DIFFERENTIATING BETWEEN MILD COGNITIVE IMPAIRMENT AND EARLY DEMENTIA WITH A NEW, COMPUTERIZED NEUROCOGNITIVE SCREENING BATTERY

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CONTEXT: Mild Cognitive Impairment (MCI) is an abnormal, state of cognitive impairment intermediate between normal ageing and very early dementia. The earliest descriptions of MCI focused on patients with memory impairment; more recent studies have established other forms of MCI, based on impairment in executive control functions, and deficits in other areas as well. Screening for MCI and early dementia, therefore, must include a range of neurocognitive tests, not just tests of memory.

Computerized Neurocognitive Testing (CNT) has the potential to administer tests of multiple cognitive domains, inexpensively, and in a short time. CNT"s represent a new tradition in mental testing, based on the earlier traditions of psychophysics, educational testing, and neuropsychology, but different as well. CNT is designed to test large numbers of people who may have very mild cognitive impairments related to 21st century problems: sports injuries, the effects of drugs and medical procedures like CABG, and ageing.

OBJECTIVE: To validate a CNT, CNS Vital Signs, that can differentiate normal age-associated memory impairment (AAMI) from MCI and mild dementia (MD).

SUBJECTS: Patients at the NC Neuropsychiatry Clinics clinically diagnosed, by standard criteria, with MCI (N=36) or mild dementia (N=53), and 89 normal controls, matched for age, race and gender.

METHODS: "CNS Vital Signs" is a PC-based neurocognitive screening battery, comprised of seven familiar tests: Verbal and Visual Memory, Tapping, Coding, the Stroop test, Shifting Attention and the CPT. The test battery is self-administered on an ordinary PC, and takes 30 minutes. The tests in the "Vital Signs" battery are highly reliable (Figure 1). Normative data from 600 normal subjects, age 10-90, indicates typical performance differences by age and gender (Figure 2). During the fifth decade of life, patients with MCI begin to diverge from normals on tests in the Vital Signs battery (Figure 3).

RESULTS: Test performance on the Vital Signs battery differed significantly among the three groups (AAMI, MCI, MD) in tests of memory, psychomotor speed, reaction time, cognitive flexibility and complex attention (General Linear Model). ROC analysis indicate acceptable levels of sensitivity and specificity especially for tests of memory, executive control and information processing speed (Figures 4,5,6; Table 1).

CONCLUSIONS: These data validate the use of CNS Vital Signs to identify patients with MCI and early dementia. CNT is ideally suited to serve as a screening tool in primary care settings, to identify patients with the earliest manifestations of dementing illness. It is ironic, that of all the serious medical conditions, dementia is the one for which the importance of early diagnosis has never been deemed important. The public health would be well served if CNT were used routinely: by primary care physicians as part of their annual examinations; perhaps also to screen elderly drivers, or to evaluate workers who are engaged in potentially hazardous occupations.

Figure 1. Test-Retest Reliability of CNS Vital Signs Compared to Other Tests
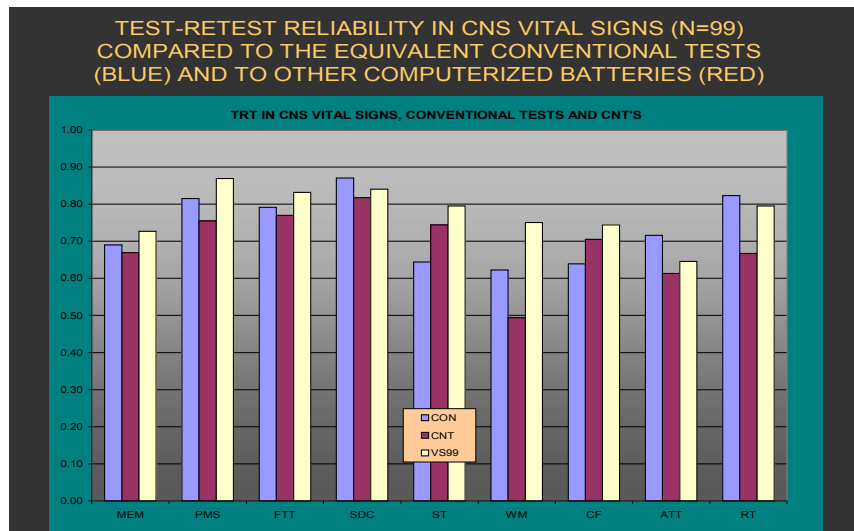

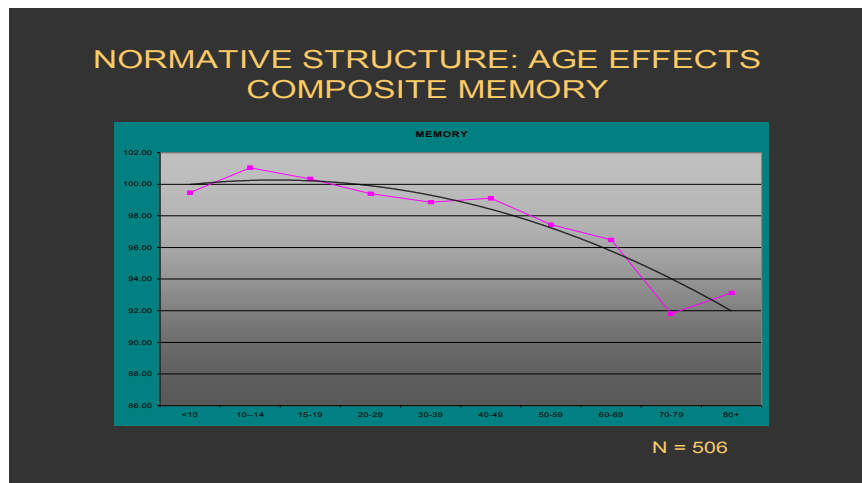**Figure 2. Age-Related Changes in Normal Subjects**

Figure 3. MCI Patients Diverge from Normals during heir 50's
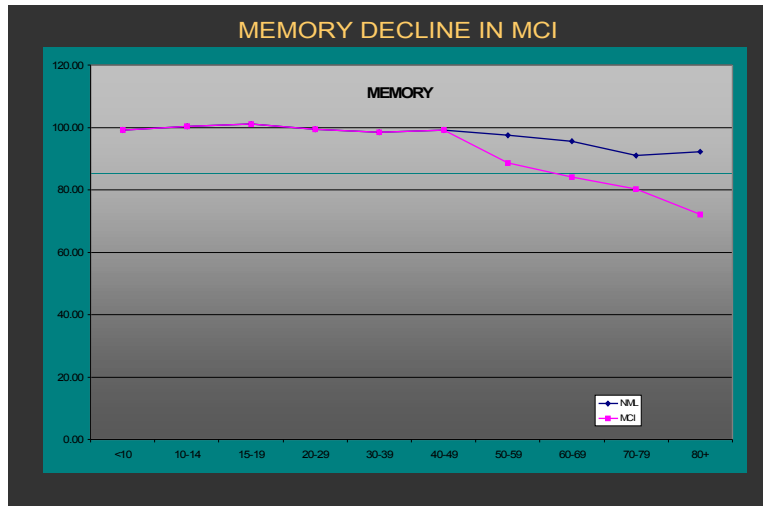

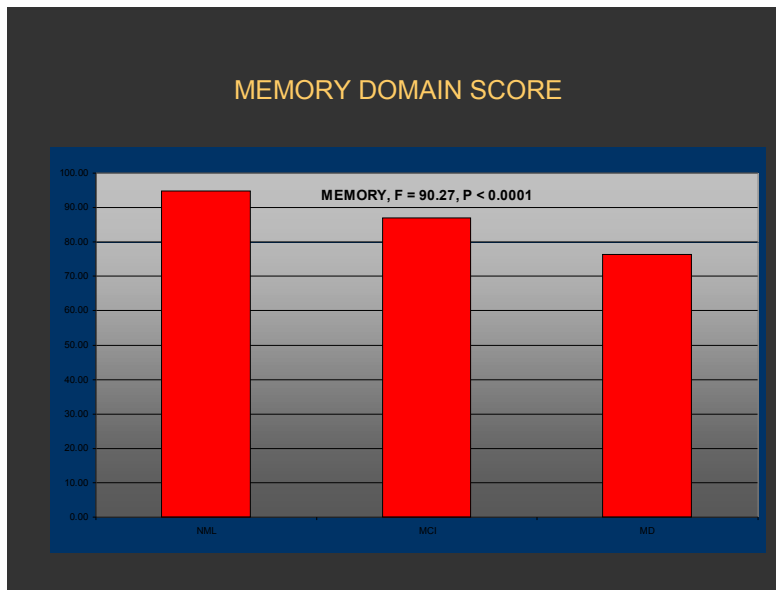**Figure 4. Memory Performance in Patients with MCI & Early Dementia**

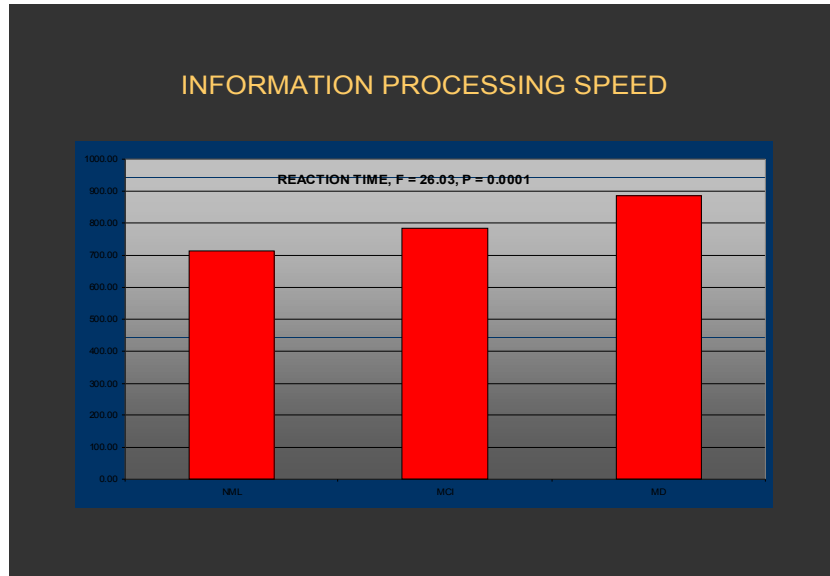**Figure 5. Information Processing Speed in Patients with MCI and Dementia**

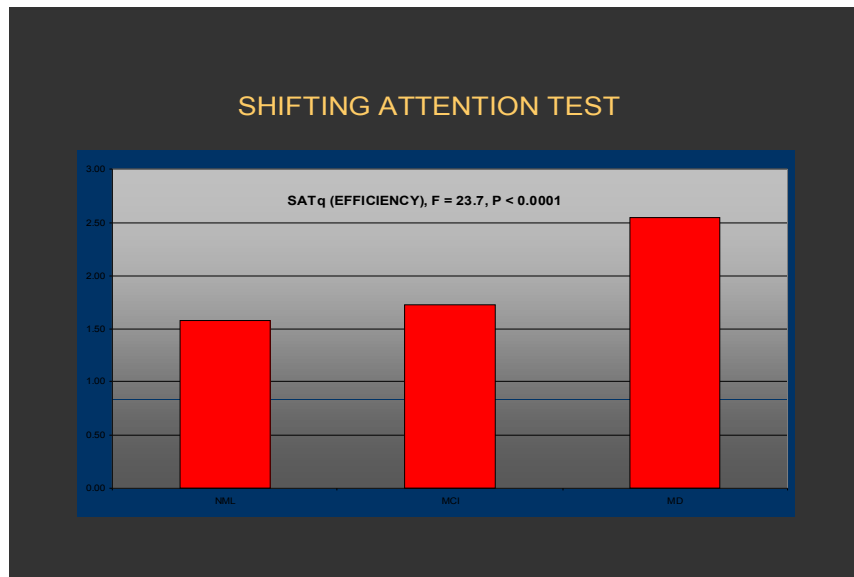
Figure 6. Executive Function in Patients with MCI and Early Dementia

Table 1. Sensitivity and Specificity of CNS Vital Signs Tests

ROC CURVES
SENSITIVITY & SPECIFICITY

	NORMALS & MCI PTS				NORMALS & DEMENTED PTS			
			90% SENS				90% SENS	
	AUC	P<	SENS	SPCFCTY	AUC	P<	SENS	SPCFCTY
MEMORY	0.667	0.0035	102	82%	0.695	0.0019	89	56%
PMS	0.679	0.0018	164	77	0.569	0.2716		
RT	0.663	0.0045	640	64	0.637	0.0294	605	94
COGN FLEX	0.692	0.0008	47	76	0.612	0.0750		
COMPLEX ATT	0.741	0.0000	7	65	0.537	0.5528		
VBM	0.711	0.0002	53	65	0.692	0.0022	47	56
VIM	0.601	0.0772			0.715	0.0006	41	50
SDCcorr	0.638	0.0158	51	75	0.674	0.0054	46	81
SATcorr	0.658	0.0058	55	85	0.660	0.0105	44	78

AT 90% SENSITIVITY, WHAT IS THE SPECIFICITY OF THE TEST? (CRITERION SET @ 75% SPECIFICITY.) MEMORY, PROCESSING SPEED AND COGNITIVE FLEXIBILITY ARE THE MOST SPECIFIC TESTS @ 90% SENSITIVITY

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