CNS Vital Signs Advancing Occupational Care

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

CNS Vital Signs

www.CNSVS.com

Contents

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.

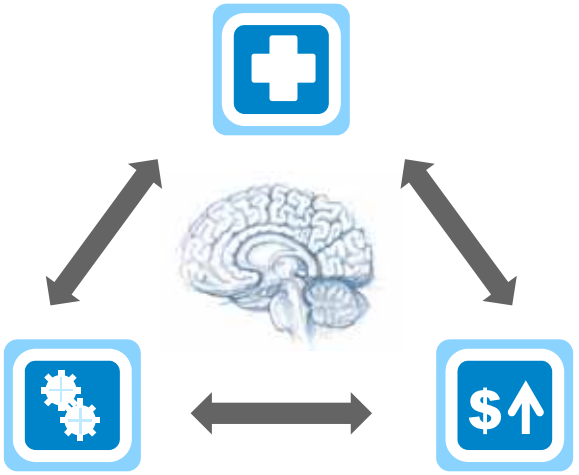
Why CNS Vital Signs?

*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

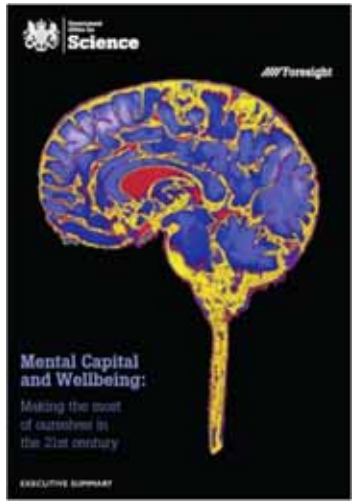
Expanded Services with Well Established Billing Codes to Improve Practice Referrals and Performance

Why CNS Vital Signs?
Cognition & Occupational Medicine

About MENTAL CAPITAL…

- *Well Done Comprehensive Report*
- *450 World-Wide Experts*
- **Cognition Is a Central Factor**

Foresight's Mental Capital and Wellbeing Project has drawn on leading-edge international research to understand how to improve mental capital and wellbeing across the population and throughout life.

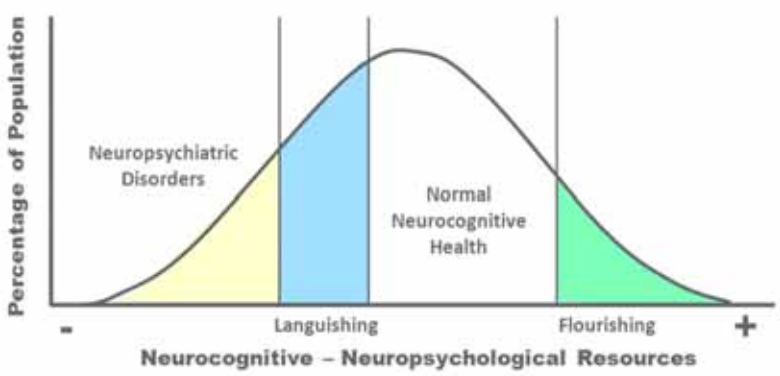


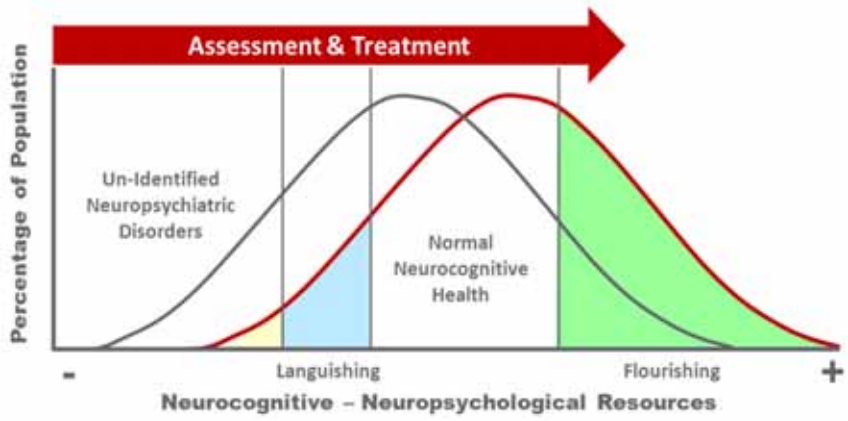
'Mental capital' refers to a person's ***COGNITIVE*** and emotional resources. It includes the ***brain's ability to process information (learning and thinking)*** but also includes emotional intelligence – interacting with others and resilience in the face of stress.

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.

Advancing Occupational Health Assessments

CNS Vital Signs Multi-Modal Assessment Platform

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…

JAMA Neurology
Formerly *Archives of Neurology*

http://archneur.jamanetwork.com/article.aspx?articleid=775928

Solvent Toxicity and Cognition Impairment

William E. Morton, MD, DrPH
Arch Neurol. 2000;57(2):282.

"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. "

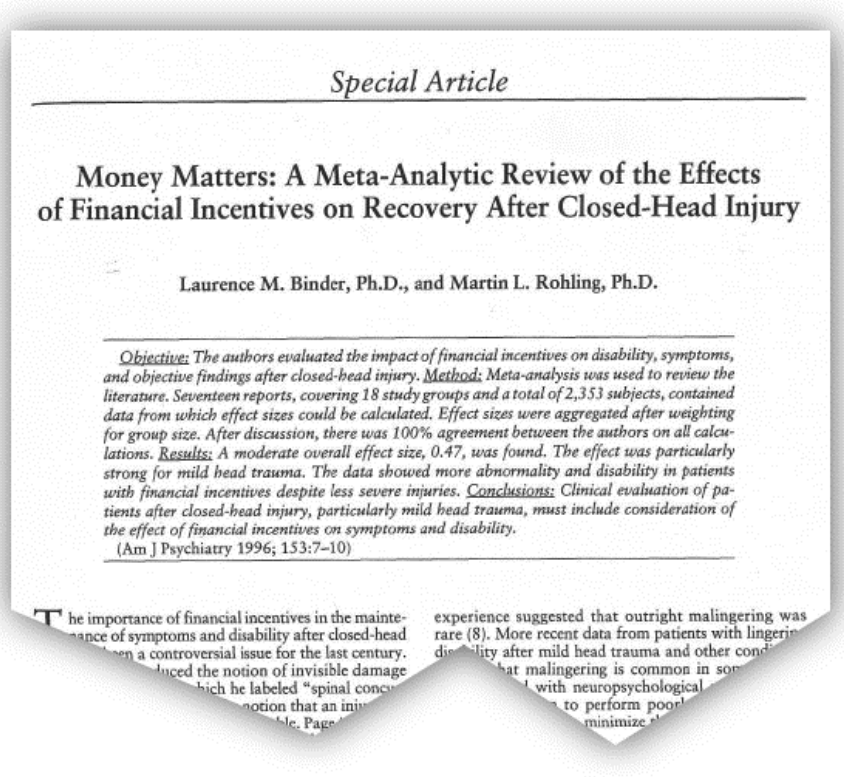
Money Matters: Assessing for Malingering or Poor Effort

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

Money matters: a meta-analytic review of the effects of financial incentives on recovery after closed-head injury.

Adapted from; Rohling ML et al.; Am J Psychiatry. 1996 Jan;153(1):7-10.

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.



Special Article

Money Matters: A Meta-Analytic Review of the Effects of Financial Incentives on Recovery After Closed-Head Injury

Laurence M. Binder, Ph.D., and Martin L. Rohling, Ph.D.

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.
(Am J Psychiatry 1996; 153:7–10)

The importance of financial incentives in the maintenance of symptoms and disability after closed-head ... been a controversial issue for the last century. ... duced the notion of invisible damage ... which he labeled "spinal concu... notion that an ini... Page ... experience suggested that outright malingering was rare (8). More recent data from patients with lingeri... disability after mild head trauma and other condi... that malingering is common in so... with neuropsychological ... to perform poorl... minimize ...

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.

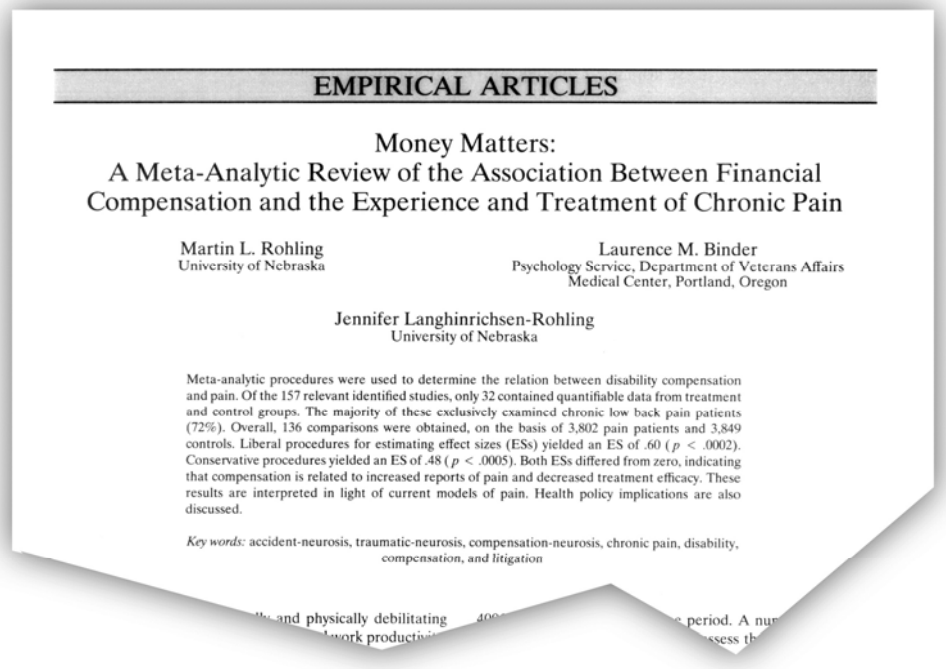
Psychometric Tests like CNS Vital Signs can Assist in the Evaluation of Genuine and Exaggerated Complaints

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



EMPIRICAL ARTICLES

Money Matters:
A Meta-Analytic Review of the Association Between Financial Compensation and the Experience and Treatment of Chronic Pain

Martin L. Rohling
University of Nebraska

Laurence M. Binder
Psychology Service, Department of Veterans Affairs Medical Center, Portland, Oregon

Jennifer Langhinrichsen-Rohling
University of Nebraska

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.

Key words: accident-neurosis, traumatic-neurosis, compensation-neurosis, chronic pain, disability, compensation, and litigation

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, *M* age 22.96 ; Male 76; Females 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 CNS-VS were included in either the simulator or control group based on their WMT performance.

Procedure

- The following measures from the CNS-VS were examined as embedded SVTs based on their ability to correctly classify an individual as either in 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.

OVERALL TOTAL CNS-VS LOGISTIC VALIDITY PREDICTIVE VALUES

CONDITIONS	ASSIGNED FEIGNED	ASSIGNED GENUINE	TOTALS
PREDICTED FEIGNED	60	7	67
PREDICTED GENUINE	8	59	67
TOTALS	68	66	134

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

	Genuine		Feigned		Overall	
Variable	*M*	*sd*	*M*	*sd*	*p*	*d*
1. Overall Test Battery Mean (OTBM)	94.4	10.5	83.4	12.8	<.0001	0.94
2. Overall Test Battery Mean SD	14.2	5.8	21.1	7.1	.0004	-1.07

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

	Genuine, Genuine		Genuine, Feigned		Feigned, Feigned		Feigned, Genuine		Overall	
Variable	*M*	*sd*	*M*	*sd*	*M*	*sd*	*M*	*sd*	*p*	*d*
1. Overall Test Battery Mean	*98.6*	*11.7*	90.9	10.4	*64.2*	*14.8*	97.4	8.2	*<.0001*	*2.6*
2. Overall Test Battery Mean SD	*14.4*	*6.5*	15.1	6.9	*21.8*	*4.8*	16.0	5.4	*.0382*	*-1.3*

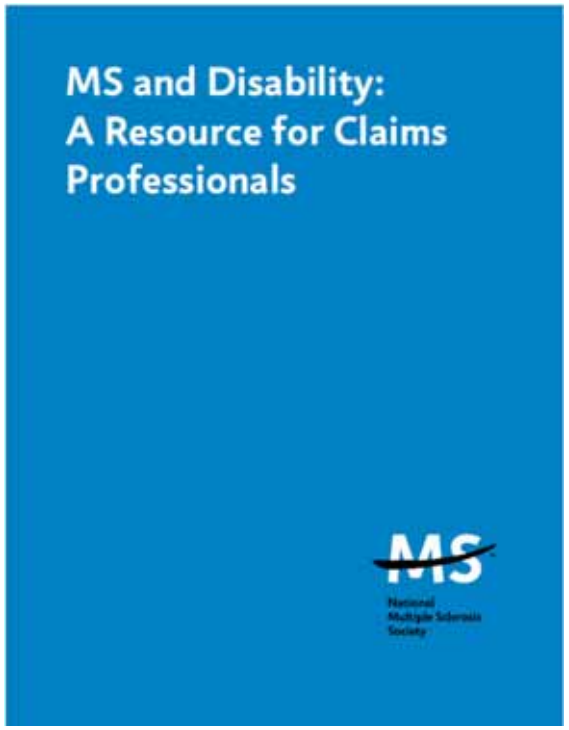
NOTE: Numbers in italics and underlined are used for the overall effect size calculation

Special thanks to Neuropsychology Research Team.

Citation: Rohling, M., Hill, B., Ploetz, D., Womble, M., Shenesey, J. , & Drayer, K. L. (2011, November). Embedded Validity Measures for a Computerized Cognitive Test Battery Poster presented at the 39th Annual NAN Conference Marco Island, FL. **E-mail Addresses:** mrohling@usouthal.edu

MS Disability Exam Information

How CNS Vital Signs can help.



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

EXAMPLE: National Multiple Sclerosis Society: Expert Opinion Paper Summary

- **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)

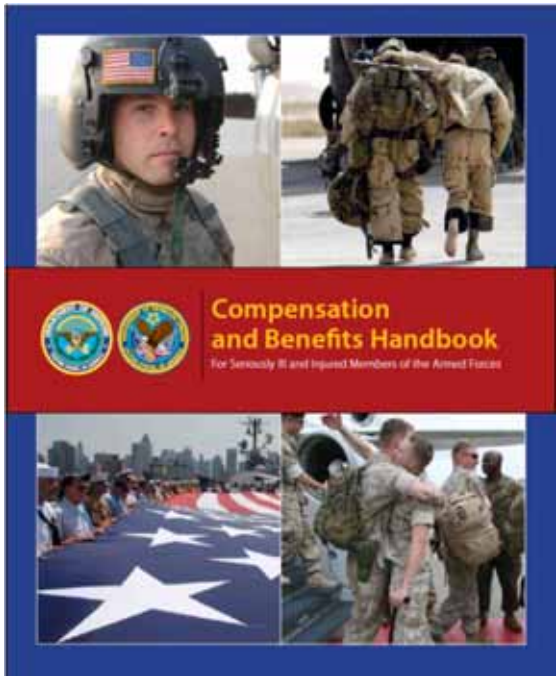
- **Enhanced MS Evaluation, Management & Tracking Strategies**
  - ***CNS Vital Signs provides a valid, reliable and granular view of neurocognitive status***
  - **Efficient:** Reports are Auto-Scored in seconds and Screens for possible in-valid tests
  - **Multi-Modal Assessment platform** allowing 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.

Compensation and Benefits Exams

Recovery from a COSI requires focusing on four areas: physical, emotional, cognitive, and spiritual.



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***

How CNS Vital Signs can help.

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.

http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.aspx?reg=391.41

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)

How CNS Vital Signs can help.

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.

http://nrcme.fmcsa.dot.gov/mehandbook/psych4_ep.aspx and http://nrcme.fmcsa.dot.gov/mehandbook/neuro4_ep.aspx

Federal Motor Carrier Safety Regulations Guidelines

How CNS Vital Signs can help.

Physical qualifications for drivers.

http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.aspx?reg=391.41

(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.

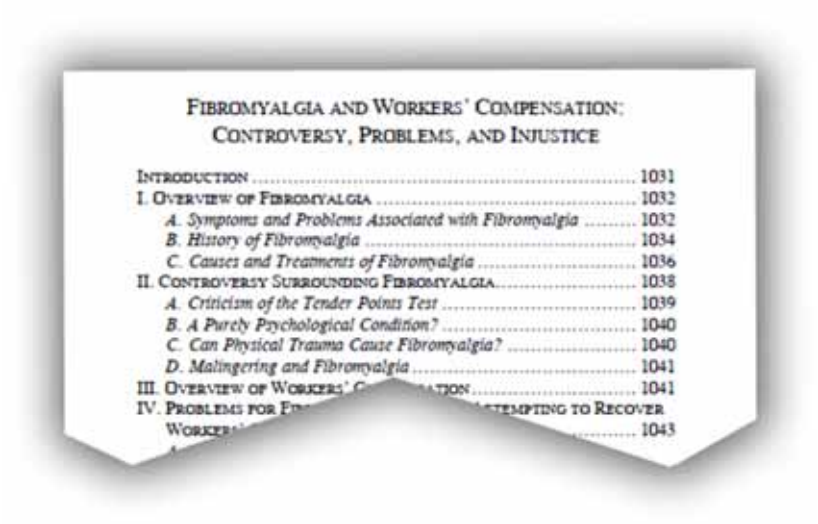
CNS Vital Signs Assessment Platform and Tests can add Validity, Reliability, and Efficiency to your Exams

http://nrcme.fmcsa.dot.gov/mehandbook/psych4_ep.aspx and http://nrcme.fmcsa.dot.gov/mehandbook/neuro4_ep.aspx

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

Ir Med J. 2008 Oct;101(9):277-8.

"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."



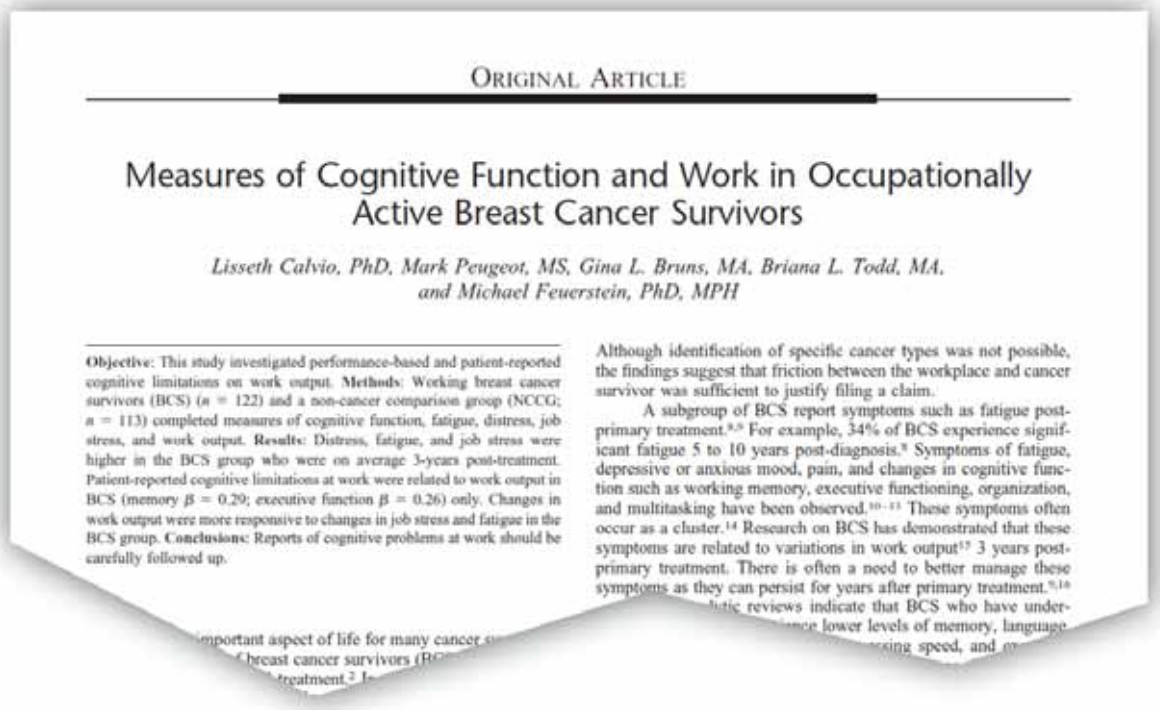
FIBROMYALGIA AND WORKERS' COMPENSATION: CONTROVERSY, PROBLEMS, AND INJUSTICE

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

Measures of Cognitive Function and Work in Occupationally Active Breast Cancer Survivors

JOEM • Volume 52, Number 2, February 2010

"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."



ORIGINAL ARTICLE

Measures of Cognitive Function and Work in Occupationally Active Breast Cancer Survivors

Lisseth Calvio, PhD, Mark Peugeot, MS, Gina L. Bruns, MA, Briana L. Todd, MA, and Michael Feuerstein, PhD, MPH

Objective: This study investigated performance-based and patient-reported cognitive limitations on work output. **Methods:** Working breast cancer survivors (BCS) (n = 122) and a non-cancer comparison group (NCCG; n = 113) completed measures of cognitive function, fatigue, distress, job stress, and work output. **Results:** Distress, fatigue, and job stress were higher in the BCS group who were on average 3-years post-treatment. Patient-reported cognitive limitations at work were related to work output in BCS (memory β = 0.29; executive function β = 0.26) only. Changes in work output were more responsive to changes in job stress and fatigue in the BCS group. **Conclusions:** Reports of cognitive problems at work should be carefully followed up.

Although identification of specific cancer types was not possible, the findings suggest that friction between the workplace and cancer survivor was sufficient to justify filing a claim.

A subgroup of BCS report symptoms such as fatigue post-primary treatment.[5,6] For example, 34% of BCS experience significant fatigue 5 to 10 years post-diagnosis.[8] Symptoms of fatigue, depressive or anxious mood, pain, and changes in cognitive function such as working memory, executive functioning, organization, and multitasking have been observed.[10–13] These symptoms often occur as a cluster.[14] Research on BCS has demonstrated that these symptoms are related to variations in work output[15] 3 years post-primary treatment. There is often a need to better manage these symptoms as they can persist for years after primary treatment.[9,16]

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

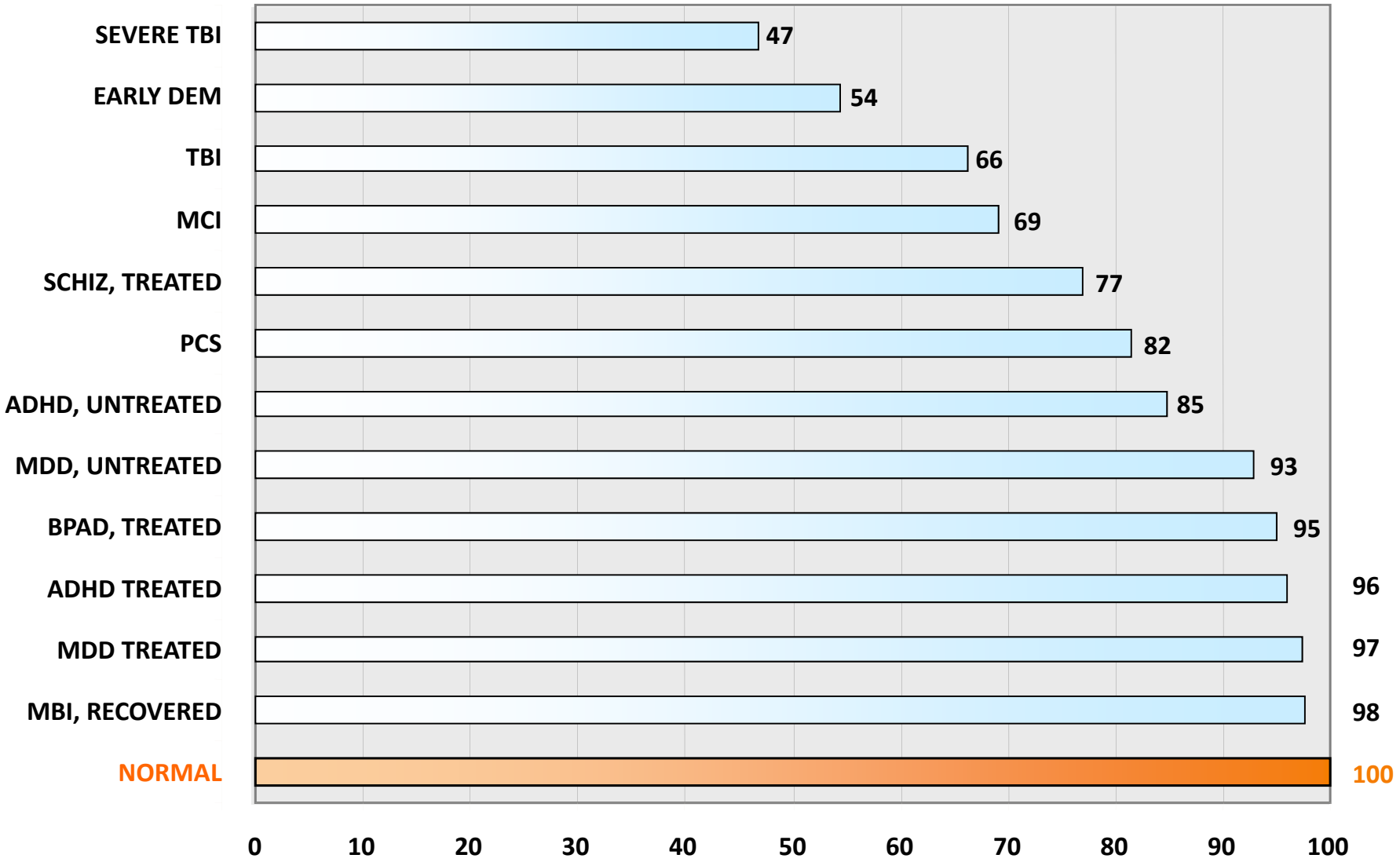
Computerized Medical and Health Rating Scales*

- 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.

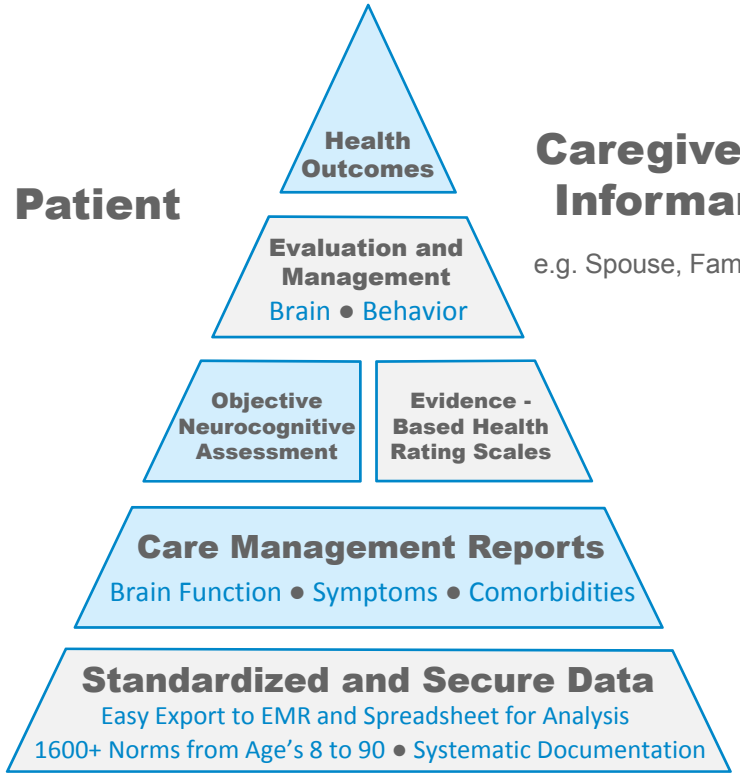
* *Used with permission… Free use of rating scales*

CNS Vital Signs: Neurocognition Index In Various Neuropsychiatric Conditions



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.

Optimized for Occupational Care Evaluation & Management



CNS Vital Signs Neurocognitive Battery in Occupational Care

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

The CNS Vital Signs Sleep Toolbox helps clinicians systematically collect brain function, symptoms, and comorbidities data, automatically scoring and systematically documenting the resulting clinical endpoints.

CNS Vital Signs Evidence-Based Rating Scales

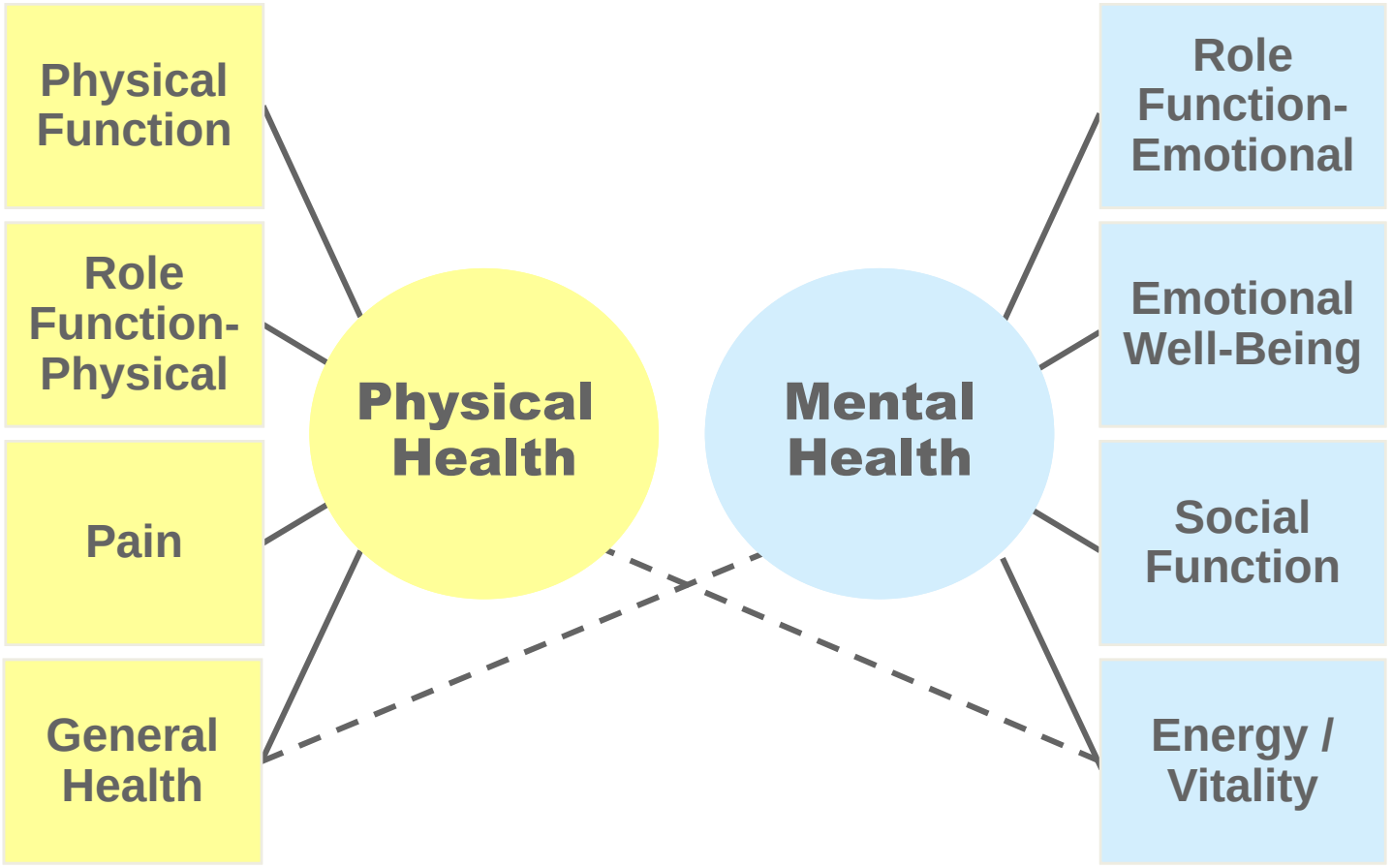
26. Alertness Rating Scale (ARS) SF-1
27. NeuroPsych Questionnaire (NPQ 207)
28. Medical Outcomes Survey (MOS SF-36)
29. NeuroPsych Questionnaire (NPQ 45)
30. ***Epworth Sleepiness Scale (ESS 8)***
31. ***Pittsburgh Sleep Quality Index (PSQI 10)***
32. Sedation Scale (SS) SF-1
33. Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist
34. Vanderbilt ADHD Parent Rating Scale
35. Vanderbilt ADHD Teacher Rating Scale
36. Vanderbilt Assessment Follow-up Parent Rating Scale
37. Vanderbilt Assessment Follow-up Teacher Rating Scale
38. Screen for Child Anxiety Related Disorders (SCARED) Child Version
39. Screen for Child Anxiety Related Disorders (SCARED) Parent Version
40. Child Obsessive-Compulsive Disorder Inventory
41. Social Anxiety Scale for Children and Adolescents
42. Pediatric Symptom Checklist (PSC)
43. Pediatric Symptom Checklist-Youth Report (Y-PSC)
44. Pediatric Symptom Checklist (PSC-17)
45. Childhood Cancer Survivor Study Neurocognitive Questionnaire (CCSS)
46. ***Zung Self-Rating Depression Scale (ZSDS)***
47. ***Zung Self-Rating Anxiety Scale (ZSAS)***
48. Stanford Geriatric Depression Scale (SGDS 30)
49. Stanford Geriatric Depression Scale (SGDS 15)
50. Memory Questionnaire (MEMQ 27)

26. ***Dizziness Handicap Inventory (DHI 25)***
27. ***Neurobehavioral Symptom Inventory (NSI 22)***
28. Head Injury Questionnaire (HIQ 90)
29. ***Alcohol Use Disorders Identification Test (AUDIT)***
30. ***Drug Use Questionnaire (DAST 20)***
31. Pain Catastrophizing Scale (PCS 13)
32. PTSD Checklist - Civilian Version (PCL-C 17)
33. ***PTSD Checklist - Military Version (PCL-M 17)***
34. PTSD Checklist - Stressor Specific Version (PCL-S 17)
35. Adult Obsessive-Compulsive Disorder Inventory (OCD-A 20)
36. Post concussion Symptom Scale (PCSS)
37. ***Combat Exposure Scale (CES 7)***
38. ***DRRI Section A: Pre-Deployment Life Events***
39. ***DRRI Section B: Childhood Experiences***
40. ***DRRI Section C: Training and Deployment Preparation***
41. ***DRRI Section D: Deployment Environment***
42. ***DRRI Section E: Life and Family Concerns***
43. ***DRRI Section F: Unit Support***
44. ***DRRI Section G: Relationship Within Unit***
45. ***DRRI Section H: Deployment Concerns***
46. ***DRRI Section I: Combat Experiences***
47. ***DRRI Section J: Post-Battle Experiences***
48. ***DRRI Section K: Exposure to Nuclear, Biological, Chemical Agents***
49. ***DRRI Section L: Post-Deployment Support***
50. ***DRRI Section M: Post-Deployment Life Events***
51. Life Events Checklist (LEC)

Defense & Veterans mTBI / Concussion Guidelines

CNS Vital Signs Occupational Toolbox

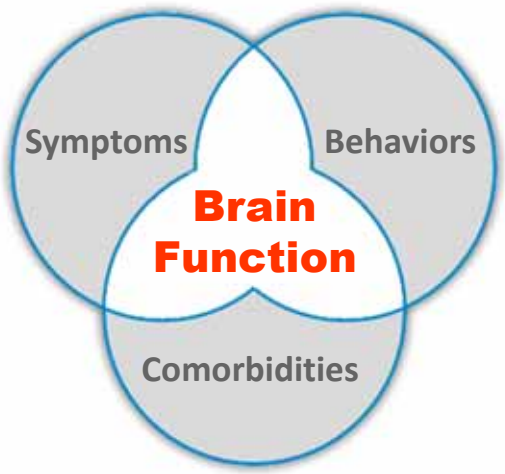
MOS SF-36… Widely Used Measure



Tools to Help Assess Symptoms and Comorbidities

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

NeuroPsych Questionnaire (NPQ) SF-45 (Page 1 of 2)

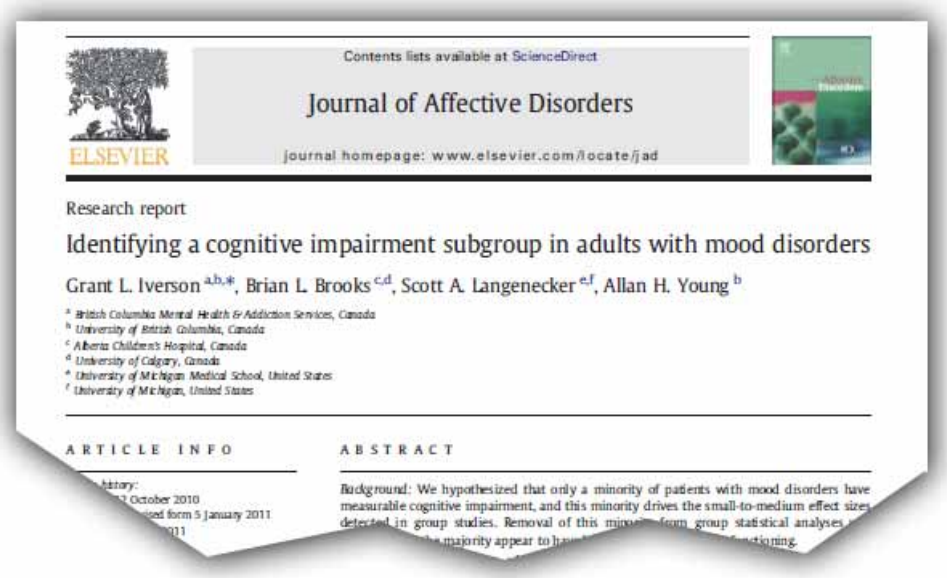
Subject Reference/ID: NPQ45SymptomAdult	Test Date: March 29, 2009 15:35:40
Age: 64	Administrator: Neuropsych Solutions
Total Test Time: 0:28 (min:secs) for all tests in this report	Language: English (United States)
This scale was administered using CNS Vital Signs	

Domain	Score	Severity	Description
Attention	100	Mild	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 familiar clinical questionnaires and rating scales; but it has been simplified, and all symptoms are scored on the same metric. Scores are reported on a scale of 0 (not a problem) to 300 (severe). As a rule, scores above 225 indicate a severe problem; scores from 150-224 indicate a moderate problem; and scores from 75-149, 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 intense symptoms. Conversely, a low score simply means that the patient (or caregiver) is not reporting 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 it generates are only meant to be interpreted by an experienced clinician in the course of a clinical examination.
Impulsive	160	Moderate	
Memory	125	Mild	
Anxiety	167	Moderate	
Panic	100	Mild	
Depression	160	Moderate	
Mood Stability	125	Mild	
Aggression	200	Moderate	
Fatigue	167	Moderate	
Sleep	100	Mild	
Suicide	100	Mild	
Pain	225	Severe	

Attention Questions		
1	Difficulty concentrating	1 - A mild problem
2	Easily distracted	1 - A mild problem
3	Feeling scattered, disorganized	1 - A mild problem
4	Forgetful, I need constant reminding	0 - Not a problem
5	Short attention span	2 - A moderate problem
Impulsive Questions		
1	Feeling restless	3 - A severe problem
2	Fidgety, I can't sit still	1 - A mild problem
3	Impatient	3 - A severe problem
4	Impulsive, act without thinking	0 - Not a problem
5	Overly active	1 - A mild problem
Memory Questions		
1	Forgetful, I need constant reminding	0 - Not a problem
2	My mind goes blank	2 - A moderate problem
3	Problems with memory	3 - A severe 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
2	Feeling nervous	2 - A moderate problem
3	Feeling restless	3 - A severe problem
4	Feeling tense	2 - A moderate problem
5	Fidgety, I can't sit still	1 - A mild problem
6	Worrying too much	2 - A moderate problem
Panic Questions		
1	Attacks of intense anxiety	0 - Not a problem
2	Feeling so nervous it's hard to breathe	2 - A moderate problem
3	Panic attacks	1 - A mild problem
Depression Questions		
1	Feeling depressed	1 - A mild problem
2	Feeling discouraged about the future	3 - A severe problem
3	Feeling irritable	0 - Not a problem
4	Feeling little or no interest in things	1 - A mild problem
5	Not enjoying things as much as before	3 - A severe problem
Mood Stability Questions		
1	Anger	3 - A severe problem
2	Easily frustrated	2 - A moderate problem
3	Feeling irritable	0 - Not a problem
4	My moods change quickly	0 - Not a problem

Helping Assess Comorbidities

Cognition and Depression



Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research report

Identifying a cognitive impairment subgroup in adults with mood disorders

Grant L. Iverson [a,b,*], Brian L. Brooks [c,d], Scott A. Langenecker [e,f], Allan H. Young [b]

[a] British Columbia Mental Health & Addiction Services, Canada
[b] University of British Columbia, Canada
[c] Alberta Children's Hospital, Canada
[d] University of Calgary, Canada
[e] University of Michigan Medical School, United States
[f] University of Michigan, United States

ARTICLE INFO

ABSTRACT

Background: We hypothesized that only a minority of patients with mood disorders have measurable cognitive impairment, and this minority drives the small-to-medium effect sizes detected in group studies. Removal of this minority from group statistical analyses ... majority appear to ... functioning.

"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."

Source: Identifying a cognitive impairment subgroup in adults with mood disorders. J Affect Disord. 2011 Aug;132(3):360-7. Epub 2011 Mar 25.

http://www.ncbi.nlm.nih.gov/pubmed/21439647

Cognition and Depression

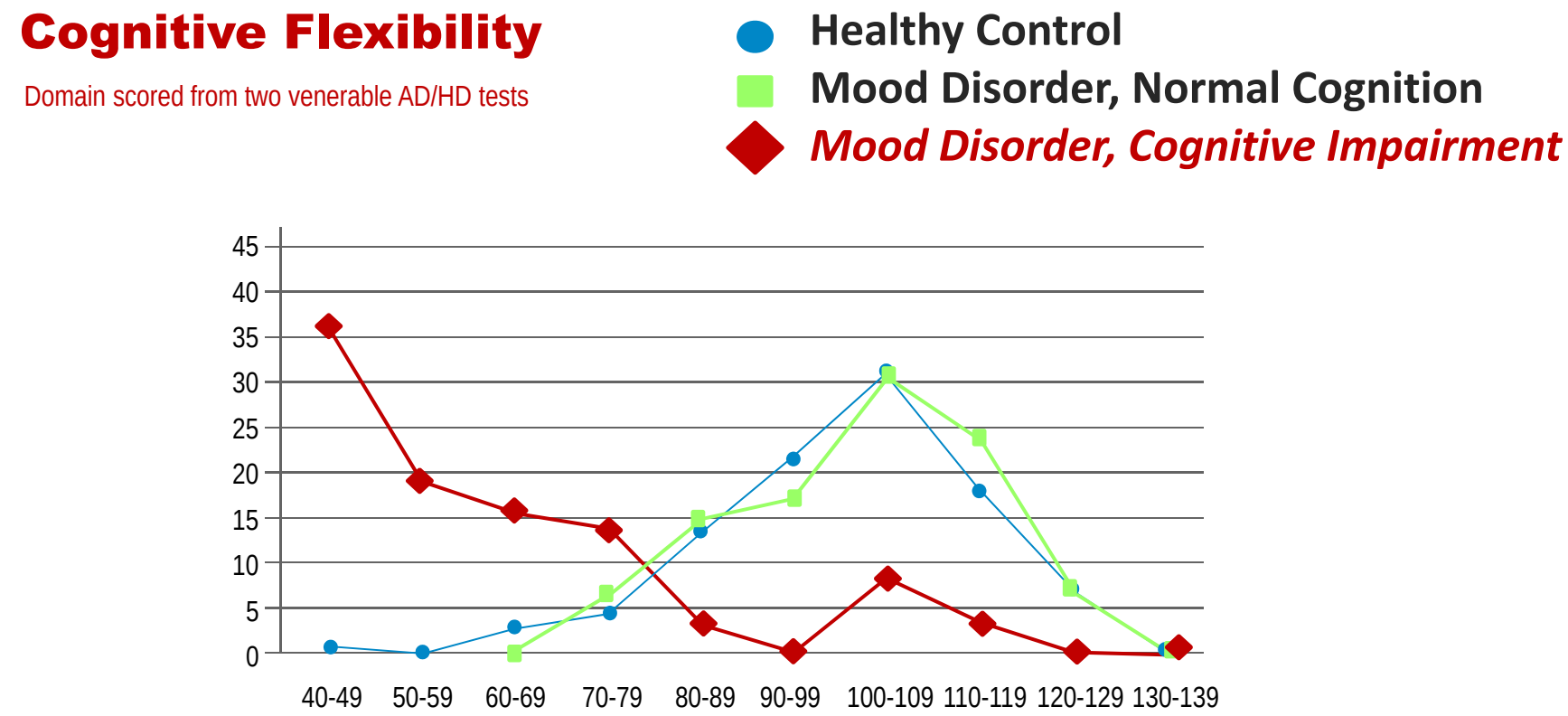


Fig. 3. Distributions of **CNS Vital Signs** ***cognitive flexibility*** index score in patients with or without impaired cognition. Figure note: Healthy control, N=660. Mood disorder, normal cognition, n=128. Mood disorder, cognitive impairment, n=58. *Normative scores were truncated at 40. Each value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

WEB & COMPUTER Based Testing

Evidence-Based Rating Scales

…identifying ***symptoms, possible comorbidities, behavioral issues****, and other important clinical information.*

Patient In-Take / Early Detection — **Multi-Modal Professional Assessment** — **Measure Progress and Performance**

Screening → **Evidence–Based Rating Scales** → **Neurocognitive Testing** → **Follow-up and Outcomes**

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*

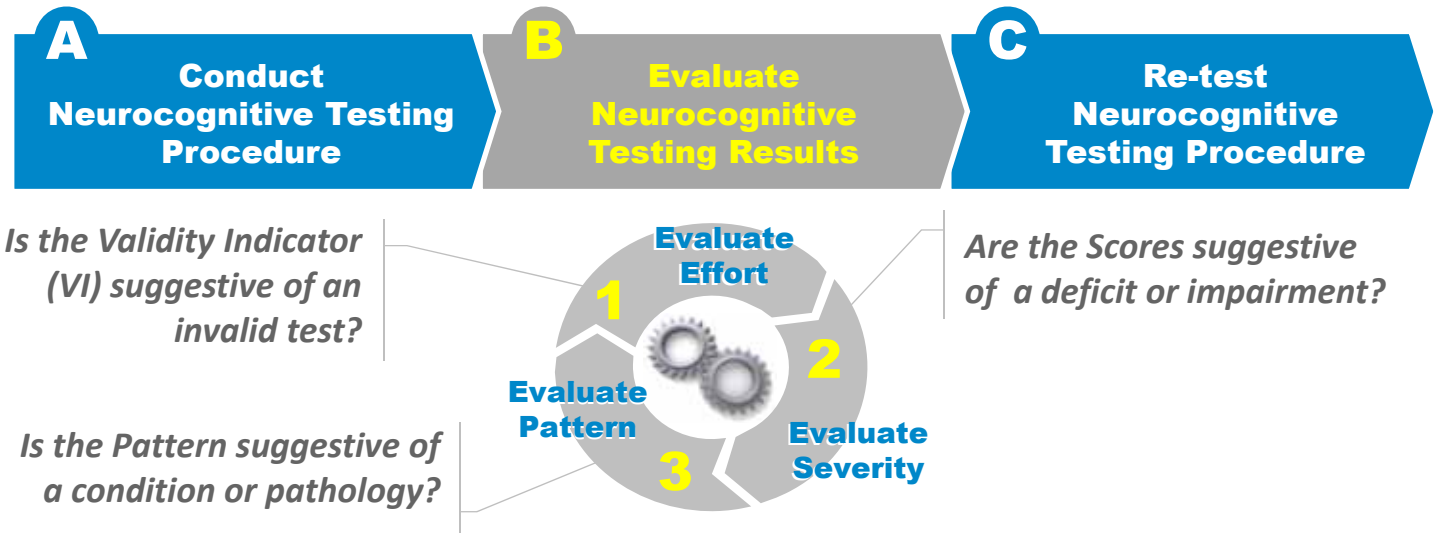
…and many more

Monitor

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

SOPHISTICATED… ***yet…*** **SIMPLE** 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.

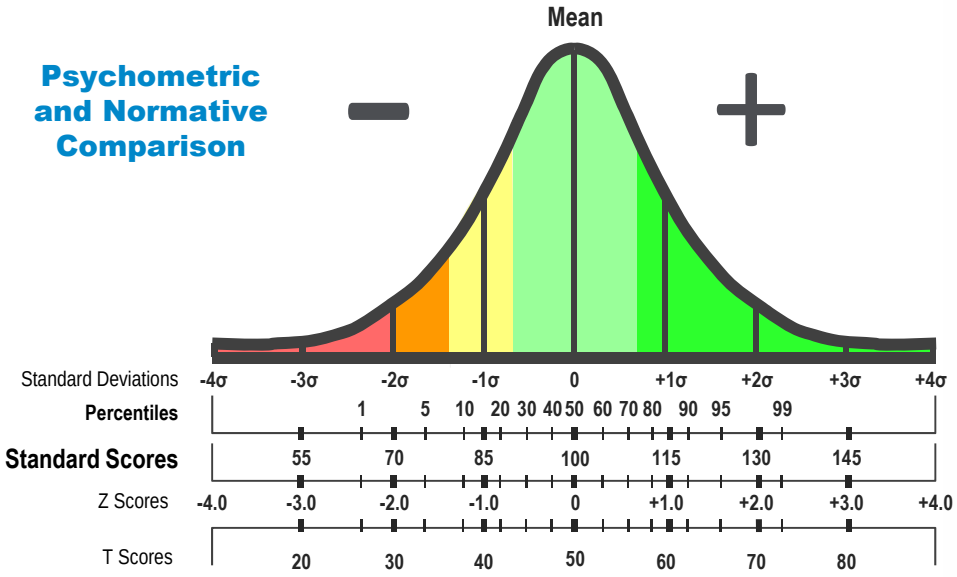
C: If invalid test results were noted then consider re-testing the patient to confirm clinical results. If the test results were valid, then, as part a continuum of care, reschedule testing to track disease progression and measure ongoing status or outcomes.

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



Above:	> 110	High Function and High Capacity
Average:	90 - 110	Normal Function and Normal Capacity
Low Average:	80 - 90	Slight Deficit and Slight Impairment
Low:	70 - 79	Moderate Deficit and Impairment Possible
Very Low:	< 70	Deficit and Impairment Likely

Standard Scores

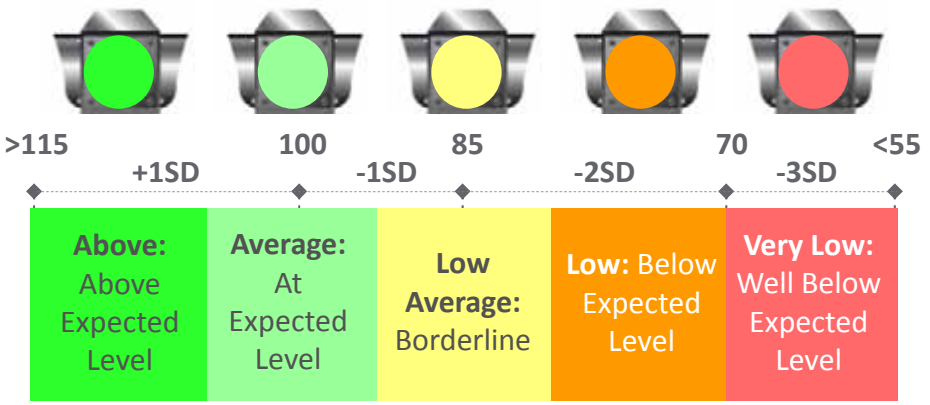
CNS Vital Signs Clinical Report					Test Date: July 23 2011 10:48:38				
Subject ID: mTBI or AD/HD					Administrator: Technician				
Language: English (United States)					Age: 27				
Patient Profile:	Percentile Range				> 74	25 - 74	9 - 24	2 - 8	< 2
	Standard Score Range				> 109	90 - 109	80 - 89	70 - 79	< 70
Domain Scores	Subject Score	Standard Score	Percentile	VI**	Above	Average	Low Average	Low	Very Low
Neurocognition Index (NCI)	NA	85	16	Yes			x		
Composite Memory	102	103	58	Yes		x			
Verbal Memory	51	93	32	Yes		x			
Visual Memory	51	110	75	Yes	x				
Processing Speed	48	79	8	Yes				x	
Executive Function	34	75	5	Yes				x	
Psychomotor Speed	174	93	32	Yes		x			
Reaction Time*	555	107	68	Yes		x			
Complex Attention*	21	56	1	Yes					x
Cognitive Flexibility	26	63	1	Yes					x
Total Test Time (min: secs)	29:12				Total time taken to complete the tests shown.				

Domain Dashboard: Above average domain scores indicate a standard score (SS) greater than 109 or a Percentile Rank (PR) greater than 74, indicating a high functioning test subject. Average is a SS 90-109 or PR 25-74, indicating normal function. Low Average is a SS 80-89 or PR 9-24 indicating a slight deficit or impairment. Below Average is a SS 70-79 or PR 2-8, indicating a moderate level of deficit or impairment. Very Low is a SS less than 70 or a PR less than 2, indicating a deficit and impairment. Reaction times are in milliseconds. An * denotes that "lower is better", otherwise higher scores are better. Subject Scores are raw scores calculations generated from data values of the individual subtests.
VI – 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.

Verbal Memory Test (VBM)	Score	Standard	Percentile	
Correct Hits - Immediate	13	102	55	**Verbal Memory Test:** Subjects have to remember 15 words and recognize them in a field of 15 distractors. The test is repeated at the end of the battery. The VBM test measures how well a subject can recognize, remember, and retrieve words e.g. exploit or attend literal representations or attribute. "Correct Hits" refers to the number of target words recognized. Low scores indicate verbal memory impairment.
Correct Passes - Immediate	14	95	37	
Correct Hits - Delay	9	85	16	
Correct Passes - Delay	15	109	73	
Visual Memory Test (VIM)	**Score**	**Standard**	**Percentile**	
Correct Hits - Immediate	13	107	68	**Visual Memory Test:** Subjects have to remember 15 geometric figures, and recognize them in a field of 15 distractors. The test is repeated at the end of the battery. The VIM test measures how well a subject can recognize, remember, and retrieve geometric figures e.g. exploit or attend symbolic or spatial representations. "Correct Hits" refers to the number of target figures recognized. Low scores indicate visual memory impairment.
Correct Passes - Immediate	14	117	87	
Correct Hits - Delay	13	111	77	
Correct Passes - Delay	11	93	32	
Finger Tapping Test (FTT)	**Score**	**Standard**	**Percentile**	
Right Taps Average	64	104	61	The **FTT** is a test of motor speed and fine motor control ability. There are three rounds of tapping with each hand. The FTT test measures the speed and the number of finger-taps with each hand. Low scores indicate motor slowing. Speed of manual motor activity varies with handedness. Most people are faster with their preferred hand but not always.
Left Taps Average	60	105	63	
Symbol Digit Coding (SDC)	**Score**	**Standard**	**Percentile**	
Correct Responses	50	80	9	The **SDC** test measures speed of processing and draw upon several cognitive processes simultaneously, such as visual scanning, visual perception, visual memory, and motor functions. Errors may be due to impulsive responding, misperception, or confusion.
Errors*	2	92	30	
Stroop Test (ST)	**Score**	**Standard**	**Percentile**	
Simple Reaction Time*	231	108	70	The **ST** measures simple and complex reaction time, inhibition / disinhibition, mental flexibility or directed attention. The ST helps assess how well a subject is able to adapt to rapidly changing and increasingly complex set of directions. Prolonged reaction times indicate cognitive slowing / impairment. Errors may be due to impulsive responding, misperception, or confusion.
Complex Reaction Time Correct*	542	100	50	
Stroop Reaction Time Correct*	568	112	79	
Stroop Commission Errors*	8	5	1	
Shifting Attention Test (SAT)	**Score**	**Standard**	**Percentile**	
Correct Responses	47	82	12	The **SAT** measures executive function or how well a subject recognizes set shifting (mental flexibility) and abstraction (rules, categories) and manages multiple tasks simultaneously. Subjects have to adjust their responses to randomly changing rules. The best scores are high correct responses, few errors and a short reaction time. Normal subjects may be slow but accurate, or fast but not so accurate. Attention deficit may be apparent.
Errors*	13	75	5	
Correct Reaction Time*	1003	97	42	
Continuous Performance Test (CPT)	**Score**	**Standard**	**Percentile**	
Correct Responses	40	104	61	The **CPT** measures sustained attention or vigilance and choice reaction time. Most normal subjects obtain near-perfect scores on this test. A long response time may suggest cognitive slowing and/or impairment. More than 2 errors (total) may be clinically significant. More than 4 errors (total) indicate attentional dysfunction.
Omission Errors*	0	104	61	
Commission Errors*	0	108	70	
Choice Reaction Time Correct*	400	99	47	

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.***



Patient Profile:	Percentile Range				> 74	25 - 74	9 - 24	2 - 8	< 2
	Standard Score Range				> 109	90 - 109	80 - 89	70 - 79	< 70
Domain Scores	Subject Score	Standard Score	Percentile	VI**	Above	Average	Low Average	Low	Very Low
Neurocognition Index (NCI)	NA	85	16	Yes			x		
Composite Memory	102	103	58	Yes		x			
Verbal Memory	51	93	32	Yes		x			
Visual Memory	51	110	75	Yes	x				
Processing Speed	48	79	8	Yes				x	
Executive Function	34	75	5	Yes				x	
Psychomotor Speed	174	93	32	Yes		x			
Reaction Time*	555	107	68	Yes		x			
Complex Attention*	21	56	1	Yes					x
Cognitive Flexibility	26	63	1	Yes					x
Total Test Time (min: secs)	29:12				Total time taken to complete the tests shown.				

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

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

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

VSX BRIEF-CORE Clinical Domains	Domain Score Calculations: 1900+ Norms, Ages 8 to 90
Neurocognition Index - NCI	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
Composite Memory	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
Verbal Memory	VBM Correct Hits Immediate + VBM Correct Passes Immediate + VBM Correct Hits Delay + VBM Correct Passes Delay
Visual Memory	VIM Correct Hits Immediate + VIM Correct Passes Immediate + VIM Correct Hits Delay + VIM Correct Passes Delay
Processing Speed	SDC Correct Responses - SDC Errors
Executive Function	SAT Correct Responses - SAT Errors
Psychomotor Speed	FTT Right Taps Average + FTT Left Taps Average + SDC Correct Responses
Reaction Time	(ST Complex Reaction Time Correct + Stroop Reaction Time Correct) / 2
Complex Attention	Stroop Commission Errors + SAT Errors + CPT Commission Errors + CPT Omission Errors
Cognitive Flexibility	SAT Correct Responses - SAT Errors - Stroop Commission Errors
VSNP Clinical Domains	Domain Score Calculations: 700+ Norms, Ages 8 to 90
Working Memory	(4PCPT Part 4 Correct Responses) - (4PCPT Part 4 Incorrect Responses)
Sustained Attention	(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)
Social Acuity	POET Correct Responses – POET Commission Errors
Reasoning (non-verbal)	NVRT Correct Responses – NVRT Commission Errors

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; NVR – 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**

Solution Example

CNS Vital Signs Mobile Test Station
ULTRA Series

$1,400.00 Testing Station with 40 test sessions.

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.

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***