CNS Vital Signs Advancing Occupational Care

Adding Value to Your Practice by Providing Solutions for Measuring, Monitoring and Managing Neurocognitive and Behavioral Health...

www.CNSVS.com
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The following pages have been assembled from various sources and publications and is meant to be a reference or roadmap guide to assist and inform how CNS Vital Signs can be used to improve clinical insight and care management, enable current guidelines, be integrated into a clinic or practice, and help improved practice revenues and performance.
Why CNS Vital Signs?

CNS Vital Signs valid, reliable, and affordable
‘research quality’ NEUROCOGNITIVE & BEHAVIORAL HEALTH assessment platform can be easily configured and deployed depending on each practices or researchers needs and goals. The CNS Vital Signs assessment platforms helps to support a practices comprehensive, state-of-the-art clinical assessment, and evidence-based treatment services for children, adolescents, and adults across the lifespan by:

- Accurately measuring and characterizing a patient’s neurocognitive function based on his or her status or effort
- Facilitating the thinking about the patient’s condition (50+ well known medical and health rating scales) and helping to explain the patient’s current difficulties
- Optimizing serial administration which helps to monitor and guide effective intervention.
- Systematically collecting brain function, behavioral, symptom, and comorbidity data enabling outcomes and evidence-based medicine

Enhanced Brain & Behavior Evaluation and Care Management

OBJECTIVE, PRECISE, and STANDARDIZED... Customizable Toolboxes or Test Panels Supporting many Neurological, Psychiatric, & Psychological Clinical Guidelines

Extend Practice Efficiency

Objective and Evidence-Based Assessments, Auto-Scored and Systematically Documented. (HIPAA Enabled)

Enhanced Revenue Streams

Expanded Services with Well Established Billing Codes to Improve Practice Referrals and Performance
Why CNS Vital Signs? 
Cognition & Occupational Medicine

About MENTAL CAPITAL...
- Well Done Comprehensive Report
- 450 World-Wide Experts
- Cognition Is a Central Factor

‘Mental capital’ refers to a person’s COGNITIVE and emotional resources. It includes the brain’s ability to process information (learning and thinking) but also includes emotional intelligence – interacting with others and resilience in the face of stress.

What’s at STAKE?
- Individual and Companies Positive Performance
- Society’s Positive Performance
- Advancing Mental Capital (Nation and Company)

Adapted from: Huppert et.al. The Science of Well-being.

Shifting the mean of the population may have a substantial impact on the tails e.g. increasing a flourishing staff or population.
The following applications for CNS Vital Signs are appropriate for occupational health and safety:

1. Rapid detection of mild cognitive dysfunction; e.g., TBI, AD/HD, MS, Early Dementia.
2. Evaluation for cognitive effects of medications & substance abuse.
3. Evaluation for alcoholism and/or illicit drugs.
4. Tracking recovery; e.g., from brain injury or stroke.
5. Fitness to drive or to undertake hazardous duties.
6. Cognitive baseline as part of a routine annual examination.

In these clinical applications, CNS Vital Signs has two functions. One is to serve as a “Brief-Core” assessment instrument, to detect impairments that may not otherwise be apparent. The second is to augment data generated from the clinical history, the examination and other psychological tests.

It is important to emphasize that, like every other medical or psychological test, CNS Vital Signs does not stand by itself. It is not a diagnostic test. It generates data that are reliable and accurate; that is all. Vital Signs data require interpretation by knowledgeable and experienced clinicians. The test is only as good as the clinician who interprets it. Ancillary information is always necessary to make sense of CNS Vital Signs data.
CNS Vital Signs in Occupational Care

CNS Vital Signs provides clinicians and researchers with leading edge neurocognitive and behavioral health assessment technologies that efficiently collects valid and reliable brain & behavioral clinical endpoints for a more objective view of a patient’s functional status, disease progression, and outcomes. The CNS Vital Signs Assessment platform supports a lifespan care model and helps enable productive interactions between the family, caregivers, and a practice team.

CNS Vital Signs is a clinical procedure that utilizes scientifically validated objective tests to evaluate the neurocognitive status of patients and covers a range of mental processes from simple motor performance, attention and memory, to executive functions. The CNS Vital Signs tests are computerized versions of well established neuropsychological tests. Medical professionals and researchers know that good health has many dimensions, one of the most important and yet least measured is the health of a person's brain. Outcomes based medicine seeks a quantitative estimate of the effect of impairment or disease and the effectiveness and efficiency of treatment. CNS Vital Signs provides a standardized and quantitative view of your patient’s CORE COGNITIVE FUNCTION.

CNS Vital Signs computerized neuropsychological tests can enhance efficiency and insight in assessing cognitive status and the difference between “normal performance” and a patients current status and provides the clinician with a normative comparison that can be paired with an interview, exam, and other valid test(s) or rating scales to help add validity to the evaluation and management of Occupational Health patients. Re-evaluation or serial testing with CNS Vital Signs supports effective patient management and tailoring of treatments e.g., medications and assessment of outcomes. A very detailed assessment of abilities is auto-scored, and the pattern of strengths and weaknesses can be used in treatment planning and measuring progress.

One of the most robust features of the CNS Vital Signs assessment is its randomization algorithm allowing for an almost infinite number of alternate forms. This allows for retesting patients and minimal practice effects. Clinicians establish a baseline and upon re-test, compare the results to assist in decision-making regarding the observed change in the patient’s condition, monitor disease or recovery progress, measure treatment results, compliance, and outcomes e.g., Therapy Management, Medication Optimization , Etc. Often Patients and families benefit from seeing testing results allowing the understanding of the status and nature of their or a loved one’s neurocognitive function. CNS Vital Signs is one of many tools clinicians use in evaluating changes in a patient’s condition.

If you have question or would like to register for a free in-service webinar go to www.CNSVS.com or email support@cnsvs.com or call 1.888.750.6941.
About CNS Vital Signs?

Assessing Brain Function: CNS Vital Signs is a clinical testing procedure used by clinicians to evaluate and manage the neurocognitive state of a patient. Across the lifetime, serial testing allows ongoing assessments of a patient’s condition, disease progression, or clinical outcome.

About CNS Vital Signs

Both Valid & Reliable Neurocognitive Testing and Evidence-Based Symptom & Functional Ratings Scales in one Platform

Optimized for...

- **MULTI-MODAL Assessment** enabling the efficient collection and systematic documentation of important brain function and behavioral, symptom and comorbid clinical endpoints
- **Lifespan Testing** - Rapid Neurocognitive Testing from ages 8 to 90
- **Longitudinal View** - CNS Vital Signs contains an Auto-Randomization Algorithm... Ideal for Serial Neurocognitive Testing with an almost unlimited number of alternate forms (others use a pseudo-randomization or limited number of alternate forms)
- **Flexible Deployment** - Easy Integration via Local Computer Software and Web-Based Testing Solutions... Ideal for busy clinics, hospitals, or academic research

Clinician Benefits

- **RAPID INSIGHT**... computerized neurocognitive testing helps clinicians evaluate and describe the health of the cognitive or higher functions of the brain in a more granular and standardized fashion.
- **DASHBOARD VIEW**... Neurocognitive domain functions and functional status is presented in a summary view that is easy to interpret.
- **LONGITUDINAL VIEW**... Repeated testing allows clinicians to track disease progress and treatment/rehabilitation effects
- **DETAILED VIEW**... Each report presents the testing data in a detailed view. All results can be easily exported to EMR’s or spreadsheets for clinical or research purposes.
- **VALID ACROSS the LIFE SPAN**... Peer reviewed normative data allows clinicians to examine patients from age 8 to 90.
Why Use CNS Vital Signs to Assess Occupational Health?

The CNS Vital Signs VSX Assessment Platform represents a legacy of innovation and a commitment to advancing neurocognitive and behavioral clinical assessment tools.

**Clinical Pathology**
*Measure and Monitor*

Assess BRAIN FUNCTION and Determine the Existence or Level of IMPAIRMENT...

CNS Vital Signs computerized neurocognitive testing allows clinicians to **assess abnormal neurocognitive impairment** by comparing patients to a ‘PEER REVIEWED’ normative data set from **ages 8 to 90** across the lifespan.

Provides a broad spectrum of clinical domains and the sensitivity to assess neurocognitive function to reveal abnormal cognitive function.

**Comorbid Status**
*Measure and Monitor*

Assess symptoms or COMORBID conditions...

Evidence-based rating scales and neurocognitive testing can help clinicians **sort out symptom, behavioral, and comorbid issues** and help better understand possible brain and behavior relationships.

**50+ Free Rating Scales:**
- SF – 36 Medical Outcomes
- Zung Self-Rating Anxiety and Depression Scales
- NeuroPsych Questionnaire NPQ-207 & NPQ-45 both Child & Adult

**Serial Assessment**
*Longitudinal View*

KEY ADVANTAGE

...contains an **auto-randomization algorithm**... Ideal for serial testing with an **almost unlimited number of alternate forms** (other systems use a pseudo-randomization or limited number of alternate forms).

This allows practices to shift toward new assessment approaches that allow for monitoring of change and the reinforcement of treatment compliance.
Mild cognitive impairment has been of major interest in the field of occupational medicine…

Solvent Toxicity and Cognition Impairment
William E. Morton, MD, DrPH

“Mild cognitive impairment has been of major interest in the field of occupational medicine since the documentation of some degree of organic cognitive impairment by neuropsychological testing. This testing has been the principal objective confirmation of disabilities in painters and other persons with significant unprotected exposures to organic solvents in whom chronic encephalopathy was suspected of developing. Typically, these affected persons will arrest their cognitive decline if the unprotected solvent exposures are avoided, and they may even manifest slight improvement with rehabilitation and attention to development of coping skills. Chronic alcoholism has a similar effect on the central nervous system, although the prospects for cessation of exposure and arrest of cognitive deterioration are not as good.”
Money Matters: Assessing for Malingering or Poor Effort

DSM-IV: Malingering criteria: The essential feature of Malingering is the intentional production of false or grossly exaggerated physical or psychological symptoms, motivated by external incentives such as avoiding military duty, avoiding work, obtaining financial compensation, evading criminal prosecution, or obtaining drugs. Under some circumstances, Malingering may represent adaptive behavior—for example, feigning illness while a captive of the enemy during wartime.


OBJECTIVE:
The authors evaluated the impact of financial incentives on disability, symptoms, and objective findings after closed-head injury.

METHOD:
Meta-analysis was used to review the literature. Seventeen reports, covering 18 study groups and a total of 2,353 subjects, contained data from which effect sizes could be calculated. Effect sizes were aggregated after weighting for group size. After discussion, there was 100% agreement between the authors on all calculations.

RESULTS:
A moderate overall effect size, 0.47, was found. The effect was particularly strong for mild head trauma. The data showed more abnormality and disability in patients with financial incentives despite less severe injuries.

CONCLUSIONS: Clinical evaluation of patients after closed-head injury, particularly mild head trauma, must include consideration of the effect of financial incentives on symptoms and disability.
Psychometric Tests like CNS Vital Signs can Assist in the Evaluation of Genuine and Exaggerated Complaints

Money matters: A meta-analytic review of the association between financial compensation and the experience and treatment of chronic pain.

Adapted from; Rohling ML et al.; Health Psychol. 1995 Nov;14(6):537-47.

Abstract
Meta-analytic procedures were used to determine the relation between disability compensation and pain. Of the 157 relevant identified studies, only 32 contained quantifiable data from treatment and control groups. The majority of these exclusively examined chronic low back pain patients (72%). Overall, 136 comparisons were obtained, on the basis of 3,802 pain patients and 3,849 controls. Liberal procedures for estimating effect sizes (ESs) yielded an ES of .60 (p < .0002). Conservative procedures yielded an ES of .48 (p < .0005). Both ESs differed from zero, indicating that compensation is related to increased reports of pain and decreased treatment efficacy. These results are interpreted in light of current models of pain. Health policy implications are also discussed.

CNS Vital Signs Embedded Validity Indicator helps clinicians evaluate if a complaint is correlated with function.
CNS Vital Signs Embedded Indicators of Valid Effort

NAN – National Academy of Neuropsychology 2011

EMBEDDED VALIDITY MEASURES FOR A COMPUTERIZED COGNITIVE TEST BATTERY
Rohling, M., Hill, B., Ploetz, D., Womble, M., Shenesey, J., & Drayer, K. L.
UNIVERSITY OF SOUTH ALABAMA

Purpose
Computerized cognitive test batteries are more often used by professional and collegiate athletes as well as the military. It is important to have a method to assess effort within the computerized test battery. This study focused on validating embedded symptom validity tests (SVTs) for a computerized cognitive test battery.

Method
Participants
- 136 undergraduate volunteers and 40 clinical cases. Male 76; Female 100.
- Subjects were randomly assigned to be either malingering simulators or controls. Subjects completed the Word Memory Test (WMT) and CNS Vital Signs (CNSVS) computerized cognitive test battery. The data from the 40 clinical cases who also completed the WMT and CNSVS were included in either the simulator or control group based on their WMT performance.

Procedure
- The following measures from the CNSVS were examined as embedded SVTs based on their ability to correctly classify an individual as either the malingering simulator or control group: Finger Tapping (Avg. for both hands < 30), Verbal Memory Imm. & Del. Correct Hits (< 8 correctly recognized), Visual Memory Imm. & Del Correct Hits (< 8 correctly recognized), & Reliable Digit Span (< 7).
- A logistic regression was also conducted using the raw scores of the domains assessed. This procedure was slightly more accurate than the embedded tests scores (88% vs 79%) and the remaining results are based on the logistic results.

Results
- The CNS-VS embedded SVTs correctly classified individuals to their known group 89% of the time (Sensitivity = 0.88; Specificity = 0.89; PPV = 0.90; NPV = 0.88).
- An ANOVA was conducted to examine the CNS-VS Neurocognitive Index (NCI) score between the known groups. A significant main effect was obtained; those in the genuine condition performed significantly better on the NCI than those in the malingering simulator condition (p < .0001).

Discussion
The embedded SVTs proposed in this study for the CNS-VS were able to accurately classify feigned versus genuine performance on this computerized test battery. These findings have particular relevance given the increasing use of computerized test batteries for baseline cognitive testing and return to play decisions after concussion.

ANOVA RESULTS OF CNS-VS EMBEDDED VALIDITY MEASURES USING PATIENT DATA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Genuine Mean</th>
<th>Frigned Mean</th>
<th>Overall P</th>
<th>Overall d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Test Battery Mean (OTBM)</td>
<td>M: 94.4</td>
<td>M: 10.5</td>
<td>p &lt; .0001</td>
<td>d: 0.94</td>
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<tr>
<td>Overall Test Battery Mean SD</td>
<td>M: 14.2</td>
<td>M: 5.8</td>
<td>p &lt; .0004</td>
<td>d: 1.07</td>
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ANOVA RESULTS OF CNS-VS EMBEDDED VALIDITY MEASURES USING ANALOG DATA

<table>
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<tr>
<th>Variable</th>
<th>Genuine Mean</th>
<th>Frigned Mean</th>
<th>Overall P</th>
<th>Overall d</th>
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</thead>
<tbody>
<tr>
<td>Overall Test Battery Mean (OTBM)</td>
<td>M: 98.6</td>
<td>M: 11.7</td>
<td>p &lt; .0001</td>
<td>d: 2.6</td>
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<tr>
<td>Overall Test Battery Mean SD</td>
<td>M: 14.1</td>
<td>M: 6.3</td>
<td>p &lt; .0002</td>
<td>d: 1.3</td>
</tr>
</tbody>
</table>

NOTE: Numbers in italics and underlined are used for the overall effect size calculation.

Solutions for Measuring, Monitoring, and Managing Neurocognitive and Behavioral Health
Cognitive problems:
Neuropsychological studies have provided evidence of disease-based cognitive loss in a substantial number of people with MS, possibly more than 60%. Symptoms of cognitive loss may include short-term memory problems, difficulty with attention and concentration, slowed processing of information, impaired executive functions (e.g., reasoning, problem solving, planning and sequencing and impaired word-finding).

Without appropriate testing and assessment, cognitive deficits may go undetected by health care professionals, and are a primary cause of early departure from the workforce. People with MS who experience cognitive changes may be in denial and/or lose self-esteem and self-confidence.

Cognitive Symptoms*
- Memory impairment
- Impaired attention/concentration
- Slowed processing speed
- Impaired executive functions
- Impaired spatial relations
- Impaired word-finding ability
* Note: Cognitive deficits are often missed in a standard neurologic exam.

Psychosocial Implications
Individual: denial; anxiety; loss of self-esteem/self-confidence; depression; may interfere with self-care and independence.
Interpersonal: family strain; marital strain; impaired communication; role shifts within the family
Employment: major cause of high unemployment rate in people with MS
Healthcare: may affect communication with providers and compliance with treatment
Why CNS Vital Signs in Occupational Care?
Benefits for Occupational Health: MS Example

**Assessment and Management of Cognitive Impairment in Multiple Sclerosis**
- Cognitive deficits appear to be present in more than half of MS patients, however the majority of persons with MS do not have impairments that significantly impair daily functioning.
- Learning/memory, speed of information processing, working memory, cognitive flexibility and other executive functions appear to be most commonly impaired.
- *Periodic screening for such deficits is recommended.*
- Intervention for such deficits is recommended: Training in strategies to compensate for deficits, Counseling/psychotherapy for patients and family to address accompanying behavioral changes and emotional responses, and develop realistic expectations.
- Treatment with medications (disease-modifying and/or symptomatic therapies).

**Enhanced MS Evaluation, Management & Tracking Strategies**
- *CNS Vital Signs provides a valid, reliable and granular view of neurocognitive status.*
- **Efficient:** Reports are Auto-Scored in seconds and Screens for possible in-valid tests.
- **Multi-Modal Assessment platform** allowing for improved *Comorbid Symptom identification and management* e.g. Fatigue, Depression, Mood, Quality of Life / Outcomes, Etc.
- **Longitudinal reports** auto-generated to monitor and measure e.g. treatment outcomes.

**Increased Revenues**

*The standard for specific assessment of cognitive function in MS patients has been the comprehensive neuropsychological assessment. Adding CNS Vital Signs for the early detection, characterization, and monitoring of MS cognitive dysfunction progression should be part of routine care as an in-take baseline, as part of a full neuropsychological assessment and periodic retesting providing clinicians with a valid and reliable longitudinal view that can be beneficial both clinically and in counseling patients and working with family members.*
One of the most common observations reported by families of service members originally not diagnosed with mTBI, is that upon return from deployment, they “have changed.” Classic neurological and cognitive symptoms of mTBI that should be recognized and discussed with medical professionals include:

- Reduced reaction time
- Decision-making difficulties
- Decreased memory and forgetfulness
- Attention and concentration difficulties
- Confused about recent events
- Repeating of thoughts and questions
- Personality changes
- Impulsiveness
- Anger
- Sadness
- Depression
- Nervousness
- Changes in sleep patterns

Service members often overlook the symptoms of mTBI because: they don’t think that they are serious issues; they don’t want to admit to the injury to their peers; or they don’t have time to attend to these symptoms due to the fatigue and stress of a wartime environment.

Traumatic Brain Injury (TBI) Traumatic brain injury is a neurological injury with possible physical, cognitive, behavioral, and emotional symptoms. Like all injuries, TBI is most appropriately and accurately diagnosed as soon as possible after the injury. TBI is not a mental health condition. The range of TBI includes mild, moderate, severe, and penetrating. Well after the injury event, Soldiers may have residual symptoms from a TBI and new or emerging PTSD symptoms. If the TBI has not been previously identified or documented, an accurate description of the traumatic events in theater usually allows a well-trained clinician to make a distinction between TBI and PTSD or other mental health conditions.
Federal Motor Carrier Safety Regulations Guidelines
Qualifications for drivers.


49 CFR 391.41(b)(9) Has no mental, nervous, organic, or functional disease or psychiatric disorder likely to interfere with his/her ability to drive a commercial motor vehicle safely;

Federal Motor Carrier Safety Regulations (FMCSRs)

Relevance to Driving

Safe and effective operation of a commercial motor vehicle (CMV) requires high levels of physical strength, skill, and coordination as well as the ability to maintain adequate attention and react promptly and appropriately to traffic, emergency situations, and other job-related stressors. Some psychological or personality disorders can directly affect memory, reasoning, attention, and judgment. Somatic and psychosomatic complaints should be thoroughly examined when determining overall fitness to drive. Disorders of a periodically incapacitating nature, even in the early stages of development, may warrant disqualification.

Risk factors associated with personality disorders can interfere with driving ability by compromising:

- Attention, concentration, or memory affecting information processing and the ability to remain vigilant to the surrounding traffic and environment.
- Visual-spatial function (e.g., motor response latency).
- Impulse control, including the degree of risk taking.
- Judgment, including the ability to predict and anticipate.
- Ability to problem solve (i.e., executive functioning), including the ability to respond to simultaneous stimuli in a changing environment when potentially dangerous situations could exist.

Commercial motor vehicle (CMV) drivers must be able to sustain vigilance and attention for extended periods in all types of traffic, road, and weather conditions. Neurological demands of driving include:

Cognitive demands: Sustained vigilance and attention, Quick reactions, Communication skills, Appropriate behavior.

How CNS Vital Signs can help.

Federal Motor Carrier Safety Regulations Guidelines

Physical qualifications for drivers.

(9) Has no mental, nervous, organic, or functional disease or psychiatric disorder likely to interfere with his/her ability to drive a commercial motor vehicle safely;

(12)(i) Does not use any drug or substance identified in 21 CFR 1308.11 Schedule I, an amphetamine, a narcotic, or other habit-forming drug.
(ii) Does not use any non-Schedule I drug or substance that is identified in the other Schedules in 21 part 1308 except when the use is prescribed by a licensed medical practitioner, as defined in §382.107, who is familiar with the driver's medical history and has advised the driver that the substance will not adversely affect the driver's ability to safely operate a commercial motor vehicle.
(13) Has no current clinical diagnosis of alcoholism.

CNS Vital Signs Assessment Platform and Tests can add Validity, Reliability, and Efficiency to your Exams

Assessment of Fibromyalgia & Chronic Fatigue Syndrome: A New Protocol Designed to Determine Work Capability – Chronic Pain Abilities Determination (CPAD)


“Objective computerized neuro-cognitive testing are also utilized as an integral component of the assessment. All results are then subject to specific computerized analysis and compared to normative and standardized work-based databases. The designed system produces reliable, consistent and reproducible results. It also proves capable of detecting any inconsistencies in patient input and results, in addition to being independent of any possible assessor bias. A new protocol has been designed to determine the working capability of individuals who suffer from various chronic disabling conditions, and represents a significant step forward in a difficult but rapidly expanding area of medical practice.”

In addition to widespread pain and tender points, fibromyalgia is often associated with a wide range of other problems. These problems most commonly include anxiety, fatigue, cognitive and memory difficulties (“fibro fog”),10
“There was a clear difference between the performance-based and the patient-reported outcome measures of cognitive function in their ability to explain the variance in work output. The NCCG’s (control group) performance-based testing results were consistently related to work output whereas their self-report was not.”
Advancing Occupational Care Management
CNS Vital Signs Occupational Toolbox

**Clinician Expertise**

- Brain Function: Processing Speed, Memory, Attentional, Executive, Psychomotor Speed & more
- Behaviors, Symptoms, and Comorbidities

## Computerized Neurocognitive Testing

- Nine Neurocognitive Domains Measured
- Processing and Psychomotor Speed
- Frontal Lobe / Executive & Attentional Tests
- Recognition Memory – immediate and delayed recall
- Immediate Auto – Scored Reports
- Rapid Assessment – 30-45 Minute initial Assessment/Baseline, 15-45 Minute for monitoring
- Easy to interpret and longitudinally graph
- Systematic & Standardized Documentation for Patient Registry/Research
- HIPAA Compliant

## Computerized Medical and Health Rating Scales*

- SF – 36 Medical Outcomes
- NeuroPsych Questionnaires (In-take, Follow-up)
- Neurobehavioral Symptom Inventory
- Pain Catastrophizing Scale
- Drug Use Questionnaire
- Head Injury Questionnaire
- Adult AD/HD Rating Scale
- Zung Self-Rating Anxiety and Depression Scales
- Epworth Sleepiness
- Pittsburgh Sleep Quality Index

NOTE: Additional Paper based scales have been used successfully with the CNSVS tests.

* Used with permission... Free use of rating scales
The NCI is a summary score standardized to a mean of 100 and an SD of 15. TBI, traumatic brain injury. DEM, dementia. MCI, mild cognitive impairment. SCHIZ, schizophrenia. PCS, post-concussion syndrome. ADHD, attention deficit hyperactivity disorder. MDD, major depression. BPAD, bipolar affective disorder. MBI, mild brain injury.
Results: Utilizing data from all 42 patients together, there was a diffuse pattern of cognitive impairment compared to age-matched controls in all cognitive domains tested (p<0.02). However, when divided into high and low functioning groups, the high functioning group had a more specific cognitive pattern, with particular difficulties with complex information processing (symbol digit coding, shifting attention test) and working memory. The low functioning group continued to have a diffuse impairment pattern.

Conclusions/Relevance: With a cognitively high functioning group of RRMS patients with well controlled MS, a subcorticofrontal pattern emerges, with particular difficulties with complex information processing and working memory. The cognitive pattern is much more diffuse with the low functioning group, even after controlling for motor speed and overall reaction time. These results could help explain the variance in cognitive testing that can be seen in MS patients.

Adapted from: AAN 2009; Higher Cognitively Functioning Relapsing-Remitting Multiple Sclerosis Patients Have a More Specific Pattern of Impairment on Neuropsychological Testing Sandeep Vaishnavi, MD, PhD, John Barkenbus, MD, C. Thomas Gualtieri, MD; NC Neuropsychiatry; Raleigh & Charlotte, NC
## CNS Vital Signs Evidence-Based Rating Scales

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<td>Medical Outcomes Survey (MOS SF-36)</td>
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<td>NeuroPsych Questionnaire (NPQ 45)</td>
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<td>30</td>
<td><strong>Epworth Sleepiness Scale (ESS 8)</strong></td>
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<td>31</td>
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<td>Sedation Scale (SS) SF-1</td>
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<td>33</td>
<td>Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist</td>
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<td>Stanford Geriatric Depression Scale (SGDS 30)</td>
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<td>49</td>
<td>Stanford Geriatric Depression Scale (SGDS 15)</td>
</tr>
<tr>
<td>50</td>
<td>Memory Questionnaire (MEMQ 27)</td>
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</table>

### Defense & Veterans mTBI / Concussion Guidelines

- Solutions for Measuring, Monitoring, and Managing Neurocognitive and Behavioral Health
CNS Vital Signs Occupational Toolbox

MOS SF-36... Widely Used Measure

Physical Health
- Physical Function
- Role Function - Physical
- Pain
- General Health

Mental Health
- Role Function - Emotional
- Emotional Well-Being
- Social Function
- Energy / Vitality
Solutions for Measuring, Monitoring, and Managing Neurocognitive and Behavioral Health

**NPQ – 45**
Rapid In-take or Re-test to Assess the Neuro–Psych Status of a Patient

The Neuropsych Questionnaire (NPQ) Short Form (SF - 45) provides a subjective measure of 13 neuropsych symptoms. The symptoms are Attention, Impulsive, Memory, Anxiety, Panic, Depression, Mood Stability, Oppositional (child – adolescent), Aggression, Fatigue, Sleep, Suicide, and Pain. The shorter NPQ version is used to monitor or follow-up with the patient before or during their visit. The NPQ 45 can be used when the longer version is either impractical or inappropriate e.g. the physician wants a quick view of their patients core symptoms. Both versions are automatically scored and the data stored.

### NPQ – 45 (Adult Patient & Informant Version)
Rapid In-take or Re-test to Assess the Neuro–Psych Status of a Patient

<table>
<thead>
<tr>
<th>Domain</th>
<th>Score</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>100</td>
<td>Mild</td>
<td>The Neuropsych Questionnaire (Short Form asks patients (or an appropriate observer) a series of questions about their clinical state. The questions are about the symptoms of various neuropsychiatric disorders. The terminology is similar to that used in the diagnostic manuals, and in many famous clinical questionnaires and rating scales; but it has been simplified, and all symptoms are scored on the same scale. Scores are reported on a scale of 0 (not a problem) to 3 (severe). As a rule, access above 225 indicate a severe problem; scores from 190-224 indicate a moderate problem; and scores from 75-148, a mild problem. A high score on the Neuropsych Questionnaire Short Form means that the patient is reporting more symptoms of greater intensity. It doesn’t necessarily mean that the patient has a particular condition; just that he or she (or their spouse, parent, or caregiver) are saying that they have a lot of symptoms. Conversely, a low score shows they’re not experiencing symptoms associated with a particular condition, at least during the period of time specified. It does not mean that the patient does not have the condition. Just as some people over-state their problems, others tend to under-state their problems. The Neuropsych Questionnaire Short Form is not a diagnostic instrument. The results 50 scores are only meant to be interpreted by an experienced clinician in the course of a clinical examination.</td>
</tr>
<tr>
<td>Impulsive</td>
<td>180</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>125</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>175</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Panic</td>
<td>100</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>160</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Mood Stability</td>
<td>125</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Aggression</td>
<td>200</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>167</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Sleep</td>
<td>100</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Suicide</td>
<td>100</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>225</td>
<td>Severe</td>
<td></td>
</tr>
</tbody>
</table>

**Attention Questions**
1. Difficulty concentrating: 1. A mild problem
2. Easily distracted: 1. A mild problem
3. Feelings scattered, disorganized: 1. A mild problem
4. Forgetful, I need constant reminding: 1. A mild problem
5. Short attention span: 1. A mild problem

**Impulsive Questions**
1. Feeling restless: 3. A severe problem
2. Feelings I can’t sit still: 1. A mild problem
3. Impaired: 3. A severe problem
4. Feelings, act without thinking: 1. A severe problem
5. Overly active: 1. A mild problem

**Memory Questions**
1. Forgetful, I need constant reminding: 0. Not a problem
4. Putting something down and then forgetting where you put it: 0. Not a problem

**Anxiety Questions**
1. Feeling anxious: 0. Not a problem
3. Feeling restless: 3. A severe problem
5. Scared; I can’t sit still: 1. A mild problem

**Panic Questions**
1. Attacks of intense anxiety: 0. Not a problem
2. Feeling as nervous it’s hard to breathe: 2. A moderate problem
3. Panic attacks: 0. Not a problem

**Depression Questions**
2. Feeling discouraged about the future: 1. A mild problem
3. Feeling fatigued: 0. Not a problem
4. Feeling little or no interest in things: 1. A mild problem
5. Not enjoying things as much as before: 1. A mild problem

**Mood Stability Questions**
1. Anger: 3. A severe problem
2. Easily frustrated: 2. A moderate problem
3. Feeling irritable: 3. A severe problem
4. My moods change quickly: 0. Not a problem

Solutions for Measuring, Monitoring, and Managing Neurocognitive and Behavioral Health
Helping Assess Comorbidities

Cognition and Depression

“Indeed, there is some suggestion that cognitive or executive functioning deficits may be a trait risk factor for depression (Douglas and Porter, 2009; Frasch et al., 2009; Micco et al., 2009; Reppermund et al., 2009). Furthermore, worse neuropsychological test performance at baseline is associated with poorer response to treatment (Dunkin et al., 2000; Kampf-Sherf et al., 2004; Mohlman and Gorman, 2005), and cognitive deficits are more pronounced in patients who are unemployed (Baune et al., 2010). It is possible that treatment refractory depression is a subtype characterized in part by cognitive impairment.

The accurate identification and quantification of neurocognitive impairment are important for research relating to neurobiological underpinnings, treatment, and functional outcome in patients with mood disorders. It is essential, methodologically, that we have accurate methods for identifying those patients who are objectively cognitively impaired and separate them from patients who have the subjective experience of poor thinking skills or thinking that is easily perturbed by negative affect, but perform normally on cognitive testing in controlled conditions. The treatments and outcomes for these two groups may differ markedly, as well as the prognosis.”


Cognition and Depression

**Cognitive Flexibility**
Domain scored from two venerable AD/HD tests

- **Healthy Control**
- **Mood Disorder, Normal Cognition**
- **Mood Disorder, Cognitive Impairment**

Fig. 3. Distributions of CNS Vital Signs *cognitive flexibility* index score in patients with or without impaired cognition. Figure note: Healthy control, N=660. Mood disorder, normal cognition, n=128. Mood disorder, cognitive impairment, n=58. *Normative scores were truncated at 40. Each value represents the percentage of subjects in that score range.*
A Systems Based Approach

**Neurocognitive Tests**
CNS Vital Signs is a computerized neurocognitive health assessment platform that enables the **OBJECTIVE EVALUATION of COGNITION**...

**Evidence-Based Rating Scales**
...identifying symptoms, possible comorbidities, **behavioral issues**, and other important clinical information.

**Screening**

**Identify**
- Possible Behavioral or Comorbid Issues
- Cognitive Status - Baseline
- NeuroPsych, Mental, and Behavioral Health Issues (symptoms that can effect educational or vocational productivity and performance)

**Behavioral**
- Neuropsychiatric Symptoms & Comorbidities
- Attentional Issues
- Internalizing (anxiety – depression – PTSD) Issues
- Externalizing (behavioral – conduct) issues
  ...and many more.

**Brain**
- Memory
- Attentional
- Executive Control
- Processing Speed
- Cognitive Flexibility
- Social Acuity
- Reasoning
- Working Memory
  ...and many more

**Monitor**
- Assess Medication Effect
- Measure Progress or Changes
- Document for Outcomes and/or Research
- Conduct Web Based Mental and Behavioral Health Surveillance
- Improve Compliance

**Follow-up and Outcomes**

**Patient In-Take / Early Detection**

**Multi-Modal Professional Assessment**

**Neurocognitive Testing**

**Evidence–Based Rating Scales**

**SOPHISTICATED... yet... SIMPE** Systems-Based approach to Screening, Assessment, & Surveillance...
**HOW? CNS Vital Signs begins with...**

**A:** Conducting a Valid Assessment (Refer to the Test Administration Guide.) To begin the staff should collect information about the CHIEF or REFERRAL COMPLAINT. This will be a primary driver for the selection of tests and rating scales. For initial evaluations or in complex presentations, a broad spectrum battery is always an appropriate starting point.

**B:** Review the immediately auto-scored report to 1 validate testing effort, 2 evaluate the Domain Dashboard to quickly assess the level of impairment or grade the deficit, and 3 Evaluate the Domain Pattern to help rule-in, rule-out, or confirm certain clinical conditions. Feedback to the patient on the testing results may be presented at the clinical encounter or at a subsequent patient visit.

**C:** If invalid test results were noted then consider re-testing the patient to confirm clinical results. If the test results were valid, then, as part a continuum of care, reschedule testing to track disease progression and measure ongoing status or outcomes.

**NOTE:** The *Validity Indicator* denotes a guideline for representing the possibility of an invalid test or domain score. “No” means a clinician should evaluate whether or not the test subject understood the test, put forth their best effort, or has a clinical condition requiring further evaluation.
Evaluate Severity – Impairment Status

CNS Vital Signs grades severity of impairment based on an age-matched normative comparison database... mTBI Example

Psychometric and Normative Comparison

Solutions for Measuring, Monitoring, and Managing Neurocognitive and Behavioral Health
Neurocognitive Domain Dashboard mTBI Example

CNS Vital Signs presents testing results in Subject (raw), Standard Scores, and Percentile Ranks. NOTE: See the CNS Vital Signs Interpretation Guide for more information.

<table>
<thead>
<tr>
<th>Patient Profile:</th>
<th>Percentile Range</th>
<th>&gt; 74</th>
<th>25 - 74</th>
<th>9 - 24</th>
<th>2 - 8</th>
<th>&lt; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Score Range</td>
<td>&gt; 109</td>
<td>90 - 109</td>
<td>80 - 89</td>
<td>70 - 79</td>
<td>&lt; 70</td>
<td></td>
</tr>
<tr>
<td>Neurocognition Index (NCI)</td>
<td>NA</td>
<td>85</td>
<td>16</td>
<td>Yes</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Composite Memory</td>
<td>102</td>
<td>103</td>
<td>58</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Memory</td>
<td>51</td>
<td>93</td>
<td>32</td>
<td>Yes</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>51</td>
<td>110</td>
<td>75</td>
<td>Yes</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>48</td>
<td>79</td>
<td>8</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Executive Function</td>
<td>34</td>
<td>75</td>
<td>5</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychomotor Speed</td>
<td>174</td>
<td>93</td>
<td>32</td>
<td>Yes</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Reaction Time*</td>
<td>555</td>
<td>107</td>
<td>68</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex Attention*</td>
<td>21</td>
<td>56</td>
<td>1</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>26</td>
<td>63</td>
<td>1</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Test Time (min: secs)</td>
<td>29:12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SD = Standard Deviation from the MEAN
CNS Vital Signs Embedded Indicators of Valid Effort

One factor that has been consistently shown to be related to poor outcome after a TBI is litigation/compensation. For example, a meta-analysis of 17 studies on the effects of financial incentives on recovery after TBI found that involvement in litigation for financial compensation was consistently associated with poor outcomes after MTBI (Binder & Rohling, 1996(49)). In that study the authors noted the effect was strongest for mild head injury.

A key advantage to the VSX assessment platform is the autoscoring of embedded indicators of patient testing effort. As with all psychological and neuropsychological testing neuropsychiatric patients can feign their responses due to incentives. When analyzing test data, either in research, or in clinical practice, it is important to know whether a test result is valid or not. Clinicians need to know if testing subjects are generating “dubious results” or a “non-credible response pattern.” CNS Vital Signs has developed “validity indicators” for its tests and domains that indicate whether the patient gave poor effort or generated invalid results. Should a subject test abnormally low triggering an “invalid” test (NO as displayed in the Validity Indicator section of the report) then that would be a reason for retesting the individual, unless your clinical judgment makes you believe that is the best score the patient can achieve. Additional Information is available at our website

<table>
<thead>
<tr>
<th>Clinical Domains</th>
<th>Test Validity Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite Memory</td>
<td>Both Verbal and Visual Memory valid.</td>
</tr>
<tr>
<td>Verbal Memory</td>
<td>Verbal Memory raw score &gt; 30.</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>Visual Memory raw score &gt; 30.</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>SDC: more than 20 correct responses.</td>
</tr>
<tr>
<td>Executive Function</td>
<td>SAT errors &lt; SAT correct responses.</td>
</tr>
<tr>
<td>Psychomotor Speed</td>
<td>FTT: total taps &gt; 40 &amp; or SDC: &gt; 20 correct responses</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>Stroop: Simple RT &lt; Complex RT &lt; Stroop RT</td>
</tr>
<tr>
<td>Complex Attention</td>
<td>Valid Stroop, CPT, and SAT. Correct &gt; incorrect response in all tests.</td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>Valid Stroop and SAT. Correct &gt; incorrect responses in all tests.</td>
</tr>
<tr>
<td>Social Acuity</td>
<td>POET correct responses &gt; 3. Correct &gt; incorrect responses</td>
</tr>
<tr>
<td>Sustained Attention</td>
<td>Valid 4PCPT: Part 2 &gt; 2 correct; part 3 &gt; 5 correct; part 4 &gt; 5 correct. Correct &gt; incorrect responses in all parts.</td>
</tr>
<tr>
<td>Working Memory</td>
<td></td>
</tr>
</tbody>
</table>

FTT - Finger Tapping Test; SAT – Shifting Attention Test; SDC – Symbol Digit Coding Test; RT – Reaction Time; CPT – Continuous Performance Test; POET – Perception of Emotions Test; NVR – Non-verbal Reasoning; 4PCPT – Four Part CPT
## Calculating Domain Scores

<table>
<thead>
<tr>
<th>VSX BRIEF-CORE Clinical Domains</th>
<th>Domain Score Calculations: 1900+ Norms, Ages 8 to 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurocognition Index - NCI</td>
<td>Average of five domain scores: Composite Memory, Psychomotor Speed, Reaction Time, Complex Attention, and Cognitive Flexibility; representing a form of a global score of neurocognition</td>
</tr>
<tr>
<td>Composite Memory</td>
<td>VBM Correct Hits Immediate + VBM Correct Passes Immediate + VBM Correct Hits Delay + VBM Correct Passes Delay + VIM Correct Hits Immediate + VIM Correct Passes Immediate + VIM Correct Hits Delay + VIM Correct Passes Delay</td>
</tr>
<tr>
<td>Verbal Memory</td>
<td>VBM Correct Hits Immediate + VBM Correct Passes Immediate + VBM Correct Hits Delay + VBM Correct Passes Delay</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>VIM Correct Hits Immediate + VIM Correct Passes Immediate + VIM Correct Hits Delay + VIM Correct Passes Delay</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>SDC Correct Responses - SDC Errors</td>
</tr>
<tr>
<td>Executive Function</td>
<td>SAT Correct Responses - SAT Errors</td>
</tr>
<tr>
<td>Psychomotor Speed</td>
<td>FTT Right Taps Average + FTT Left Taps Average + SDC Correct Responses</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>(ST Complex Reaction Time Correct + Stroop Reaction Time Correct) / 2</td>
</tr>
<tr>
<td>Complex Attention</td>
<td>Stroop Commission Errors + SAT Errors + CPT Commission Errors + CPT Omission Errors</td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>SAT Correct Responses - SAT Errors - Stroop Commission Errors</td>
</tr>
<tr>
<td>VSNP Clinical Domains</td>
<td>Domain Score Calculations: 700+ Norms, Ages 8 to 90</td>
</tr>
<tr>
<td>Working Memory</td>
<td>(4PCPT Part 4 Correct Responses) - (4PCPT Part 4 Incorrect Responses)</td>
</tr>
<tr>
<td>Sustained Attention</td>
<td>(4PCPT Part 2 Correct Responses + 4PCPT Part 3 Correct Responses + 4PCPT Part 4 Correct Responses) – (4PCPT Part 2 Incorrect Responses + 4PCPT Part 3 Incorrect Responses + 4PCPT Part 4 Incorrect Responses)</td>
</tr>
<tr>
<td>Social Acuity</td>
<td>POET Correct Responses – POET Commission Errors</td>
</tr>
<tr>
<td>Reasoning (non-verbal)</td>
<td>NVRT Correct Responses – NVRT Commission Errors</td>
</tr>
</tbody>
</table>

### Abbreviations Defined:

VBM – Verbal Memory Test; VIM – Visual Memory Test; SDC – Symbol Digit Coding Test; SAT – Shifting Attention Test; FTT - Finger Tapping Test; ST - Stroop Test; CPT – Continuous Performance Test; 4PCPT – Four Part CPT; POET – Perception of Emotions Test; NVRT – Non-verbal Reasoning Test.
HOW can CNS Vital Signs Benefit My Practice?

Ask about our NO COST Practice Evaluation!

CNS Vital Signs Benefits

- Enhanced Patient Insight and Care Management
- Enables Evidence-Based Medicine and Outcomes
- Improved Practice Efficiencies and Documentation
- Improved Practice Revenues and Performance

Potential Return On Investment

Based on Established Billing Codes*

40 Patient Test Sessions ROI:

$2,400 to $10,000+
Possible Yearly IMPACT... $80K to $160K depending on patient volumes...

*Based on a survey of Payers. Contact support@cnsvs.com for billing information.

CNS Vital Signs Mobile Test Station
ULTRA Series

$1,400.00
Testing Station with 40 test sessions.

Popular with Clinics and Hospitals: Engineered with BUSY PRACTICES in mind (roll into exam rooms), the Ultra Series combines the ultimate in practical functionality, ergonomic ease-of-use, and remarkable durability.
NEXT STEPS:
Contact Us...

Getting Started

Step One: Register at www.CNSVS.com
After registering download the VSX ‘Brief-Core’ Assessment Software with 5 FREE Test Sessions... Take it for a test drive.

Step Two: Schedule a FREE One-on-One In-Service Webinar... Contact CNS Vital Signs Support support@cnsvs.com with dates and times that you will be available.

After the webinar the total CNS Vital Signs Assessment platform (Web & Local) can be configured to meet your practice needs.

Learn More

Contact me to receive report examples, case studies, administration guides etc.

- Website: www.CNSVS.com
- Phone: 888.750.6941
- Email: support@cnsvs.com
- Address:
  598 Airport Blvd.
  Suite 1400
  Morrisville, NC 27560

“The webinar training was terrific... it covered the Validity & Reliability of the platform, the interpretation of results, billing and coding, testing protocol, and the integration of the CNS Vital Signs platform into our practice.” Practice Administrator