CNS Vital Signs Advancing Multiple Sclerosis 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*
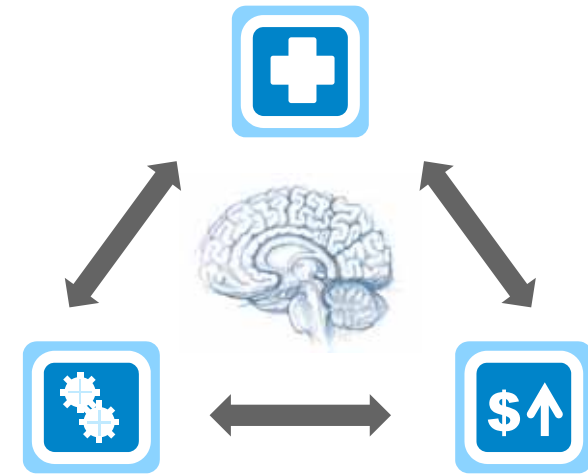
Extend Practice Efficiency

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 in Multiple Sclerosis?
Benefits for Multiple Sclerosis Clinics

- **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.

HOW Can CNS VS Help?

Etiology of MS

Genes & Environment

↓

Abnormal Immune Response

↓

Multiple Sclerosis

Immune Stimulation (Infections?) → ↓ ← **Secondary Factors**

Worsening MS
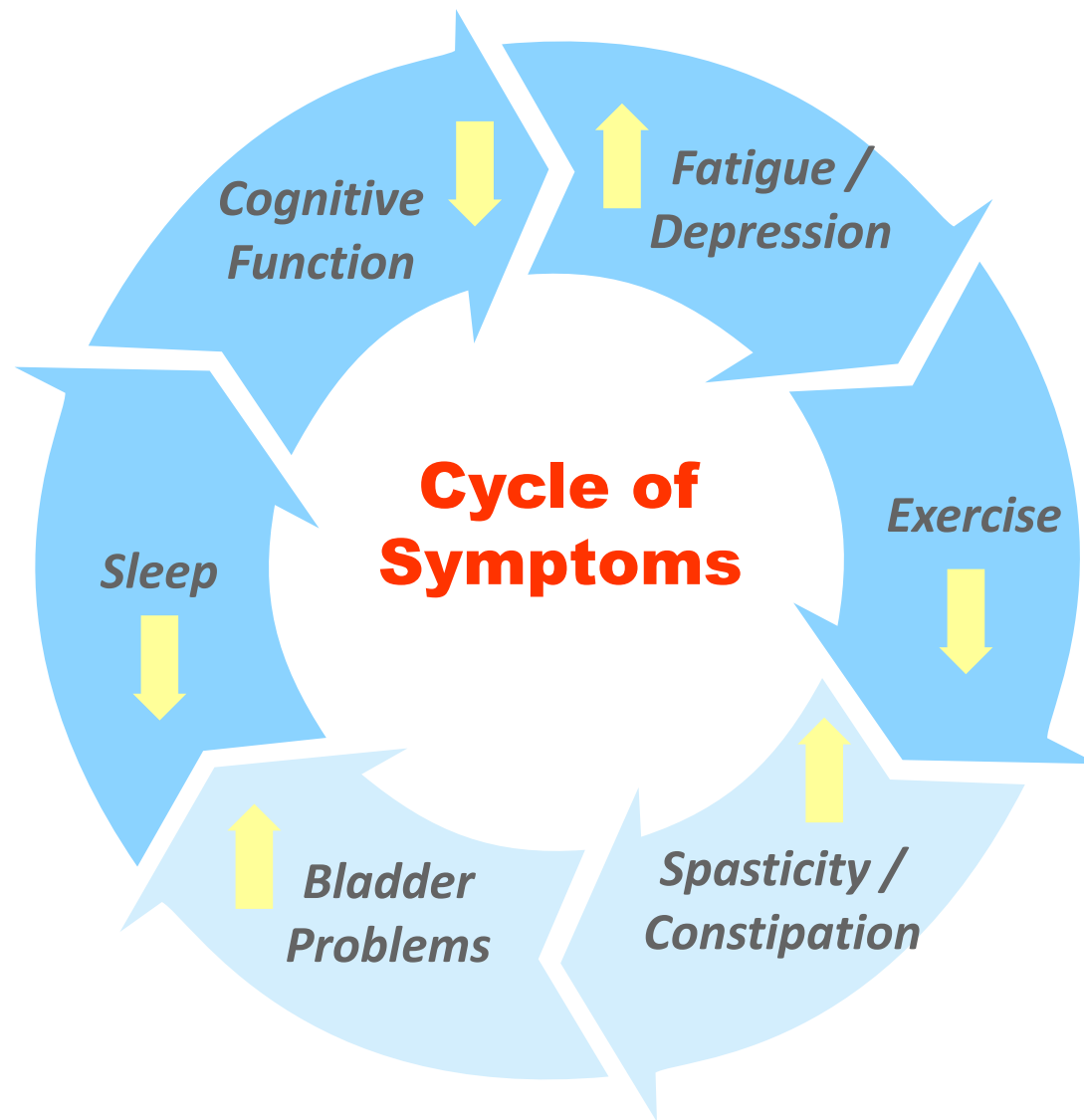
Adapted From: Cohen, B. Int J MS Care, 2007; 9 (Suppl4):4-10; Ben-Zacharia A, et al. Mutiple Sclerosis Counseling Points. 2007;3(3):1-12.

Cycle of Symptoms

Cognitive Function

Fatigue / Depression

Exercise

Sleep

Bladder Problems

Spasticity / Constipation

Adapted From: Crayton H, et.al. Neurology, 2004;63 (11 Suppl 5): S12-S18.

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.

About: CNS Vital Signs in Multiple Sclerosis

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 chronic care model and helps enable productive interactions between the family, caregivers, and a specialist 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 Multiple Sclerosis. Re-evaluation or serial testing with CNS Vital Signs supports the effective 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.

Why Use CNS Vital Signs to Assess MS?

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

Comorbid Status
Measure and Monitor

Serial Assessment
Longitudinal View

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.

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

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.

Neurocognitive function in MS patients can vary and affect various sites within the brain, no single cognitive deficit pattern is characteristic of all patients with MS. However, specific deficits tend to be seen in MS. These deficits include problems with memory, attention, executive functioning, generative fluency, and information processing speed. Adapted from: Rao et.al. ; Heaton et.al.; Benedict et.al.

Advancing MS Care Management

CNS Vital Signs Multiple Sclerosis 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

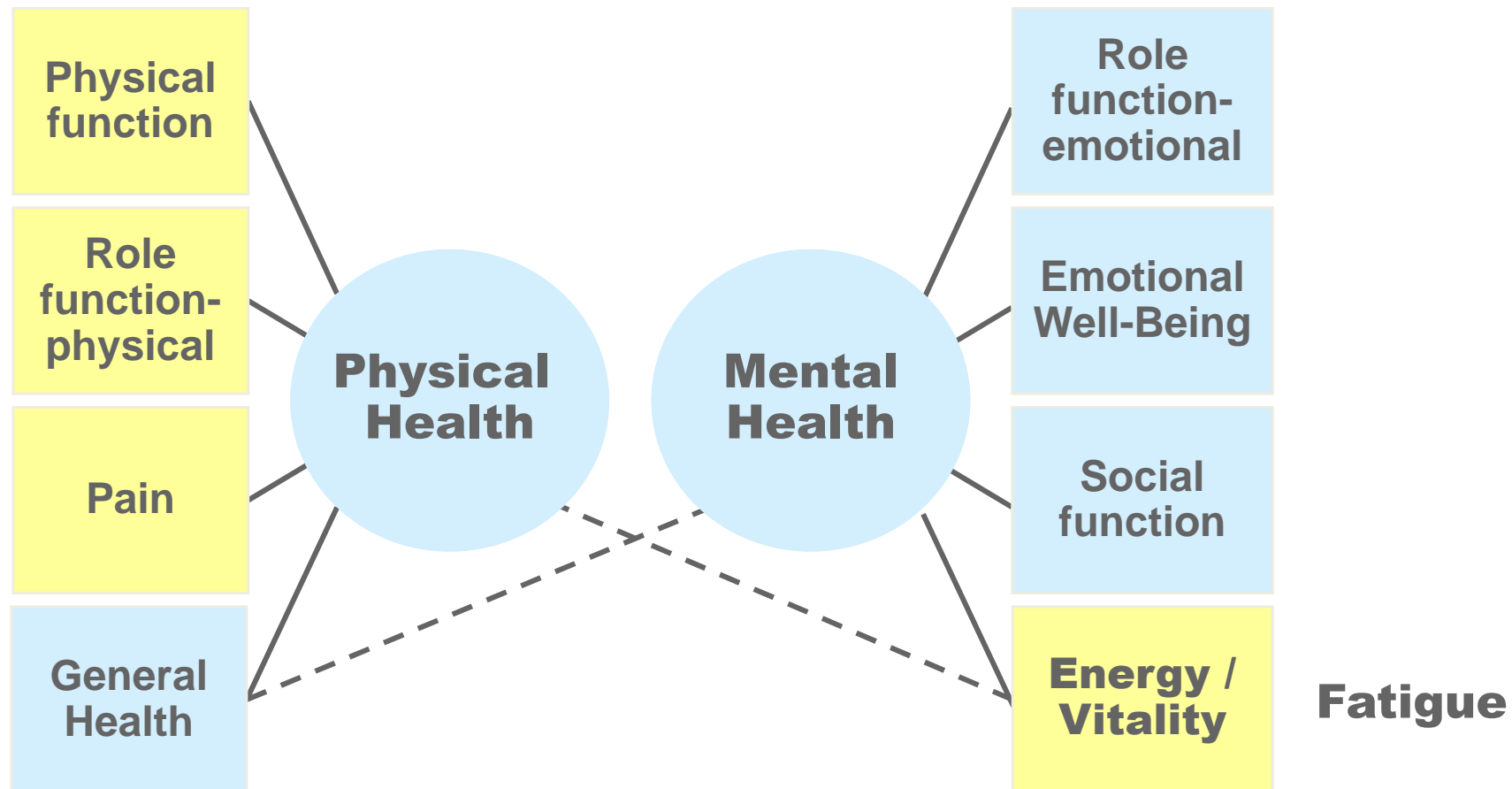### Computerized Medical and Health Rating Scales*

- SF – 36 Medical Outcomes
- Zung Self-Rating Anxiety and Depression Scales
- NeuroPsych Questionnaire NPQ-207 & NPQ-45 both Child & Adult
- Epworth Sleepiness
- Pittsburgh Sleep Quality Index
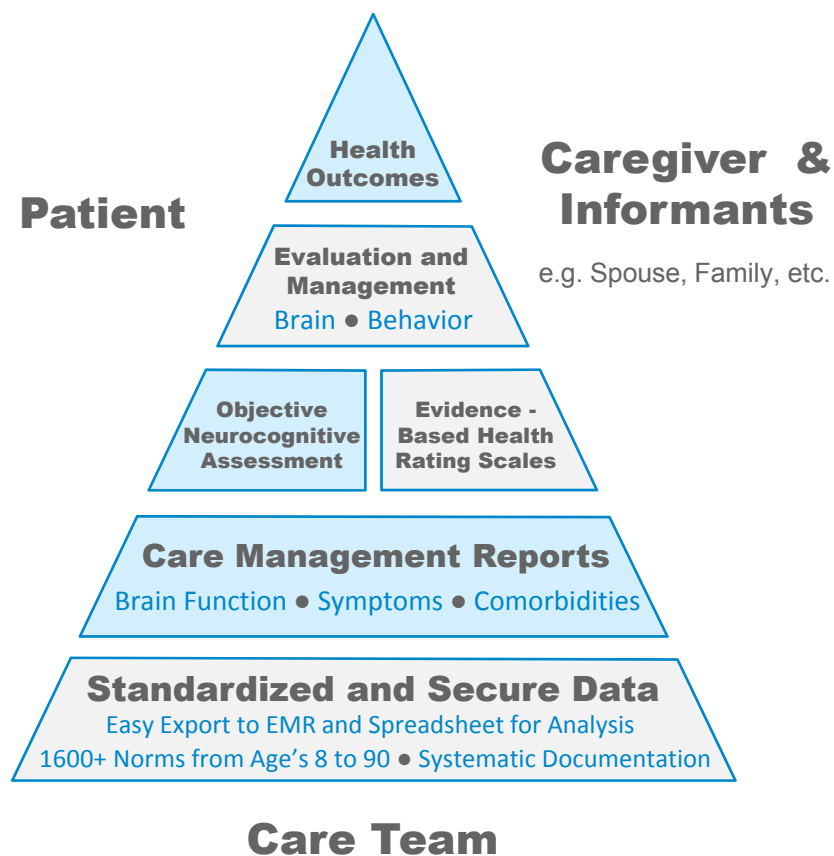
Used with permission… Free use of rating scales

CNS Vital Signs MS Toolbox

Physical function

Role function-physical

Pain

General Health

Physical Health

Mental Health

Role function-emotional

Emotional Well-Being

Social function

Energy / Vitality

Fatigue

Optimized for MS Evaluation & Management

Patient **Caregiver & Informants**

e.g. Spouse, Family, etc.

- Health Outcomes
- Evaluation and Management — Brain ● Behavior
- Objective Neurocognitive Assessment | Evidence - Based Health Rating Scales
- **Care Management Reports** — Brain Function ● Symptoms ● Comorbidities
- **Standardized and Secure Data** — Easy Export to EMR and Spreadsheet for Analysis / 1600+ Norms from Age's 8 to 90 ● Systematic Documentation

Care Team

CNS Vital Signs Neurocognitive Battery in Multiple Sclerosis

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.

Computerized neuropsychological battery detects psychomotor processing speed impairment as the core cognitive deficit in relapsing - remitting multiple sclerosis patients

Messinis L., PhD., Anyfantis E., M.Sc., Lyros E., MD, PhD., Papathanasopoulos P., MD, PhD Department of Neurology, Neuropsychology Section, University of Patras Medical School, Greece; 7th International Congress on the Improvement of the Quality of Life on Dementia, etc; Thessaloniki, Greece, 29 January 1st Febrauary 2009

Discussion and Conclusions

Our findings support the literature that RRMS patients present cognitive impairments when compared to healthy controls [7]. Furthermore, measures of information processing speed appear to be the most robust and sensitive markers of this impairment [8], a finding confirmed by our data.

These results also indicate that the CNS vital signs battery is able to detect cognitive impairments in RRMS patients. Furthermore, it appears to be highly sensitive in detecting psychomotor processing speed deficits in RRMS patients with a low disability status, as were the patients in this study.

We conclude, that RRMS patients present cognitive deficits even in the absence of significant physical disability, and that these patients should be routinely assessed for cognitive decline. The CNS Vital signs neuropsychological battery could provide the non - neuropsychologist clinician with a reliable screening tool for detecting cognitive deficits in RRMS patients.

Table 2. Neuropsychological performance on the CNSVS Battery: mean (SD)

Cogntive Domain	RRMS	Controls	
Memory	93.8 (8.5)	94.7 (5.8)	NS
*Psychomotor Speed	155.23 (20.68)	177.86 (22.02)	< .05
Reaction Time	682.06 (115.08)	658.97 (82.25)	NS
*Complex Attention	8.8 (6.2)	5.8 (2.6)	< .05
*Cognitive Flexibility	38.4 (15.2)	45.6 (10.10)	< .05

*Significant difference between groups (p <.05) based on parametric t-tests

Table 1. clinical and demographic characteristics: mean (SD)

Variables	RRMS (n= 30)	Controls (n=25)
*Age	34.6 (8.4)	35.4 (7.6)
*Sex	27 females / 3 males	23 females/ 2 males
* Education (yrs)	12.2 (3.0)	12.7 (2.6)
* § Estimated Intelligence level	98.50 (12.30)	99.40 (11.65)
Disease duration	5.8 (4.6)	-
EDSS (disability status)	2.8 (1.4)	-

*Non significant difference between groups (p <.05) based on parametric t-tests (age, education, intelligence level) and x^2 test (sex)
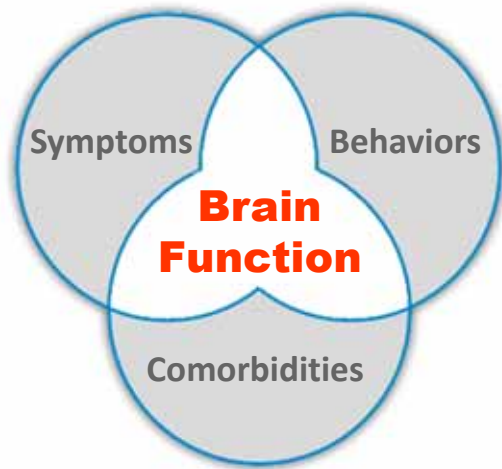
§ Intelligence (IQ) was estimated by administering the vocabulary and matrix reasoning subscales of the Wechsler abbreviated scale of intelligence (WASI), Greek-adapted version [6]

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.**

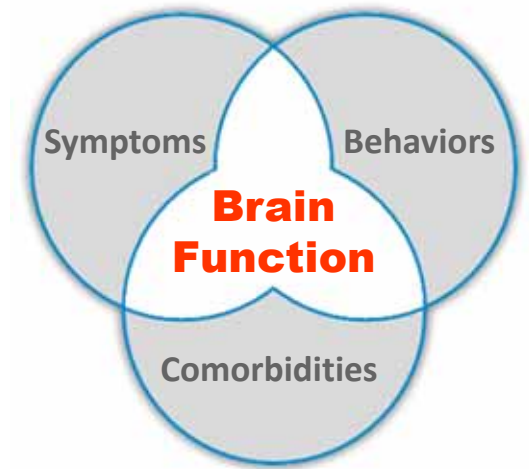## NPQ – 45 (Adult Patient & Informant Version)

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

Solutions for Measuring , Monitoring, and Managing Neurocognitive and Behavioral Health

13

Computerized Neurocognitive Testing can Help Assess Cognitive Function vs. Possible 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]

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ARTICLE INFO

ABSTRACT

history:
2 October 2010
ised form 5 January 2011
011

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 the majority appear to ha... 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

Solutions for Measuring , Monitoring, and Managing Neurocognitive and Behavioral Health

Cognition and Depression

Cognitive Flexibility

Domain scored from two venerable AD/HD tests

● Healthy Control
■ Mood Disorder, Normal Cognition
◆ *Mood Disorder, Cognitive Impairment*
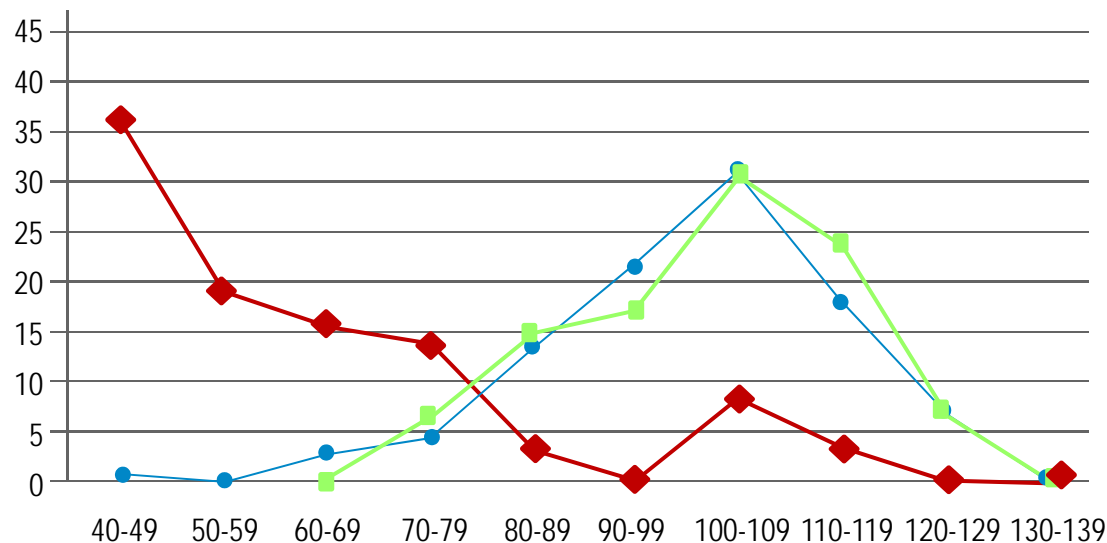
Fig. 3. Distributions of **CNS Vital Signs** *cognitive flexibility* index score in patients with or without impaired cognition. Figure note: Healthy control, N=660. Mood disorder, normal cognition, n=128. Mood disorder, cognitive impairment, n=58. *Normative scores were truncated at 40. Each value represents the percentage of subjects in that score range.

Solutions for Measuring , Monitoring, and Managing Neurocognitive and Behavioral Health

HOW? CNS Vital Signs begins with...

| A Conduct Neurocognitive Testing Procedure | B Evaluate Neurocognitive Testing Results | C Re-test Neurocognitive Testing Procedure |

Is the Validity Indicator (VI) suggestive of an invalid test?

1 Evaluate Effort

2 Evaluate Severity

3 Evaluate Pattern

Are the Scores suggestive of a deficit or impairment?

Is the Pattern suggestive of a condition or pathology?
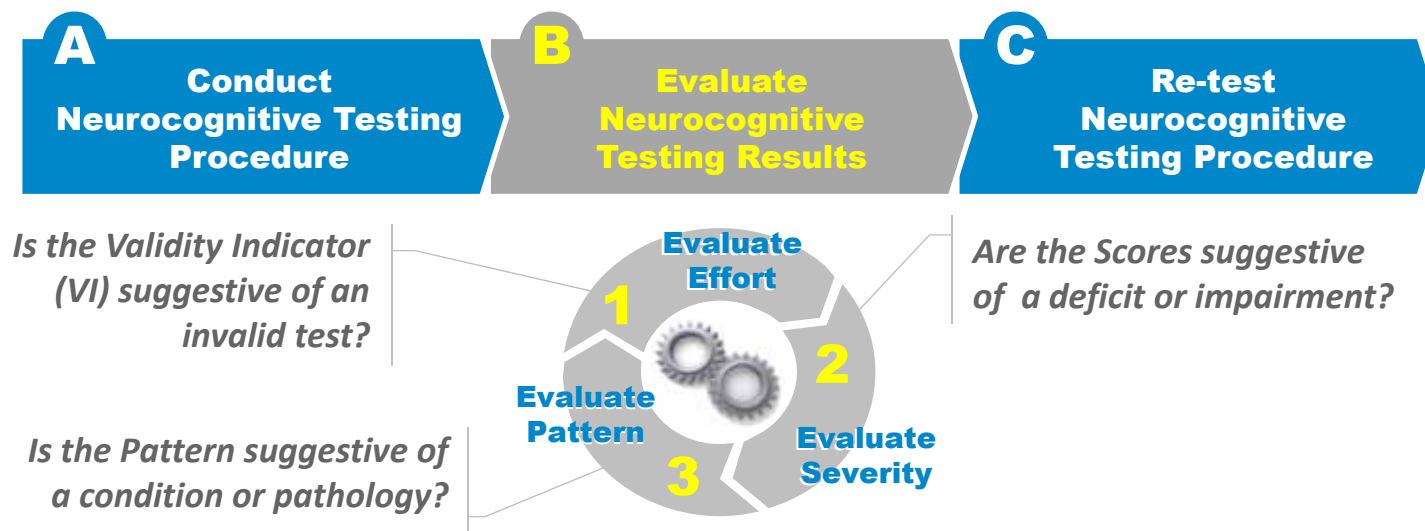
A: Conducting a Valid Assessment (Refer to the Test Administration Guide.) To begin the staff should collect information about the CHIEF or REFERRAL COMPLAINT. This will be a primary driver for the selection of tests and rating scales. For initial evaluations or in complex presentations, a broad spectrum 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

− Mean +

Standard Deviations	-4σ	-3σ	-2σ	-1σ	0	+1σ	+2σ	+3σ	+4σ
Percentiles		1	5 10 20 30 40 50 60 70 80		90 95	99			
Standard Scores		55	70	85	100	115	130	145	
Z Scores	-4.0	-3.0	-2.0	-1.0	0	+1.0	+2.0	+3.0	+4.0
T Scores		20	30	40	50	60	70	80	

	Standard Scores	
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**

CNS Vital Signs Clinical Report

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.
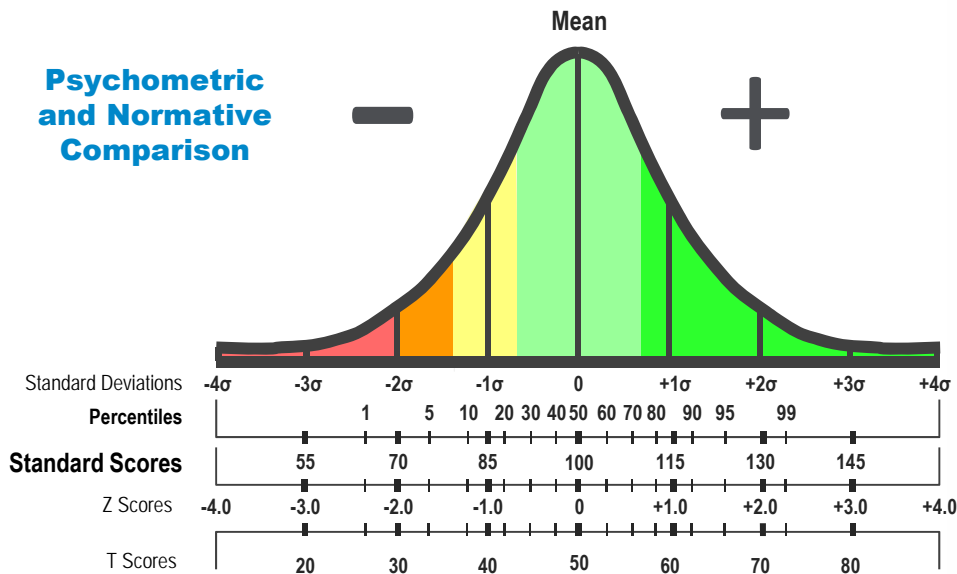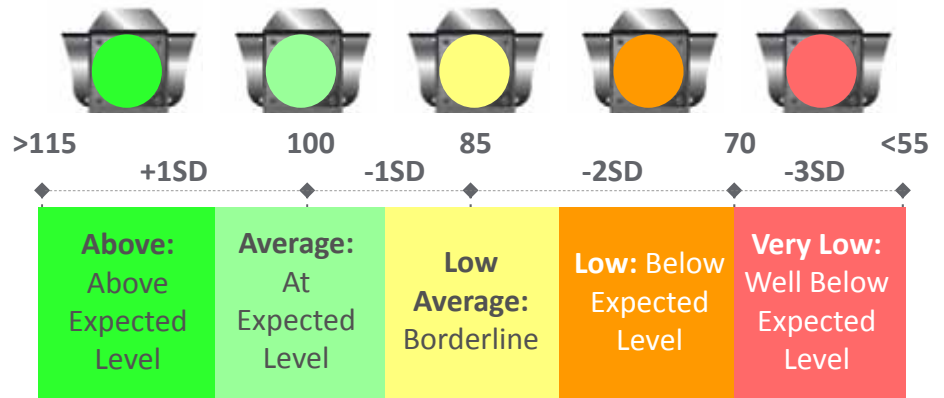**VI** – Validity Indicator:** Denotes a guideline for representing the possibility of an invalid test or domain score. "No" means a clinician should evaluate whether or not the test subject understood the test, put forth their best effort, or has a clinical condition requiring further evaluation.

Verbal Memory Test (VBM)	Score	Standard	Percentile
Correct Hits - Immediate	13	102	55
Correct Passes - Immediate	14	95	37
Correct Hits - Delay	9	85	16
Correct Passes - Delay	15	109	73

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.

Visual Memory Test (VIM)	Score	Standard	Percentile
Correct Hits - Immediate	13	107	68
Correct Passes - Immediate	14	117	87
Correct Hits - Delay	13	111	77
Correct Passes - Delay	11	93	32

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.

Finger Tapping Test (FTT)	Score	Standard	Percentile
Right Taps Average	64	104	61
Left Taps Average	60	105	63

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.

Symbol Digit Coding (SDC)	Score	Standard	Percentile
Correct Responses	50	80	9
Errors*	2	92	30

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.

Stroop Test (ST)	Score	Standard	Percentile
Simple Reaction Time*	231	108	70
Complex Reaction Time Correct*	542	100	50
Stroop Reaction Time Correct*	568	112	79
Stroop Commission Errors*	8	5	1

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.

Shifting Attention Test (SAT)	Score	Standard	Percentile
Correct Responses	47	82	12
Errors*	13	75	5
Correct Reaction Time*	1003	97	42

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.

Continuous Performance Test (CPT)	Score	Standard	Percentile
Correct Responses	40	104	61
Omission Errors*	0	104	61
Commission Errors*	0	108	70
Choice Reaction Time Correct*	400	99	47

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.

Neurocognitive Domain Dashboard

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.**

>115	100	85	70	<55
+1SD	-1SD		-2SD	-3SD
Above: Above Expected Level	**Average:** At Expected Level	**Low Average:** Borderline	**Low:** Below Expected Level	**Very Low:** Well Below Expected Level

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

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

Solution Example

$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*

Solutions for Measuring , Monitoring, and Managing Neurocognitive and Behavioral Health