickness, unspecified

Educational in Nature/Not Medically Necessary/Not Covered:

ICD-9-CM Diagnosis Codes	**Description**
	All other codes

ICD-10-CM Diagnosis Codes (Effective 10/01/2014)	**Description**
	All other codes

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