CNS Vital Signs Memory

(MCI, Dementia, Alzheimer's, Etc.)

and Healthy Aging

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

CNS Vital Signs®

www.CNSVS.com

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

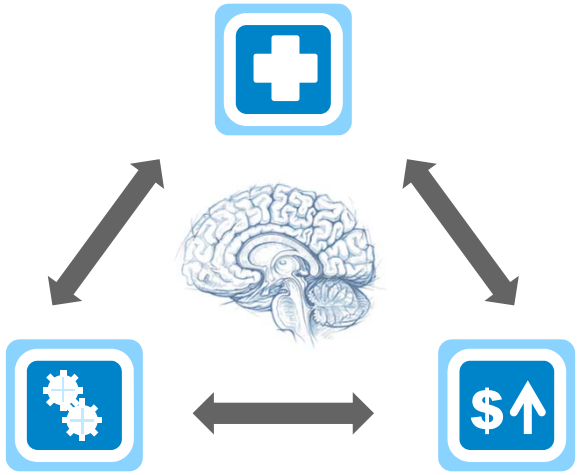
Why CNS Vital Signs?

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

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

Enhanced Brain & Behavior Evaluation and Care Management

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



Extend Practice Efficiency

Objective and Evidence-Based Assessments, Auto-Scored and Systematically Documented.

(HIPAA Enabled)

Enhanced Revenue Streams

Expanded Services with Well Established Billing Codes to Improve Practice Performance

WHY 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 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.

Introduction: CNS Vital Signs in Memory

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.

CNS Vital Signs computerized neuropsychological tests can enhance efficiency and insight in assessing cognitive status and the difference between "normal aging" and a patients current status and provides the clinician with a normative comparison that can be paired with an interview, exam, and other markers to help add validity to the evaluation or identify the need for further neuropsychological testing. Re-evaluation testing with CNS Vital Signs supports the detection of progressive decline or serial change in individuals over time and enabling outcomes. Many times an assessment can detect a problem years before the illness becomes clinically apparent. This allows for early treatment. 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.

CNS Vital Signs VSX BRIEF-CORE assessment platform contains seven tests of neurocognitive function which are autoscored into nine clinical domains, the Stanford Geriatric Depression Rating Scales, Memory Questionnaire, the Medical Outcomes Survey SF-36 (QOL), a NeuroPsych Questionnaire (NPQ), and other well known assessment tools. The CNS Vital Signs Memory-MCI Toolbox automatically scores and systematically documents the resulting clinical endpoints.

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.

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 Memory?

The CNS Vital Signs VSX Assessment Platform represents a legacy of innovation and a commitment to advancing neurocognitive and behavioral clinical assessment tools that help support a TEAM MANAGEMENT concept between primary care and specialists.

Clinical Pathology

Measure and Monitor

Assess BRAIN FUNCTION and Determine Possibility of IMPAIRMENT or to help Rule-In or Rule-Out…

CNS Vital Signs computerized neurocognitive testing allows clinicians to ***assess abnormal cognitive impairment*** by comparing patients to our 'PEER REVIEWED' normative data

Certain DOMAIN Scores can be ***informative in confirming a possible clinical condition e.g., Non-Amnestic or Amnestic MCI***

Comorbid Status

Measure and Monitor

CNS Vital Signs enables the recently updated Mild Cognitive Impairment guidelines.

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: Geriatric Depression Scale, Zung Anxiety & Depression, SR-36, Etc.

Longitudinal View

Track Progression

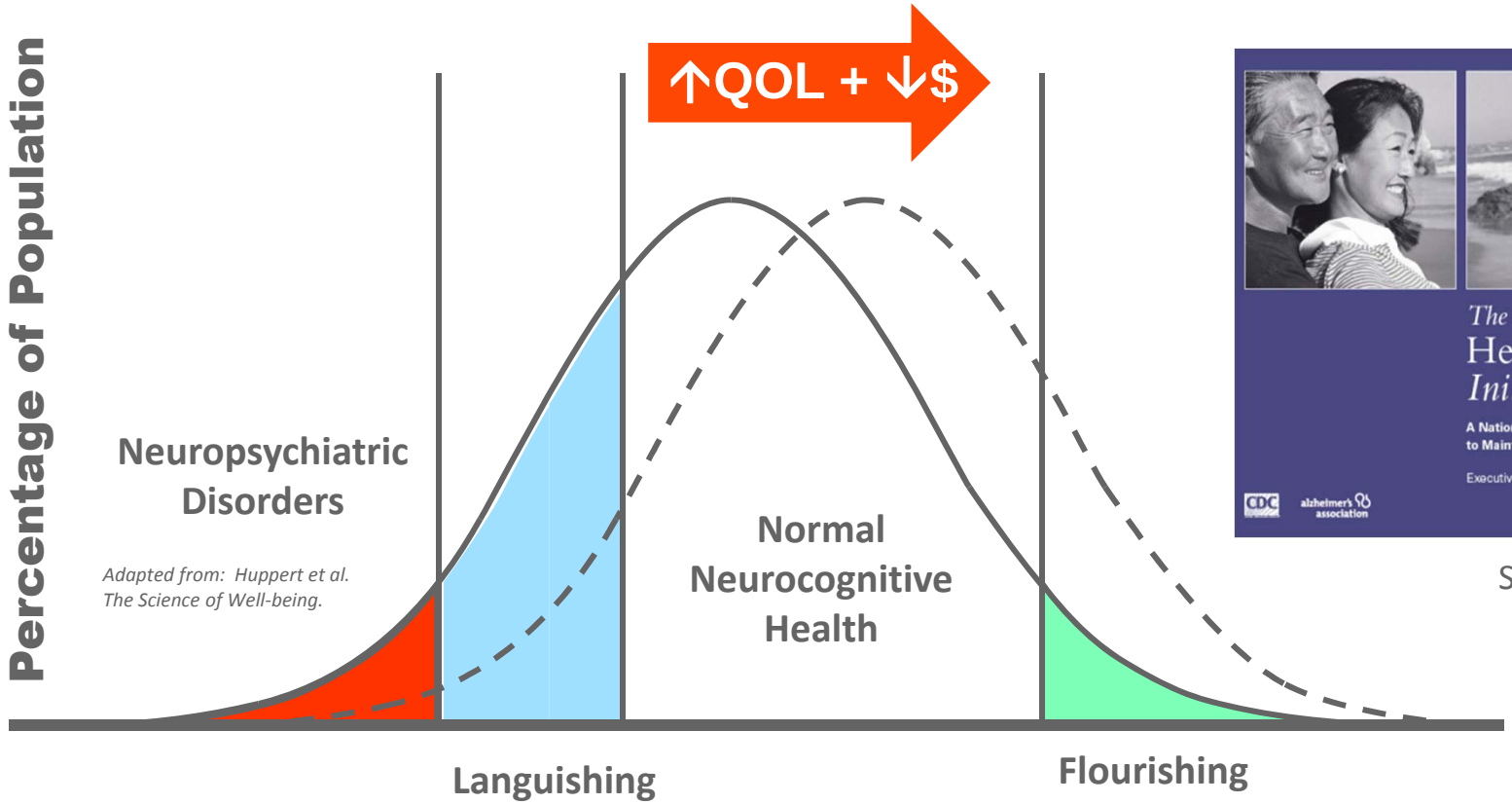
Computerized neurocognitive testing allows clinicians to ***assess abnormal cognitive decline with an auto-randomized algorithm for an almost unlimited number of alternate forms… adding validity to a*** **LONGITUDINAL VIEW**.

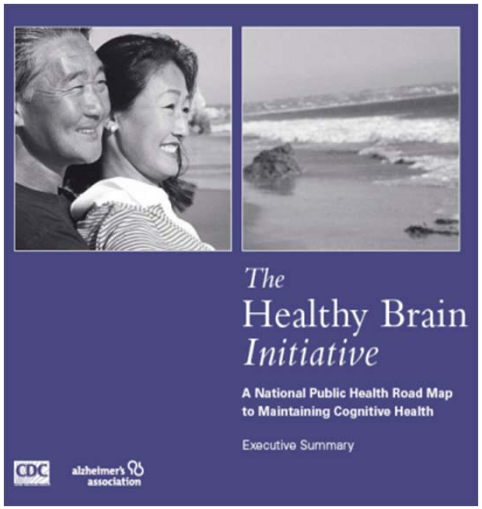
Supporting the future…The **DSM-V is recommending a NEW CODE "Neurocognitive Disorder"** and many conditions that neurocognitive testing is recommended e.g. Delirium, Vascular Disease, HIV, Etc.

"Diseases of the brain commonly produce changes in behavior, including impairment of cognitive abilities and production of neuropsychiatric symptoms. Knowledge of the presence and characteristics of these changes can aid in the evaluation, management, and longitudinal care of patients with neurologic and psychiatric diseases." Adapted from: Neurology 1996;47:592-599.

Societal Opportunity: About Healthy Aging

Shifting the mean of the population may have a substantial impact on the tails e.g. decreasing levels of mental disorders and increasing a flourishing population.





Source: CDC

Neurocognitive – Neuropsychological Resources

"Diseases of the brain commonly produce changes in behavior, including impairment of cognitive abilities and production of neuropsychiatric symptoms. Knowledge of the presence and characteristics of these changes can aid in the evaluation, management, and longitudinal care of patients with neurologic and psychiatric diseases." Adapted from: Neurology 1996;47:592-599.

Medicare Mandate for Cognitive Assessment

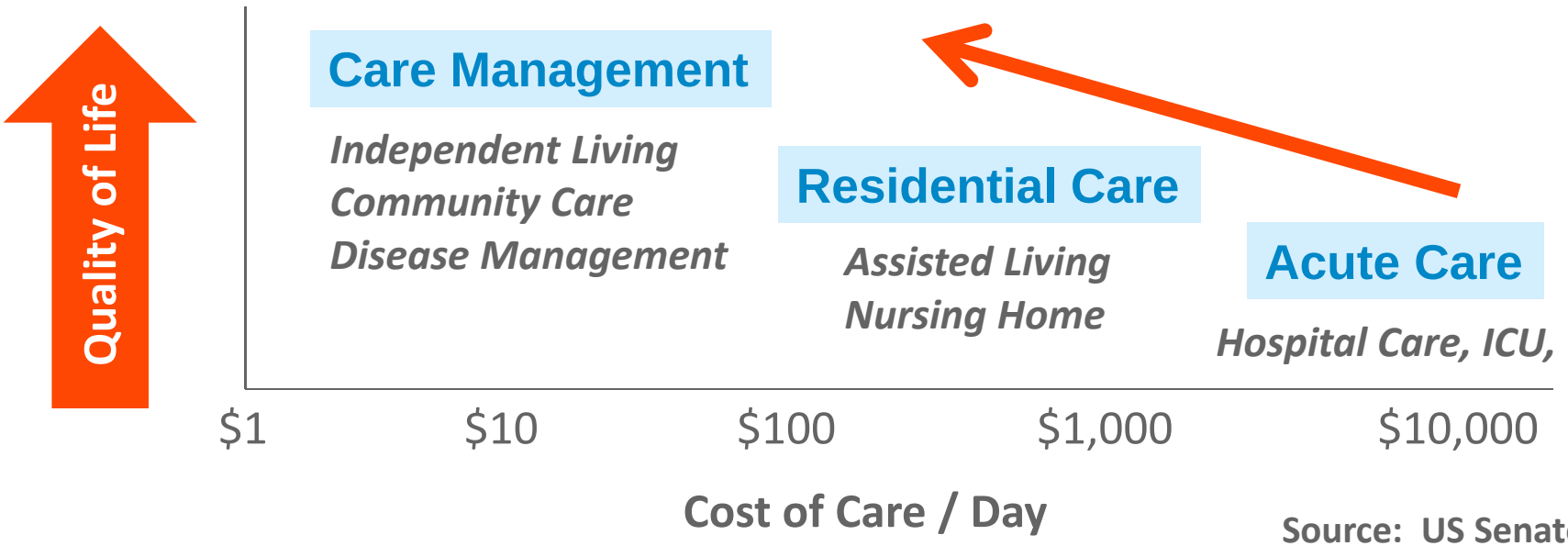
Effective January 1, 2011 Medicare now provides an Annual Wellness Visit benefit, in addition to the "Welcome to Medicare" physical exam that occurs only in the first year of joining Medicare. The new Annual Wellness Visit benefit includes several preventive health services, including **"detection of any cognitive impairment".** This is a new medical exam that has some important implications for both patients and physicians.

Source: http://mybraintest.org/dl/Cognitive_Screening_Tests_for_Medicare_Annual_Wellness_Visit.pdf

In the midst of the most significant demographic transformation in decades with the first wave of baby boomers beginning to turn 65 next year, assessment for cognitive impairment detection is essential as millions of Americans advance to an age when they are at greater risk for developing Alzheimer's and other dementias. (Source: Alzheimer's Association)

WHY?

From Reactive Care to Proactive Care



Source: US Senate

Increasing Recognition: Aging Baby Boomers

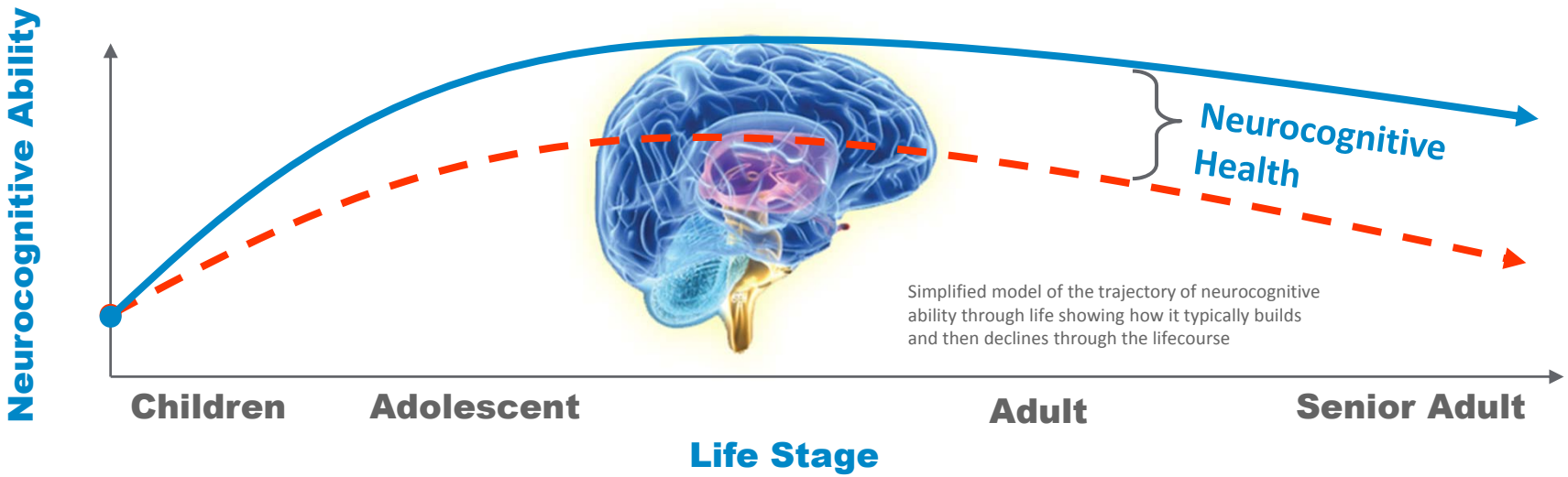
Early Detection of Cognitive Impairment, Dementia Significantly Reduces Healthcare Costs

July 20, 2010 (Honolulu, Hawaii) — Early detection, diagnosis, and care of individuals with newly diagnosed cognitive impairment and dementia can significantly reduce outpatient healthcare costs new research suggests… multicenter pilot program… **show healthcare costs for 1 year before and after diagnosis decreased by $1741 in the year after diagnosis of cognitive impairment compared with the year before diagnosis.**

Typically, said Dr. McCarten, patients with undiagnosed dementia go from crisis to crisis, which includes frequent visits to the emergency department and extensive testing."Through early diagnosis and proper chronic disease management, we hope to prevent this type of approach to care and put an end to the so-called pop-drop, where dad (or mom) is regularly brought to the emergency department because the family doesn't know what else to do," he said. This type of acute care approach is expensive, ineffective, and grueling for patients and families, he added.

WSJ July 20th 2010

About Neurocognitive Health

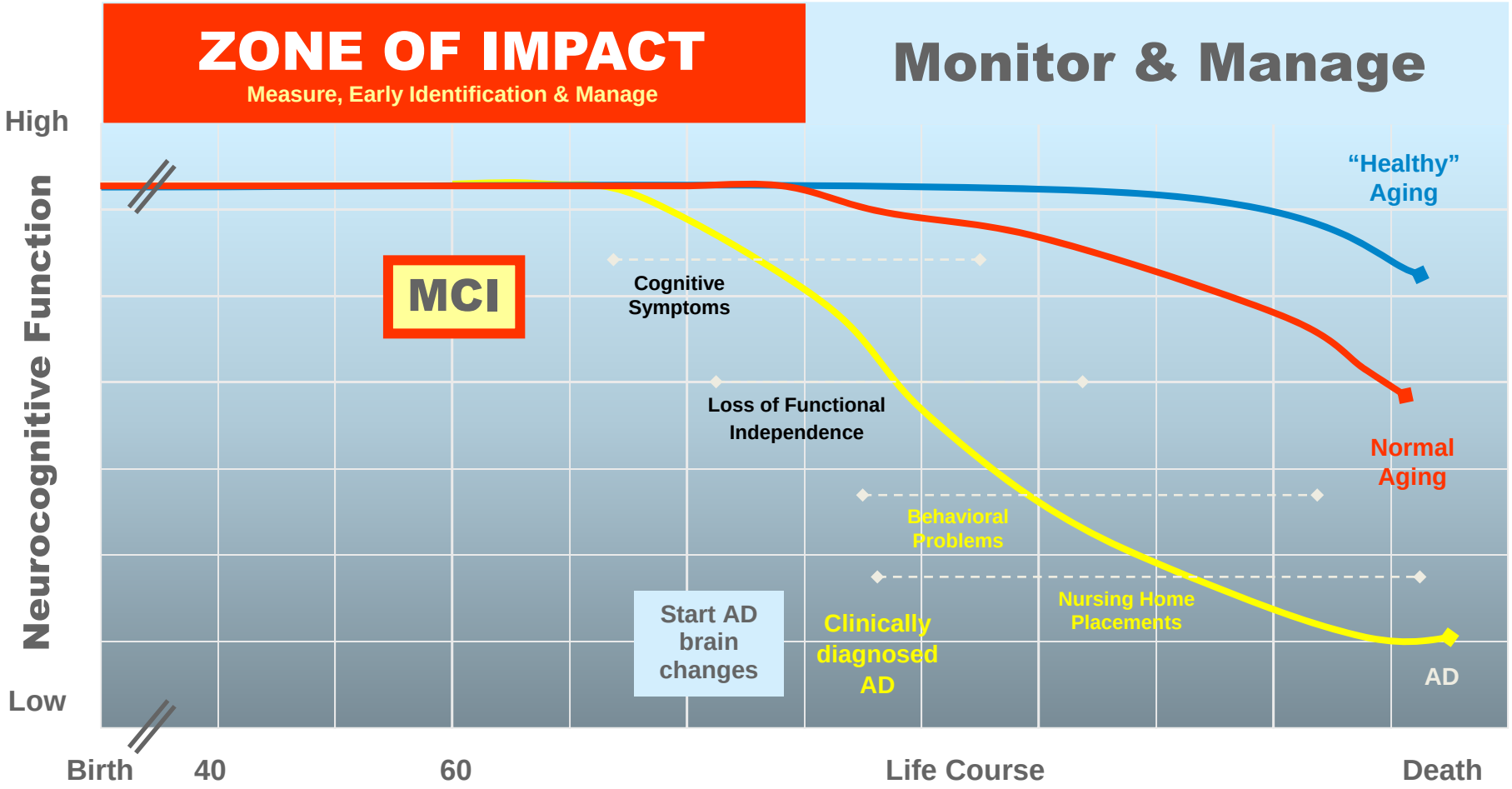


- "Neurocognition" refers to the higher brain functions: learning, remembering, concentrating, solving problems and making decisions. Neurocognitive processes are active in virtually all of our day-to-day activities — **Neurocognitive Health Matters.**
- Medical professionals and researchers know that good health has many dimensions, one of the most important and yet least measured is the health of a person's brain.
- Assessing Neurocognition against a lifespan normative data set allows clinicians to grade the level of impairment or deficit being experienced by the patient.
- Early detection and effective management (nutrition, sleep, exercise, etc.) can impact neurocognitive health.
- Serial assessment enables the clinician to measure disease progression or track treatment outcomes.

Neurocognitive symptoms are a prominent feature of nearly all neurodegenerative dementias. Specialized assessment of memory, executive functions, language, and visuospatial skills may aid in the differential diagnosis.
Source: Krueger, Casey E.; Kramer, Joel H. CONTINUUM: Lifelong Learning in Neurology. Volume; 16(2) Dementia. April 2010: pp 176-190.

Neurocognitive Health… Shifting the MEAN

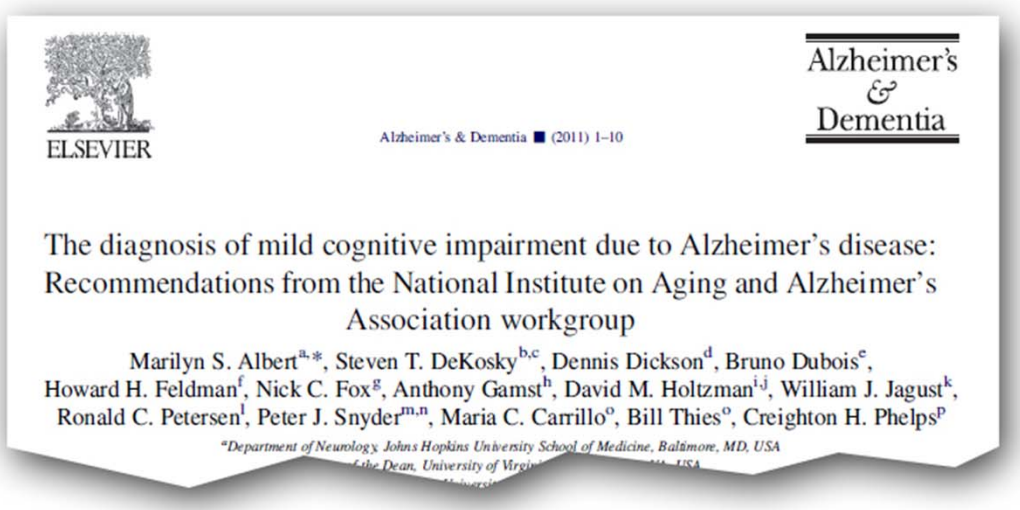
Adapted From: NIA; Feldman and Gracon. In Gauthier S (Ed.) Clinical Diagnosis and Management of Alzheimer's Disease. Martin Dunitz, London, 1996, 241.



"If we could keep people who are still functioning from having any further decline for five years-- then they would probably die from something else… The impact would be immeasurable."

Source: Forbes 4-08; Todd Golde, neuroscientist at the Mayo Clinic, in Jacksonville, Fla.

WHY? New MCI Guidelines


ELSEVIER

Alzheimer's & Dementia ■ (2011) 1–10

Alzheimer's & Dementia

The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging and Alzheimer's Association workgroup

Marilyn S. Albert[a,*], Steven T. DeKosky[b,c], Dennis Dickson[d], Bruno Dubois[e], Howard H. Feldman[f], Nick C. Fox[g], Anthony Gamst[h], David M. Holtzman[i,j], William J. Jagust[k], Ronald C. Petersen[l], Peter J. Snyder[m,n], Maria C. Carrillo[o], Bill Thies[o], Creighton H. Phelps[p]

[a]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

2.1. MCI—Criteria for the clinical and cognitive syndrome

- Concern regarding a change in cognition
- Impairment in one or more cognitive domains
- Preservation of independence in functional abilities
- Not demented

■ = How CNS Vital Signs can help.

2.2 Cognitive characteristics of MCI

It is important to determine whether there ***is objective evidence of cognitive decline***, and if so, ***the degree of this decline*** in the reports by the individual and/or an informant. ***Cognitive testing is optimal for objectively assessing the degree of cognitive impairment*** for an individual. Scores on cognitive tests for individuals with MCI are typically 1 to 1.5 standard deviations below the mean for their ***age and education matched peers on culturally appropriate normative data*** (i.e., for the impaired domain(s), when available). It is emphasized that these ranges are guidelines and not cutoff scores.

2.2.1. Cognitive assessment

…impairment in episodic ***memory*** (i.e., the ability to learn and retain new information) is most commonly seen in MCI patients who subsequently progress to a diagnosis of AD dementia… These tests share the characteristic that they assess ***both immediate and delayed recall***, so that it is possible to determine retention over a delay… Because other cognitive domains can be impaired among individuals with MCI, it is important to examine domains in addition to memory. These include: ***executive functions, language, visuospatial skills, and attentional control.*** Many validated clinical neuropsychological measures are available to assess these cognitive domains…

2.2.3. Longitudinal cognitive evaluation

Evidence of progressive decline in cognition provides additional evidence that the individual has "MCI due to AD," as noted earlier in the text. Thus, ***it is important to obtain longitudinal assessments of cognition, whenever possible.*** It is recognized that a diagnosis will likely need to be given without the benefit of this information; however, ***obtaining objective evidence of progressive declines in cognition over time is important for establishing the accuracy of the diagnosis, as well as for assessing any potential treatment response.***

Advancing Memory Care

CNS Vital Signs MCI – Memory Toolbox

Clinician Expertise

Brain Function: Verbal and Visual Memory (both immediate and delayed recall), Executive Function, and Attentional Domains

Computerized Neurocognitive Testing

- Nine Neurocognitive Domains Measured
- Longitudinal View
- Verbal and Visual Memory
- Three Executive Control Tests
- Two Attentional Tests
- Working Memory – Nback Test
- Immediate Auto – Scored Reports
- Rapid Assessment - 30 Minute Initial Assessment/Baseline, 15 Minute Follow-up for Treatment Effect
- Easy to Interpret
- HIPAA Compliant

Behaviors, Symptoms, and Comorbidities

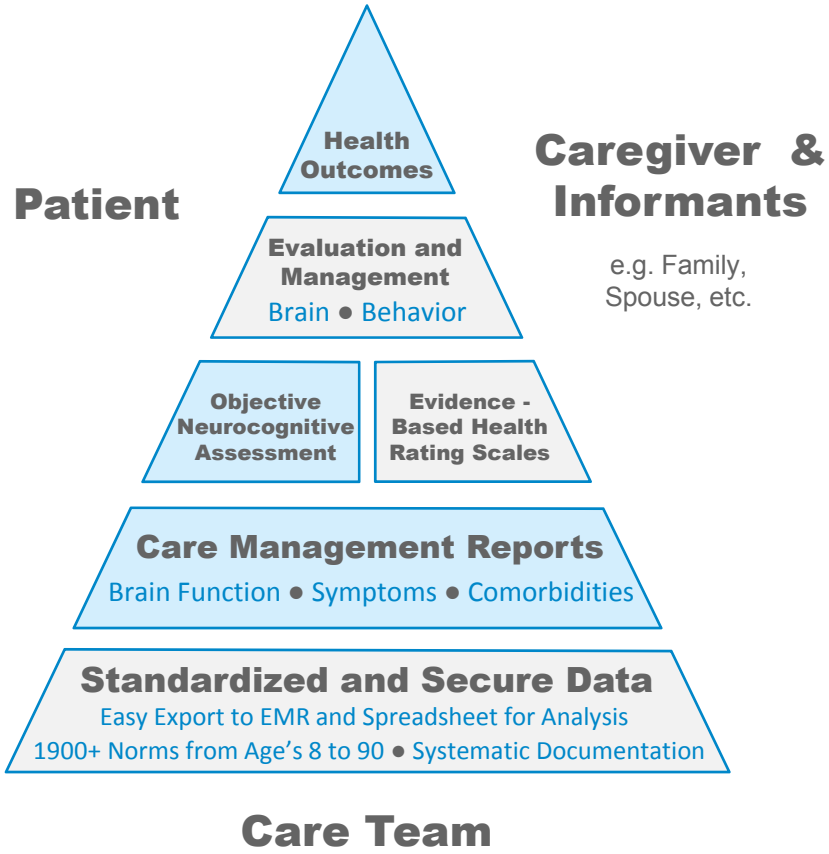
Computerized Medical and Health Rating Scales*

- Geriatric Depression Scales 15 & 30
- Zung Depression & Anxiety Scales
- Memory Questionnaire
- Medical Outcomes Survey (MOS) SF-36
- NeuroPsych Questionnaire (NPQ-207) & (NPQ-45) Adult
- Epworth and/or Pittsburg Sleep Scales

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

WHY Practices use CNS Vital Signs?

Optimized for Care Management



System and Product Features

- **Millisecond Precision**
- **Auto-Randomization Algorithm…** Ideal for Serial Testing with an almost unlimited number of alternate forms (others use a pseudo-randomization or limited number of alternate forms)
- **Less Ceiling Effect… Minimal Practice Effect**
- **Stability & Ease of Use** (intuitive design)
- **Rapidly Configure Custom Solution**
- **Flexible** (web & local) **& Secure Platform** - HIPAA and 21 CFR 11 compliant
- **Ease of Data Management**
- **Tablet Enabled**… IPad Optimized
- **Telemedicine Enabled**
- **Auto-Scored… Immediate Results**
- **Cultural Reach…** ***50+ Languages***

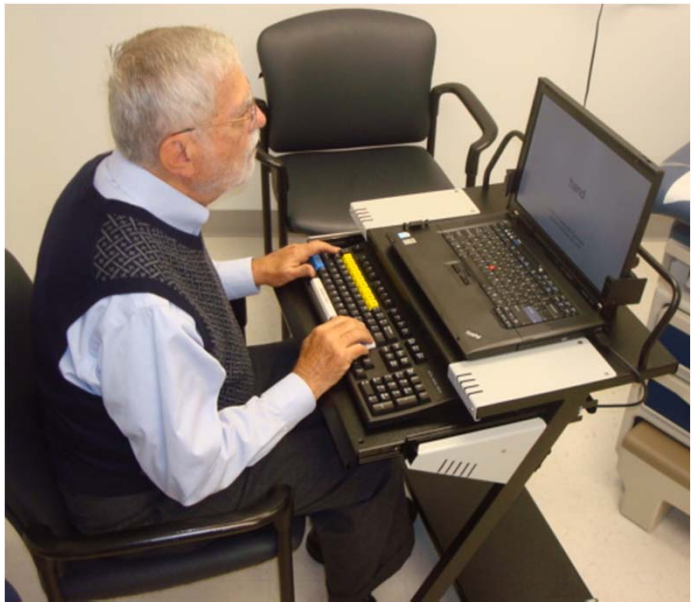
Why Computerized Neurocognitive Testing?

- **Improved Clinical Insight** (multiple domains, granular view, standardized, norms 8 to 90)

- **Practice Efficiency** (Brief-Core neurocognitive testing & evidence-based rating scales… auto-scored reports)

- **Increased Practice Revenues** (billable procedure… Medicare mandated coverage)

Testing Solution Example



MCI - Healthy Aging Assessment

WHY? CNS Vital Signs

CNS Vital Signs allows clinicians to assess weather neurocognitive problems are just a part of normal aging, or if their patients have impairments that may be symptomatic of more severe underlying issues, such as Alzheimer's or Dementia.

The CNS Vital Signs assessment platform is a systematic, informative, and cost-effective method of gathering OBJECTIVE and SUBJECTIVE memory or MCI (mild cognitive impairment) clinical markers and other important clinical information.

CNS Vital Signs enables the easy collection of computerized brain function domains as well as symptom and comorbidity data from evidence based medical and health rating scales; supporting the cognitive health management process by allowing clinicians to efficiently collected testing data and autoscore the results into easy to read reports. Besides providing valuable clinical information to assist in the evaluation and management of Memory Loss, CNS Vital Signs also enables continuity between evaluation and assessment of treatment results with a longitudinal view that can assist in measuring disease progression and / or outcomes.

CNS Vital Signs assessment platform contains the VSX BRIEF-CORE Neurocognitive Battery, the Stanford Geriatric Depression Rating Scales, Memory Questionnaire, the Medical Outcomes Survey SF-36 (QOL), a NeuroPsych Questionnaire (NPQ), and over 50+ additional well known rating scales. The CNS Vital Signs MCI Toolbox automatically scores and systematically documents the resulting clinical endpoints.

CNS Vital Signs computerized neuropsychological tests provides the clinician with a normative comparison that can be paired with an interview, exam, and other markers to help add validity to the evaluation or identify the need for further neuropsychological testing. Re-evaluation testing with CNS Vital Signs supports the detection of progressive decline or serial change in individuals over time and enabling outcomes.

How should MEMORY IMPAIRMENT be measured and assessed? "The objective memory impairment that is part of the criteria is determined by a combination of the history from the subject and an informant, supplemented with neuropsychological testing. The degree of impairment is assessed neuropsychologically , but the result of the impairment is determined by the clinician through the exam and interview. Consequently, no single cutoff score determines the memory impairment. ***Rather the degree of memory impairment is gauged relative to appropriate normative data.***" Source: Mild Cognitive Impairment; Ronald C. Petersen

HOW? Neurocognitive Health Management

Aggressive Evaluation, Management and Monitoring of MCI/Dementia Syndromes

Don Schmechel et,al. ICAD Paris 2011

	First Visit	Second Visit 4-6 Weeks	2 Month Visit	3 Month Depending on Intervention
History & Physical	●			
Neurocognitive Exam	●			
MMSE Screen	●			
Social Work Consultation & Overview	●			
Review/Order Neuroimaging, Sleep Studies, etc.	●			
Blood Work	●			
Genetic Testing	●			
Other Blood Work (homocysteine, inflammatory indices, etc.)	●			
Establish Primary, Secondary, Medical Diagnosis	●			
Computerized Neurocognitive Testing **(CNS Vital Signs)**	●	●	●	●
Review of Clinical Status			●	●
Review of Genetics, Blood Work, Imaging			●	
Revision of Diagnosis			●	
Selection of Interventions (Nx-Nutrition, Rx-Pharmacologic, Ex-Exercise, etc.)	●	●	●	●

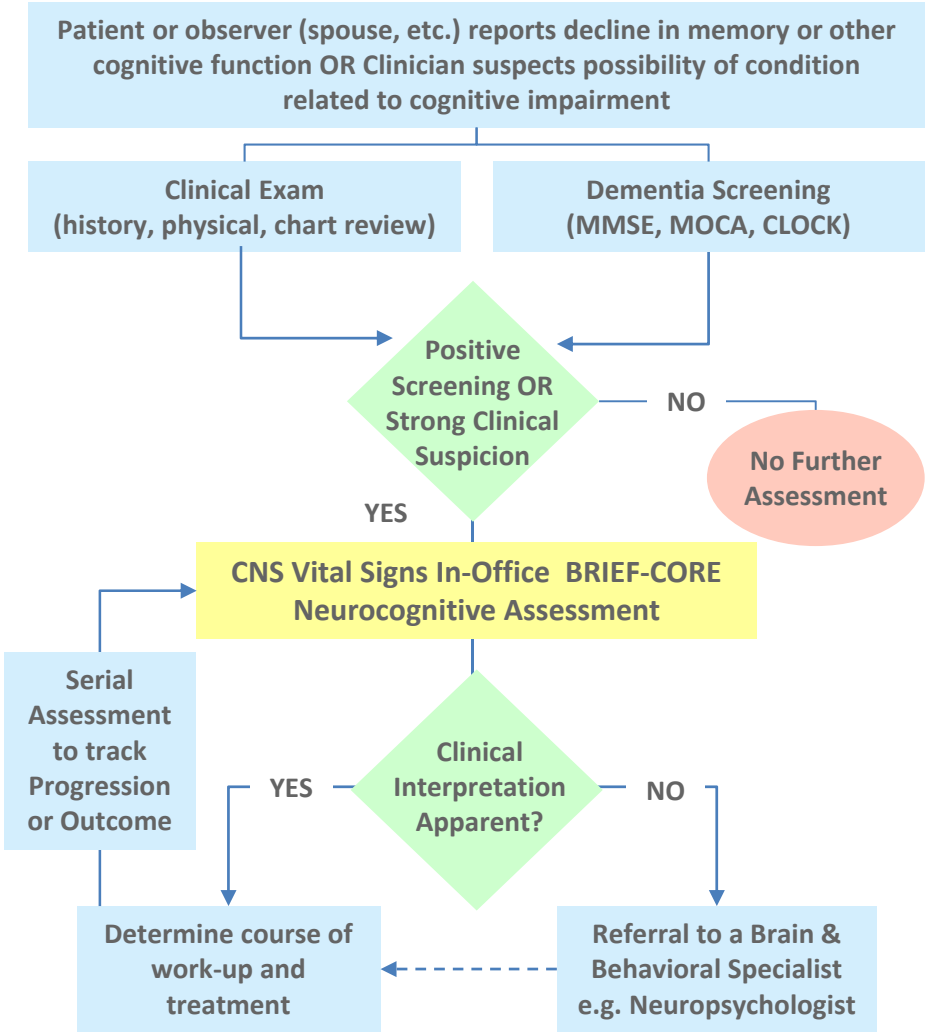
Aggressive Evaluation, Management and Monitoring of MCI/Dementia Syndromes

Don Schmechel et,al. ICAD Paris 2011

1. Most cases of MCI/dementia have multiple factors, particularly vascular.
2. Factors that can be identified include sleep disorders, vasculopathic factors including diabetes, dyslipidemias, MTHFR alleles (homocysteine metabolism), nutritional.
3. Aggressive evaluation will often include genetic testing to help in differential diagnosis and treatment selection
4. Treatment will then involve multiple therapies and interventions
5. Staging and monitoring can be assisted by cognitive testing at relatively frequent intervals, including short screens such as MMSE or MOCA forms.
6. Finer detail ("granularity") can be revealed using computer cognitively testing such as here illustrated by CNS Vital Signs battery. Test can be administered by support personnel, takes 30-40 minutes, and has alternate forms. Most patients with high school education and reasonable exposure to computers can handle testing. Familiarity and practice effects can be dealt with by leading in with two baselines prior to monitoring.
7. MCI and dementia are treatable disorders, involving complex interactions of genes-environment including behavioral responses and life practices of patient and caregiver.
8. Clinical stability and improvement should be sought for assiduously by dealing with all reasonable treatable factors impacting behavior and cognition.

HOW? Integrating into Clinical Practice

Possible Algorithm



Additionally…

…Assuming that screening is positive or that clinical suspicion is strong, full in-office computerized cognitive assessment is warranted.

…requires the use of a validated system that is objective and standardized…

…with an assessment of a patient's cognitive function that gives a profile of performance across multiple cognitive domains.

…In difficult cases in which clinical interpretation of in-office computerized assessment results is not apparent, referral to a neuropsychologist might be warranted, as in some cases of MCI or frontotemporal dementia…

Conceptually, the proposed algorithm attempts to direct practicing physicians in the proper use of different types of currently available tools for neurocognitive screening and assessment. The scheme is driven by the availability of tools that are valid and easy to use, particularly in-office computerized cognitive assessment, as well as by medicoeconomic realities.

Adapted from: Practicality of a computerized system for cognitive assessment in the elderly; Alzheimer's & Dementia; November 4 (2008) 14–21

How CNS Vital Signs Assessment Platform can Help?

Computerized Neurocognitive Testing combined with Evidence-Based Rating Scales can help clinicians rule-in or rule-out clinical conditions, and assess the level of impairment.

Pathogenesis

Clinical Classification		Degenerative	Vascular	Psychiatric	Medical Conditions
Nonamnestic MCI	Single Domain	FTD			
	Multiple Domain	DLB	VaD		
Amnestic MCI	Single Domain	AD		Depr	
	Multiple Domain	AD	VaD	Depr	

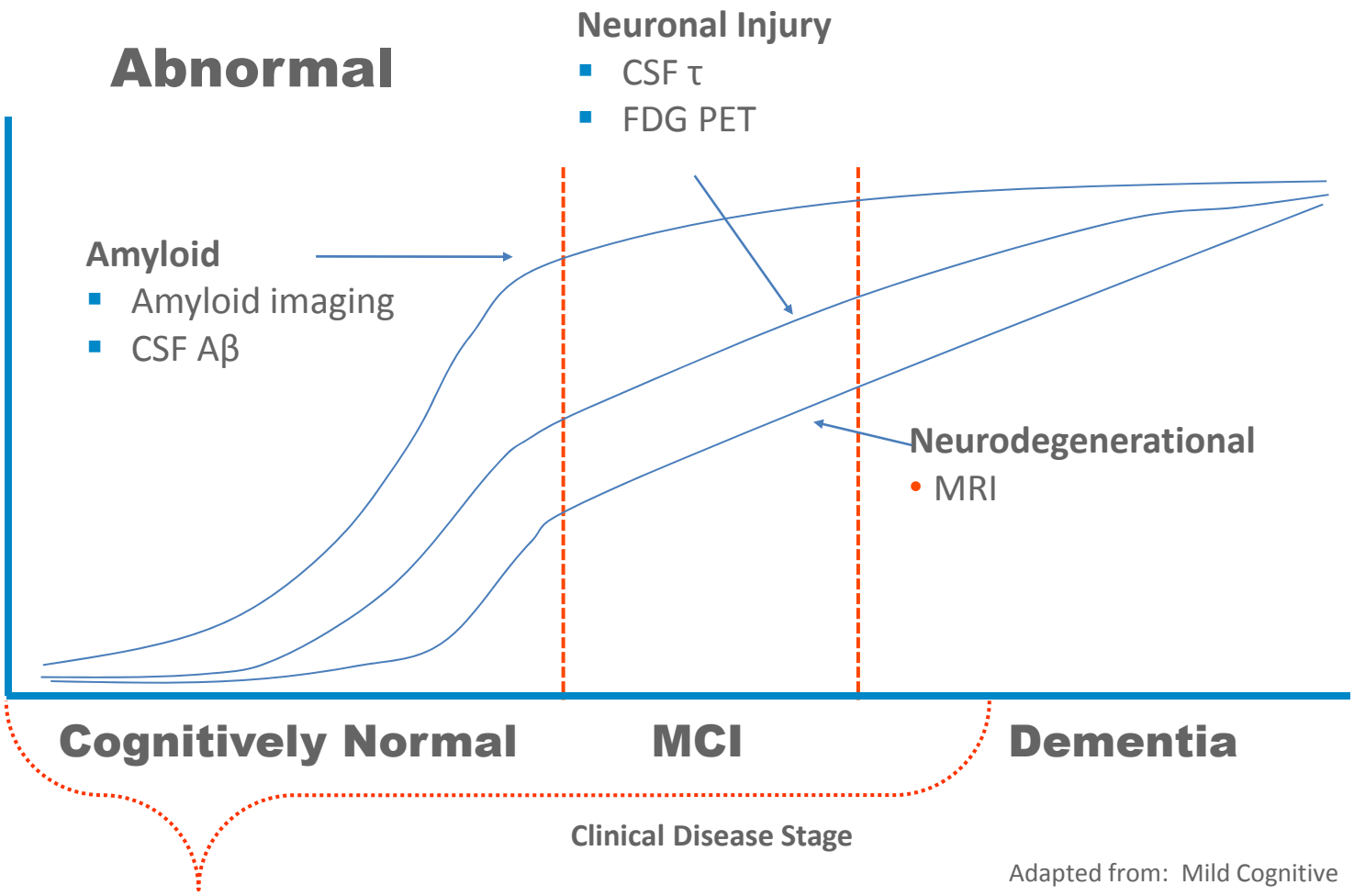
AD = indicates Alzheimer disease;
Depr = depression;
DLB = dementia with Lewy bodies;
FTD = frontotemporal dementia; and
VaD = vascular dementia.

= ***CNS Vital Signs Neurocognitive Testing***

= ***CNS Vital Signs Evidence-Based Rating Scales , H&P, and Exam***

Adapted from: Mild Cognitive Impairment: *Ten Years Later; Ronald C. Petersen, PhD, MD;* ARCH NEUROL/VOL 66 (NO. 12), DEC 2009

How CNS Vital Signs Assessment Platform can Help?

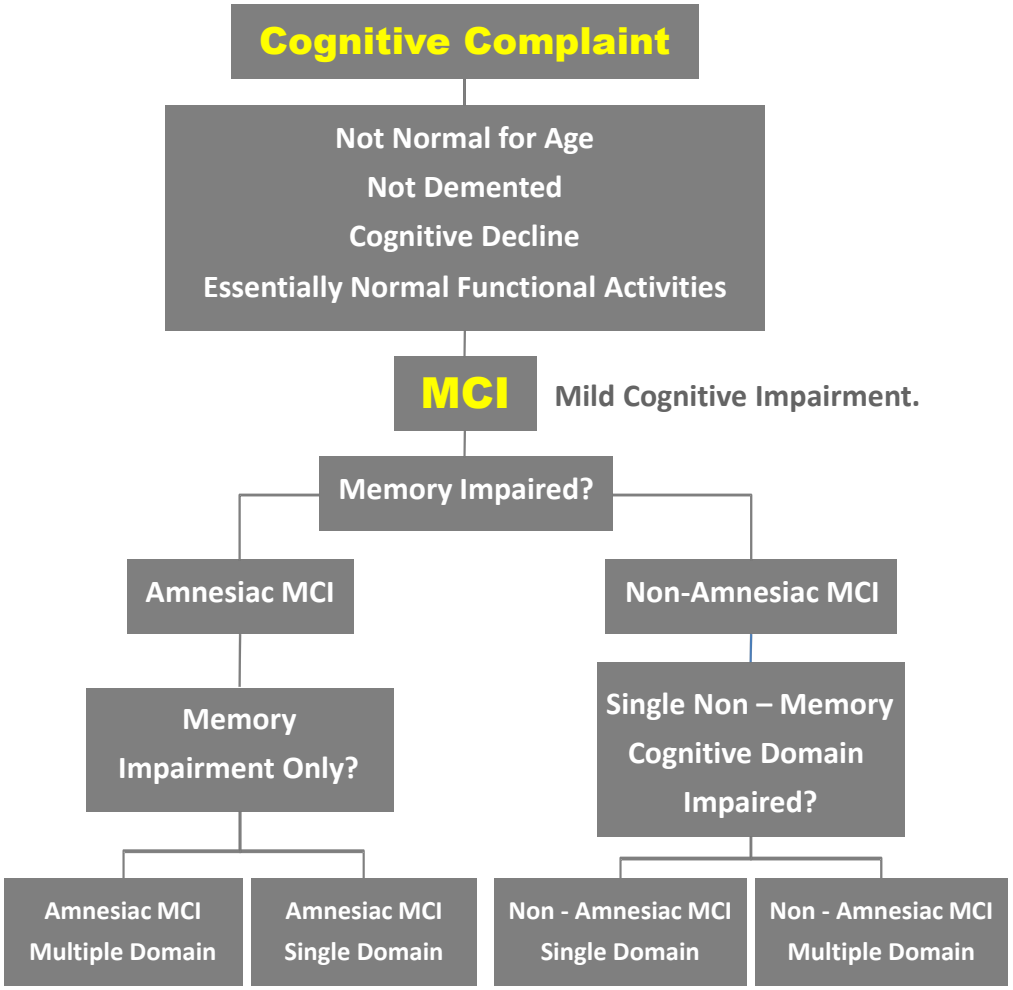


Adapted from: Mild Cognitive Impairment: *Ten Years Later; Ronald C. Petersen, PhD, MD;* ARCH NEUROL/VOL 66 (NO. 12), DEC 2009

CNS Vital Signs

Serial Assessment for a Longitudinal View

Algorithm for Assessing and Subtyping MCI



"Two subtypes of MCI – Mild Cognitive Impairment has emerged: amnestic (including memory impairment) and non-amnestic (non-memory cognitive domains impaired)…This assessment process usually begins with a person, or an informant who knows the person well, expressing some complaint about the person's cognitive function. When presented with these complaints, the clinician should first establish whether this constitutes normal cognition or suspected dementia. This can be done by taking a history and performing a mental status exam, possibly complemented with neuropsychological testing. "

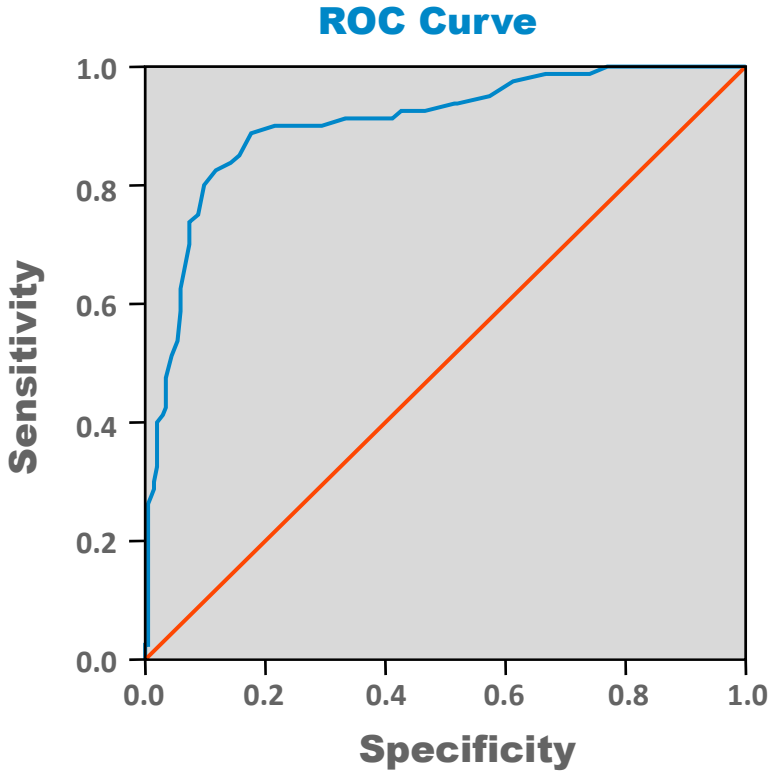
Adapted from: Petersen R, Negash S. *CNS Spectr. Vol 13, No 1. 2008.*

Effective 01-01-06: Medicare Part B coverage of neuropsychological tests is authorized under section 1861(s)(2)(C) of the Social Security Act. Payment for neuropsychological tests is authorized under section 1842 (b)(2)(A) of the Social Security Act.

Sensitivity & Specificity of Computerized Testing for MCI

ICAD 2008 – Chicago, IL

C THOMAS GUALTIERI North Carolina Neuropsychiatry Chapel Hill
ALAN F BOYD CNS Vital Signs Chapel Hill



Cognitive Domain	Neurocognitive Test(s)	AUC
Composite Memory	VBM, VIM	**0.90**
Immediate Memory	VBM, VIM	**0.88**
Verbal Memory	VBM	**0.85**
Delayed Memory	VBM, VIM	**0.85**
Visual Memory	VIM	**0.85**
Neurocognition Index	VBM, VIM, FTT, SDC, ST, SAT, CPT	**0.85**
Cognitive Flexibility	ST, SAT	0.80
Complex Attention	ST, SAT, CPT	0.80
Psychomotor Speed	FTT, SDC	0.79
Executive Function	SAT	0.78
Working Memory	WMT	0.77
Sustained Attention	WMT	0.76
Processing Speed	SDC	0.73
Reaction Time	ST	0.71
Reasoning	NVRT	.65

Computerized tests are an efficient way to assess large numbers of people who may have mild cognitive disorders, including MCI and early dementia. The CNS Vital Signs battery was administered to 322 patients age 55-94 at the NC Neuropsychiatry Clinics in Chapel Hill & Charlotte; to 102 elderly people at the New England Cognitive Center in Hartford, CT ; and to 92 elderly subjects at the University of Colorado in Denver. The patients were clinically diagnosed as normal, MCI or early dementia. The different components of the CNS Vital Signs battery were evaluated for receiver operating characteristics. Memory tests were the most sensitive and specific for the purpose of differentiating between normals and patients with MCI, followed by the composite Neurocognition Index, and then measures of executive function , processing speed and attention. A BRIEF-CORE assessment battery, therefore, would appropriately consist of tests of verbal and visual memory, executive function, processing speed, and complex attention.

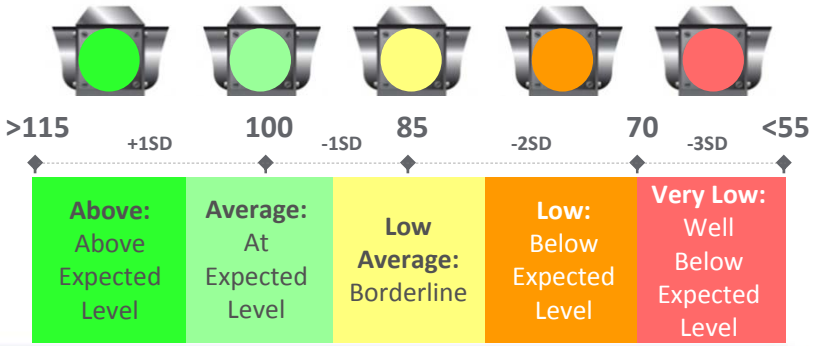
We compared the sensitivity & specificity of all the relevant domains generated by the CNS Vital Signs battery. The area under the ROC curve is the best single representation of the sensitivity & specificity of a mental test. The various memory domains were the best indicators of MCI. All of the memory domains were significantly different when normals were compared to patients with MCI and early dementia, but the composite memory domain was the best of all the memory scores.

CNS Vital Signs Domain Dashboard

Subtyping MCI with CNS Vital Signs

Effective neurocognitive assessment is able to differentiate between those memory problems that are consistent with the person's age (normative reference group). The hallmark of intrinsic neurodegenerative diseases is progressive decline from normal through preclinical to overt disease.

- Normal -> Asymptomatic -> Symptomatic
- Hallmark is decline over time
- Testing must be sensitive to serial change



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	84	14	Yes			x		
Composite Memory	60	52	1	Yes					x
Verbal Memory	30	54	1	Yes					x
Visual Memory	30	68	1	Yes					x
Processing Speed	16	83	13	Yes			x		
Executive Function	8	91	27	Yes		x			
Psychomotor Speed	112	97	42	Yes		x			
Reaction Time*	938	92	30	Yes		x			
Complex Attention*	22	89	23	Yes			x		
Cognitive Flexibility	6	90	25	Yes		x			
Total Test Time (min: secs)	34:12				Total time taken to complete the tests shown.				

Amnestic MCI

Non-Amnestic MCI

Using CNS Vital Signs in the Medicare wellness or pre-diagnostic neurobehavioral exam helps clinicians detect important neurocognitive changes. A clinicians goal is to detect persons with the most subtle beginnings of decline so that they can receive treatment before morbidity has consequences, participate in trials of potential disease-modifying therapies, and in future plan for the disease's consequences. This detection allows for appropriate follow-up such as additional neurocognitive testing e.g. full neuropsychological evaluation and serial assessment with CNS Vital Signs to track disease progression or outcomes.

Optimized to Enable Guidelines

ELSEVIER

Alzheimer's & Dementia ■ (2011) 1–10

Alzheimer's & Dementia

The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging and Alzheimer's Association workgroup

Marilyn S. Albert[a,*], Steven T. DeKosky[b,c], Dennis Dickson[d], Bruno Dubois[e], Howard H. Feldman[f], Nick C. Fox[g], Anthony Gamst[h], David M. Holtzman[i,j], William J. Jagust[k], Ronald C. Petersen[l], Peter J. Snyder[m,n], Maria C. Carrillo[o], Bill Thies[o], Creighton H. Phelps[p]

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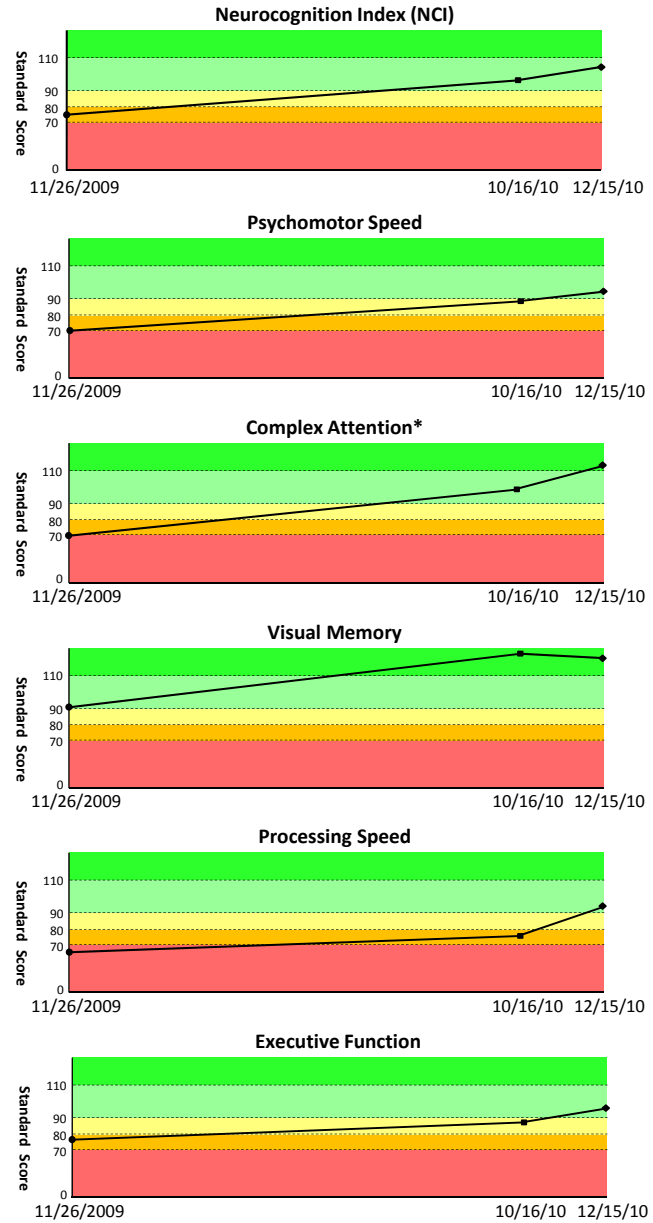
2.2.3. Longitudinal cognitive evaluation

Evidence of progressive decline in cognition provides additional evidence that the individual has "MCI due to AD," as noted earlier in the text. Thus, ***it is important to obtain longitudinal assessments of cognition, whenever possible.*** It is recognized that a diagnosis will likely need to be given without the benefit of this information; however, ***obtaining objective evidence of progressive declines in cognition over time is important for establishing the accuracy of the diagnosis, as well as for assessing any potential treatment response.***



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
(Supports pay-for-performance paradigm.)

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.*

Memory Assessment Public Health Outreach

" We were doing an NIH aging trial and were publicizing free neurocognitive testing if the research subject met the inclusion criteria. We were astonished with the number of subjects that were willing to pay out of pocket to have the MEMORY tested… that is why we started a dedicated Memory Assessment Program" - NIH Researcher

	Initiate		Implement			Impact	
Events	*Commitment to conduct a Memory View program*	*Procure, and deploy necessary resources.*	*Communicate and train internal stakeholders*	*Launch with advertising and public relations.*	*Enroll and assess subjects*	*Conduct patient feed back and referrals*	*Review program performance*
Activities	Decision for support by clinic or hospital and providers, assign leaders, and budget.	Obtain the necessary assessment platform s e.g. computers, web vs. local, etc.	Develop and train staff on In-take, Assessment, and Follow-up processes and systems.	Develop and launch promotional program	Schedule, collect fee, and complete testing,	Review results, and recommend actions (referrals) and provide necessary education.	Review program and assess improvement .

Program Deliverables

Projected Costs:
2600 tests = $39,000
1.5 FTE = $65,000
2 test stations = $2,800
Advertising = $14K
Estimated costs = $121K

Throughput:
10 patients a day = 2600 patient evaluations per year X $100 fee = $260K estimated revenue.

Return:
Societal Benefit = Delayed onset of dementia and associated disabilities + Prevention of other neuro diseases.

Institute Benefit = Profit $139K + neuro referrals + 2600 potential PET scan baselines established + positive PR.

Estimates developed for a hospital based neuroscience institute program.

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***

APPENDIX

The Importance of Millisecond Precision

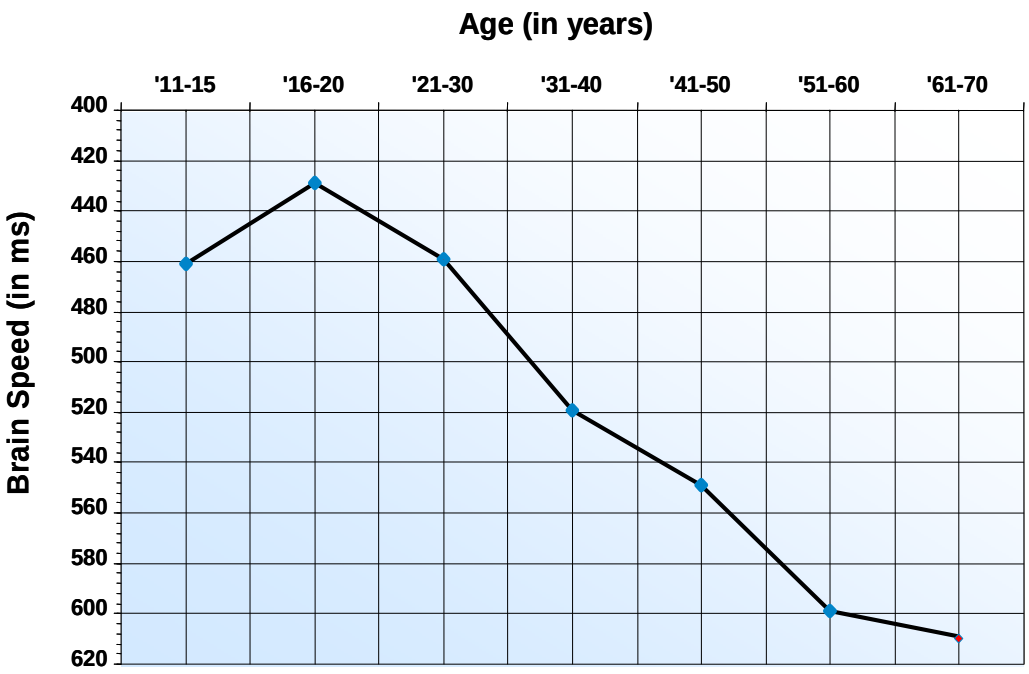
"… the **speed** of memory performance may be the first aspect of the memory system to decline as the system begins to fail." *Int'l Jnl Ger Psychiatry, Vol. 10: 199-206 ('95)*

"… traditional tests for dementia were relatively ineffective for identifying its early forms. The only effective assessment… is one that measures both **speed** & accuracy."*Int Psychogeriatr, 1996; 8(3):397-411*

"…research suggests that **speed** of performance may reflect the efficiency of mental processes." *Nature Neuroscience 2000; 3: 509-515*

"… **speed** scores identify impairments that would otherwise be missed using traditional measures. …**speed** scores on measures of attention & memory… identify patients with MCI". *Research & Practice In Alzheimer's Disease, Vol. 3, 2000*

Normal Speed of Processing Decline



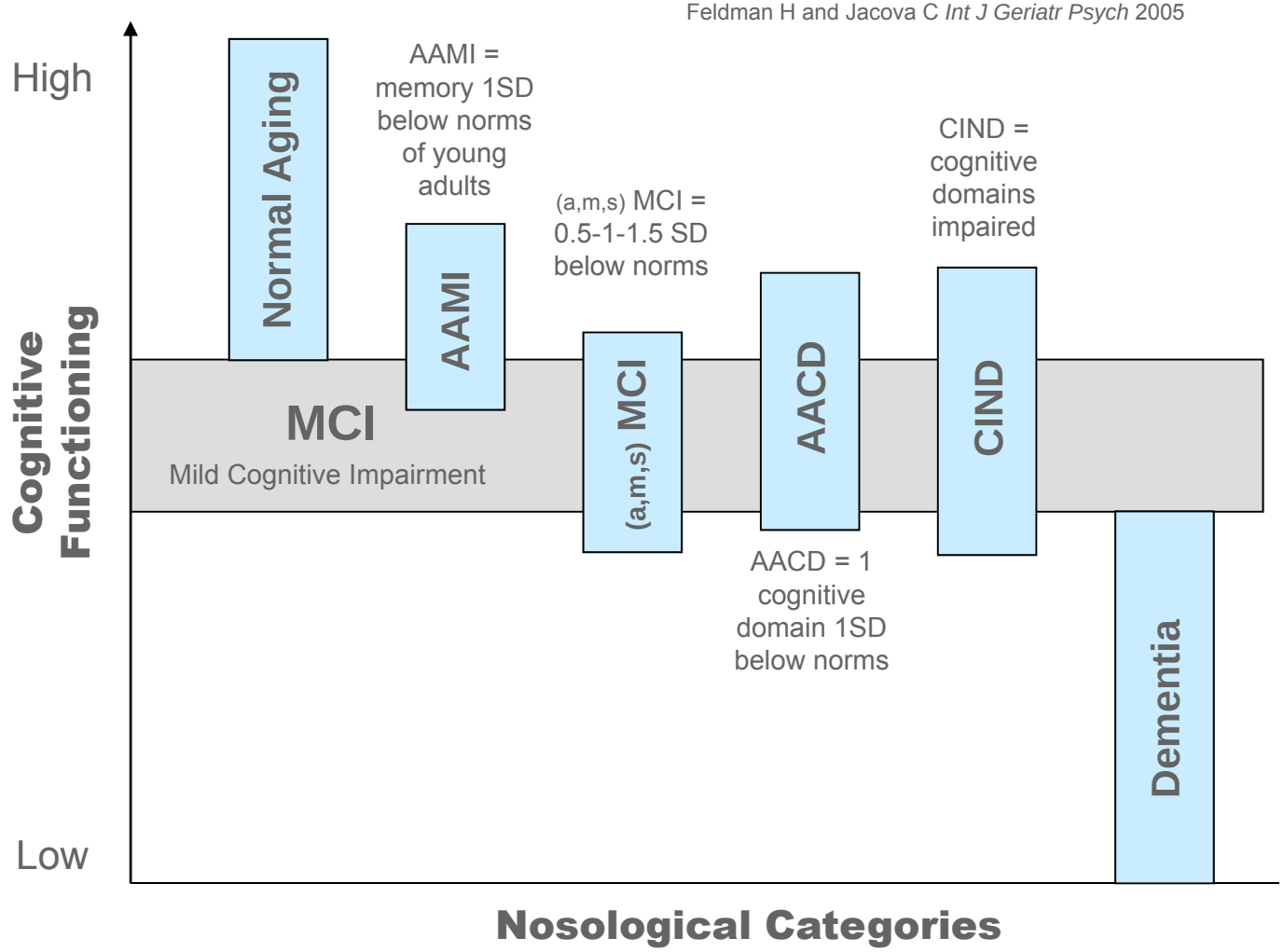
Source: Yogesh Shah, Ruth O'Hara; ***Speed* of processing, the missing measure in early detection of MCI?;** March 13th 2001

A few 100ms in processing speed may spell the difference between a healthy & an "unhealthy" brain.

Source: Yogesh Shah Associate Director, Mercy/Mayo Family Practice Residency Program; Medical Director, Integrative Medicine, Mercy Hospital; Board Member, Iowa Alzheimer's Association

Memory Complaint… Condition Segmentation

Adapted from: Mild Cognitive Impairment, Aging to Alzheimer's Disease; Oxford Press, Jan 2003; Feldman H and Jacova C *Int J Geriatr Psych* 2005



aMCI = Amnesic MCI, memory complaint, memory impaired for age; usually of a degenerative nature; 1.5 SD below normal subjects—while other domains might be very mildly impaired at perhaps less than 0.5 SD below appropriate comparison subjects. …this is the most common, and most of the literature on the topic refers to this form of the disorder. In all likelihood, when this form of MCI is on a degenerative basis, the vast majority of cases will progress to AD.

mMCI = Multiple-domain MCI; two or more domains including memory; 0.5 to 1.0 SD level of impairment. The diagnosis of multiple-domain MCI is a clinical judgment on the part of the person evaluating the subject and cannot be made solely on the basis of neuro-psychological testing. Persons with multiple-domain MCI may progress to AD or perhaps to vascular dementia.

sMCI = Single non-memory impairment; characterized by a person having a relatively isolated impairment in a single non-memory domain such as executive function… These mild conditions could represent incipient forms of other dementias. For example, the executive symptoms may lead to frontotemporal dementia. (2001 Petersen et.al.)

CIND = Cognitive impairment, no dementia includes encephalopathy, delirium, MR, etc. (1997 Graham et.al.) Canadian Study of Health and Aging

AACD = Age associated cognitive decline. Objective cognitive decline (1994 Levy et.al.) International Psycogeriatric Association

AAMI = Age associated memory impairment. (1986 Crook et.al.) NIMH workgroup.

Benign senescent forgetfulness = (1962 Kral et.al.)

Key Issue: Overlap of symptoms, definitions or co-morbidities. Do you want a battery designed and tested to measure MEMORY Conditions and provide a continuum of neurocognitive care across a wide range of Neuro/Psych conditions?

Proposed NEW DSM-5 Neurocognitive Disorders

NEUROCOGNITIVE DISORDERS

A Proposal from the DSM-5 Neurocognitive Disorders Work Group: Dilip Jeste (Chair), Deborah Blacker, Dan Blazer, Mary Ganguli, Igor Grant, Jane Paulsen, Ronald Petersen, and Perminder Sachdev

INTRODUCTION:
The DSM-5 Neurocognitive Disorders Work Group proposes that a new category of Neurocognitive Disorders replace the DSM-IV Category of “Delirium, Dementia, Amnestic, and Other Geriatric Cognitive Disorders".

The defining characteristics of these disorders are that their core or primary deficits are in cognition and that these deficits represent a *decline from a previously attained level of cognitive functioning; the latter feature distinguishes them from the neurodevelopmental disorders in which a neurocognitive deficit is present at birth* or interferes with development. However, it is possible to develop a neurocognitive disorder superimposed on a neurodevelopmental disorder, for example Alzheimer's disease in a patient with mental retardation associated with Down Syndrome.

This section includes three broadly defined syndromes.
(1) Delirium,
(2) Major Neurocognitive Disorder,
(3) Minor Neurocognitive Disorder.

Disorders in this section are attributable to changes in brain structure, function, or chemistry. The etiologies of these syndromes, when known, are to be coded as subtypes. Typically, the etiology is more likely to be identifiable in Delirium and Major Neurocognitive Disorder than in Minor Neurocognitive Disorder, although this will vary across etiologic subtypes.

Proposed DSM-5 Neurocognitive Disorders

Cognitive Domain	Examples of Symptoms or Observations	Examples of Assessments
Complex attenton (sustained attention, divided attention, selective attention, processing speed)	**Major:** Increased difficulty in environments with multiple stimuli (TV, radio, conversation), easily distracted by competitive events in the environment. Unable to attend unless input is restricted and simplified. Difficulty holding recent memory in working mind, such as recalling phone numbers or addresses just given, or reporting back what was just said. Unable to conduct math calculations in head. All thinking takes longer than usual and components to be processed must be simplified to one or a few. **Minor:** Normal tasks take longer than previously. Begin to find errors in tasks regularly conducted; find work needs more double-checking than previously. Find that thinking is easier when not competing with other things (radio, TV, other conversations, cell phone, driving).	**Sustained attention:** maintenance of attention over time—pressing a button every time a tone is heard. **Selective attention:** maintenance of attention despite competing stimuli and/or distractors—hearing numbers and letters read and asked to count number of *letters only at end of task.* ***Divided attention:*** *attending to* two tasks within the same time period--- rapidly tapping while learning a story being read. Processing speed can be quantified on any task by timing it---time to put together a design of blocks, time to match symbols with numbers
Executive ability (planning, decision-making, working memory, responding to feedback/error correction, overriding habits, mental flexibility)	**Major:** Abandons complex projects. Needs to focus on one task at a time. Needs to rely on others to plan appointments or make decisions. **Minor:** Increased effort required to complete multi-stage projects. Increased difficulty multi-tasking, or difficulty resuming a task interrupted by a visitor or phone call. May complain of increased fatigue from the extra effort required to organize, plan and make decisions. May report that large social gatherings are more taxing or less enjoyable due to increased effort required to follow shifting conversations.	**Planning:** finding the exit to a maze, Decision-making: simulated gambling. Working memory: the ability to hold and manipulate a group of items --adding up a list of numbers or repeating a span of numbers or words backwards. **Feedback/Error correction:** rules of a task are determined by whether responses are correct or incorrect—correct to shape for 5 items changes to correct by placement in next 5 items. **Overriding habits:** choosing a more complex and effortful solution to be correct e.g., looking away from the direction indicated by an arrow, naming ink colors of words, **Mental flexibility:** ability to shift between two tasks or response rules, e.g., from verbal to key-press response, from adding numbers to ordering numbers, from ordering by size to ordering by color.

Proposed DSM-5 Neurocognitive Disorders

Cognitive Domain	Examples of Symptoms or Observations	Examples of Assessments
Learning and Memory (immediate memory, recent memory [including free recall, cued recall, and recognition memory])	**Major:** Repeats self in conversation, often within the same conversation, can't keep track of short list of items when shopping or plans for the day. Requires frequent reminders to orient to task at hand. **Minor:** Difficulty recalling recent events, and increased reliance on list-making or calendar. Needs occasional reminders or re-reading to keep track of characters in a movie or novel. Occasionally may repeat self over a few weeks to the same person, loses track of whether bills have already been paid.	**Immediate Memory Span:** repeat a list of words or digits. **Recent Memory:** Following a delay, assess **Free Recall:** ask the subject to name as many words as possible (or present a story, and ask the subject to recall as many elements as possible). **Cued Recall:** provide semantic cues like "list all the food items on the list" or "name all of the children from the story" **Recognition Memory:** ask about specific items—e.g., was 'apple' on the list? or "was the man in the story named Bill?"
Language (expressive language [including naming, fluency, grammar and syntax] and receptive language	**Major:** Significant difficulties with expressive or receptive language. Often uses general use terms such as "that thing" and "you know what I mean," and prefers general pronouns, rather than names. With severe impairment, even names of closer friends and family may not be recalled. Idiosyncratic word usage, grammatical errors, spontaneity of output and economy of utterances occur. Stereotypy of speech occurs, echolalia and automatic speech typically precede mutism. **Minor:** Noticeable word-finding difficulty. May substitute general for specific terms. May avoid use of specific names of acquaintances. Grammatical errors involve subtle omission or incorrect use of articles, preposition, auxiliary verbs, etc. Press of speech is subtle and may involve fewer pauses than socially appropriate.	**Expressive Language:** Confrontational Naming: identification of objects or pictures (note: naming common objects is insufficient to detect Minor impairments). Fluency: name as many items as possible in a semantic (e.g., animals) or phonemic (e.g., starting with f) category in 1 minute. **Grammar and Syntax:** omission or incorrect use of articles, prepositions, auxiliary verbs, etc.—errors observed during naming and fluency tests are compared with norms to assess frequency of errors and compare with normal slips of the tongue. **Receptive Language:** comprehension—word definition and object-pointing tasks involving animate and inanimate stimuli.

Proposed DSM-5 Neurocognitive Disorders

Cognitive Domain	Examples of Symptoms or Observations	Examples of Assessments
Visuoconstructional perceptual ability (construction, visual perception)	**Major:** Significant difficulties using tools, navigating in familiar environments; often more confused at dusk when shadows and lowering levels of light change perceptions. **Minor:** May need to rely more on maps or others for directions. Uses notes and follows others to get to a new place. May find self lost or turned around when not concentrating on task. Less precision in parking. Greater effort required for spatial tasks such as carpentry, assembly, sewing or knitting	**Construction:** assembly of items requiring hand-eye coordination). **Visual perception:** line bisection tasks for basic visual defect or attentional neglect. Motor-free perceptual tasks (including facial recognition) require the identification and/or matching of figures--best tasks cannot be verbally mediated and are not objects—some require the decision of whether a figure can be "real" or not based on dimensionality.
Social cognition (recognition of emotions, theory of mind, behavioral regulation)	**Major:** Behavior clearly out of acceptable social range; insensitivity to social standards of modesty in dress, political, religious, or sexual topics of conversation, excessive focus on a topic despite group's disinterest or direct feedback, behavioral intention without regard to family or friends, decision-making without regard to safety (inappropriate clothing for weather or social setting). Typically there is little insight into these changes **Minor:** Subtle changes in behavior or attitude, often described as a change in personality, such as less ability to recognize social cues or read facial expressions, decreased empathy, an increase in extraversion or introversion, decreased inhibition, or subtle or episodic apathy or restlessness.	**Recognition of Emotions:** identification of emotion in images of faces representing a variety of both positive and negative emotions. **Theory of Mind:** the ability to consider another person's state of mind or experience—story cards with questions to elicit information about the mental state of the individuals' portrayed such as "where will the girl look for the lost bag?" or "why is the boy sad?" **Behavioral Regulation:** use tests above, plus measures of disinhibition and impulsivity (e.g., instructed to key press to "H t" in a string of letters whereas key presses to"H x" may indicate disinhibition.