











Testing we can do for your patients

10 Normed Neurocognitive Tests... 50+ Rating Scales

Fully Integrated System with VS4 Local Computer Software and Cloud-Based Online Testing

<p>Verbal Memory (VBM) Approx. 3 Minutes</p>		<ul style="list-style-type: none"> ■ Learning Words ■ Memory for Words ■ Word Recognition ■ Immediate and Delayed Recall
<p>Visual Memory (VIM) Approx. 3 Minutes</p>		<ul style="list-style-type: none"> ■ Learning Shapes ■ Memory for Shapes ■ Shapes Recognition ■ Immediate and Delayed Recall
<p>Finger Tapping (FTT) Approx. 2 Minutes</p>		<ul style="list-style-type: none"> ■ Motor Speed ■ Fine Motor Control
<p>Symbol Digit Coding (SDC) Approx. 4 Minutes</p>		<ul style="list-style-type: none"> ■ Complex Information Processing Accuracy ■ Complex Attention ■ Visual-Perceptual Speed ■ Information Processing Speed
<p>Stroop Test (ST) Approx. 4 - 5 Minutes</p>		<ul style="list-style-type: none"> ■ Simple Reaction Time ■ Complex Reaction Time ■ Stroop Reaction Time ■ Inhibition / Disinhibition ■ Frontal or Executive Skills
<p>Shifting Attention (SAT) Approx. 2.5 Minutes</p>		<ul style="list-style-type: none"> ■ Executive Function ■ Shifting Sets: Rules, Categories, & Rapid Decision Making ■ Reaction Time
<p>Continuous Performance (CPT) Approx. 5 Minutes</p>		<ul style="list-style-type: none"> ■ Sustained Attention ■ Choice Reaction Time ■ Impulsivity
<p>Perception of Emotions (POET) Approx. 2 Minutes</p>		<ul style="list-style-type: none"> ■ Social Cognition or Emotional Acuity ■ Choice Reaction Time
<p>Non-Verbal Reasoning (NVRT) Approx. 3.5 Minutes</p>		<ul style="list-style-type: none"> ■ Reasoning ■ Reasoning Recognition Speed
<p>4-Part Continuous Performance (FPCPT) Approx. 7 Minutes</p>		<ul style="list-style-type: none"> ■ Sustained Attention ■ Working Memory

Computerized versions of **VENERABLE NEUROPSYCHOLOGICAL TESTS**. Measures the **SPEED** and **ACCURACY** of a patient's response. **TOTAL TEST TIME** depends on the number of tests and rating instruments selected. Modular testing panels can be custom configured according to clinical practice or research needs.

CNS Vital Signs assessment platform includes 50+ medical and health rating instruments helping identify and systematically document **PATIENT** and **INFORMANT** ratings of symptoms, behaviors and comorbidities.

Pediatric - Adolescent Instruments:

Developmental - Mental Health

- Pediatric Symptom Checklist (PSC-35, Youth and PSC-17)
- Vanderbilt ADHD Diagnostic Parent & Teacher Rating Scales
- Vanderbilt Assessment Follow-up Parent & Teacher Rating Scales
- PHQ-9 Depression & GAD-7 Anxiety
- DASS - Depression, Anxiety and Stress Scale 21 & 42 (14 years of age and up)
- Screen for Child Anxiety Related Disorders (SCARED) Child & Parent Version
- Social Anxiety Scale for Children and Adolescents (SASCA)

Targeted Instruments

- Child Obsessive-Compulsive Disorder Inventory (OCD-C)
- Childhood Cancer Survivor Study Neurocognitive Questionnaire (CCSS)
- Neurobehavioral Symptom Inventory (NSI)
- DSM -5 PTSD Checklist (PCL-5) & Stressor Specific (PCL-5)

Substance Abuse - SBIRT

- Drug Use Questionnaire (DAST)
- Alcohol Use Disorders Identification Test (AUDIT)

Adult Instruments:

Health Risk - Mental Health

- Patient Health Questionnaire (PHQ-9)
- General Anxiety Disorder (GAD-7)
- DASS - Depression, Anxiety and Stress Scales 21 & 42
- Zung Self-Rating Depression & Anxiety Scales
- Stanford Geriatric Depression Scales (SGDS) 15 & 25

Targeted Instruments

- Quality of Life Medical Outcomes Survey (MOS) SF-36
- Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist
- DSM-5 PTSD Checklist (PCL-5), also the Civilian (PCL-C), Stressor Specific (PCL-S) and Military (PCL-M)
- Fall Risk Questionnaire (FRQ)
- Health Assessment Questionnaire (HAQ) Disability Scale
- Modified Fatigue Impact Scale (MFIS)
- Neurobehavioral Symptom Inventory (NSI)
- Dizziness Handicap Inventory (DHI)
- Head Injury Questionnaire (HIQ)
- Memory Questionnaire (MEMQ)
- Adult Obsessive-Compulsive Disorder Inventory (OCD-A)
- MHE Questionnaire
- Combat Exposure Scale (CES)
- Life Events Checklist (LEC)
- Deployment Risk and Resiliency Inventories
- Life Habits Checklist
- Medical Symptoms Questionnaire (Past 30 Days) and (Past 48 Hours)

Sleep

- Epworth Sleepiness Scale (ESS)
- Pittsburgh Sleep Quality Index (PSQI)
- Sedation Scale (SS)
- Alertness Rating Scale (ARS)

Substance Abuse - SBIRT

- Drug Use Questionnaire (DAST)
- Alcohol Use Disorders Identification Test (AUDIT)

Pain

- Numeric Pain Scale
- Pain Catastrophizing Scale (PCS)

Case Examples: Concussion, mTBI, PTSD

mTBI / Concussion Post Injury: 20-Year-Old Male

Patient Profile:	Percentile Range				> 74	25 - 74	9 - 24	2 - 8	< 2
	Subject Score	Standard Score	Percentile	V ¹	> 109	90 - 109	80 - 89	70 - 79	< 70
Neurocognition Index (NCI)	85	18	Yes	Above	Average	Low Average	Low	Very Low	
Composite Memory	102	102	58	Yes	X				
Verbal Memory	81	83	32	Yes	X				
Visual Memory	18	110	79	Yes	X				
Psychomotor Speed	174	83	32	Yes	X				
Reaction Time ²	888	107	88	Yes	X				
Complex Attention ³	21	96	1	Yes				X	
Cognitive Flexibility	28	61	1	Yes				X	
Processing Speed	48	74	0	Yes			X	X	
Executive Function	34	73	0	Yes			X	X	
Simple Visual Attention	40	108	70	Yes	X				
Motor Speed	124	105	63	Yes	X				

Following a collision in a club rugby match Paul, a 20-year-old college student, visited the ER complaining of a headache and nausea. Not having a cognitive baseline Paul was given CNS Vital Signs VS4 Clinical Battery (1st post injury). Compared to his peers he scored below average in 4 of 11 cognitive domains. His lowest scores were in domains represented by frontal lobe tests.

After examining Paul, and reviewing the CT scan, symptom scale as well as the cognitive test results; Paul was started on a concussion management protocol. Two weeks later after he was symptom free, he was administered the test again (2nd post injury). The CNS Vital Signs session and longitudinal reports were available immediately after the testing session allowing the clinician to evaluate and manage Paul efficiently at the office visit.

The CNS Vital Signs testing platform is designed to support TBI, mTBI and sports concussion guidelines.

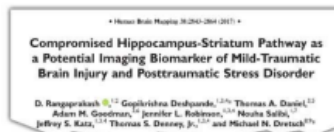
mTBI / Concussion 2nd Post Injury: 20-Year-Old Male

Patient Profile:	Percentile Range				> 74	25 - 74	9 - 24	2 - 8	< 2
	Subject Score	Standard Score	Percentile	V ¹	> 109	90 - 109	80 - 89	70 - 79	< 70
Neurocognition Index (NCI)	113	81	Yes	X					
Composite Memory	118	100	88	Yes	X				
Verbal Memory	88	116	88	Yes	X				
Visual Memory	88	100	98	Yes	X				
Psychomotor Speed	201	170	76	Yes	X				
Reaction Time ²	688	108	78	Yes	X				
Complex Attention ³	3	110	78	Yes	X				
Cognitive Flexibility	55	108	70	Yes	X				
Processing Speed	65	100	80	Yes	X				
Executive Function	56	108	70	Yes	X				
Simple Visual Attention	40	108	70	Yes	X				
Motor Speed	128	118	84	Yes	X				



Correlation to Imaging Markers

Post Concussion Syndrome - PTSD



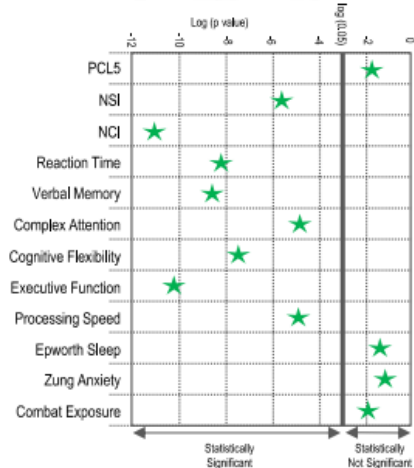
Examining Microstructural White Matter in Active-Duty Soldiers with a History of Mild Traumatic Brain Injury and Traumatic Stress

Method: Seventy-four active-duty U.S. soldiers with PTS (n = 16) and PTS with co-morbid history of mTBI (PTS/mTBI; n = 28) were compared to a military control group (n = 30). Participants received a battery of neurocognitive and clinical symptom measures. The number of abnormal DTI (diffusion tensor imaging) values was determined (> 2 SDs from the mean of the control group) for fractional anisotropy (FA) and mean diffusivity (MD), and then compared between groups...

Results: The comorbid PTS/mTBI group had significantly greater traumatic stress, depression, anxiety, and post-concussive symptoms, and they performed worse on neurocognitive testing than those with PTS alone and controls. The groups differed greatly on several clinical variables, but contrary to what we hypothesized, they did not differ greatly on primary and exploratory analytic approaches of hetero-spatial whole brain DTI analyses.

Conclusion: In conclusion, our findings do not provide strong evidence of compromised white matter integrity between our clinical groups compared to controls using several analytic approaches. **In contrast, our groups were best categorized by robust differences in clinical symptoms and neurocognitive scores (i.e., CNS Vital Signs / TOMM).** As such, our findings suggest that psychological health conditions rather than pathoanatomical changes may be contributing to symptoms presented by soldiers with comorbid PTS and mTBI.

Adapted from: Dretsch, Michael N., Raif T. Lange, Jeffrey S. Katz, Adam Goodman, Thomas A. Daniel, Gopikrishna Deshpande, Thomas S. Denney, Grant L. Iverson, and Jennifer L. Robinson. 2017. "Examining Microstructural White Matter in Active-Duty Soldiers with a History of Mild Traumatic Brain Injury and Traumatic Stress." The Open Neuroimaging Journal



*Comparing symptom severity, neurocognitive functioning, and self-report measures of the control subjects and the... PCS-PTSD group (green stars). The significance threshold (0.05) is visible as a thick horizontal line. Control subjects exhibited significantly better neurocognitive performance, less sleepiness and anxiety, and less combat exposure. **PCS-PTSD subjects exhibited significantly worse neurocognitive performance and higher PCS symptom.**

*Adapted from: Human Brain Mapping 38:2843-2864 (2017); Compromised Hippocampus-Striatum Pathway as a Potential Imaging Biomarker of Mild-Traumatic Brain Injury and Posttraumatic Stress Disorder; Rangaprakash et al.