

The Ottawa Hospital | L'Hôpital d'Ottawa

Neuropsychology and the Aging Population: How, When, and Where to Intervene

Dr. Lori Della Malva
Neuropsychologist
Ottawa Hospital

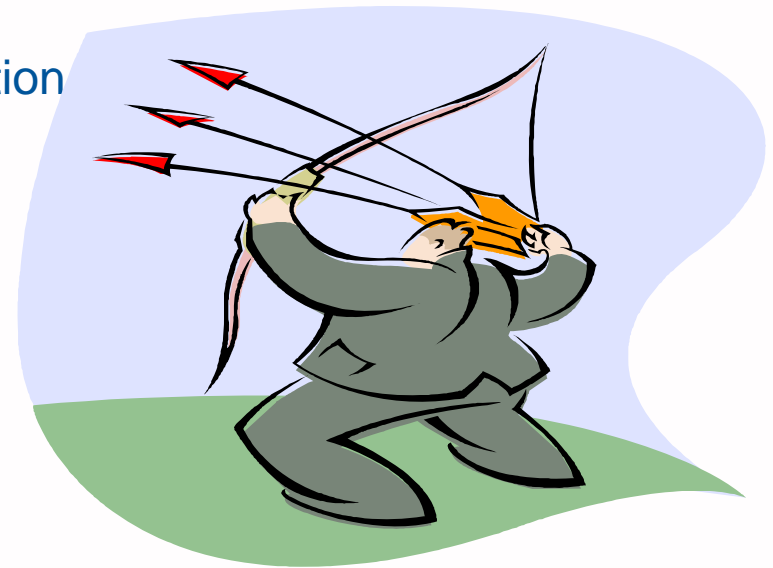


Compassionate People. World-Class Care. Des gens de compassion. Des soins de calibre mondial.



Objectives:

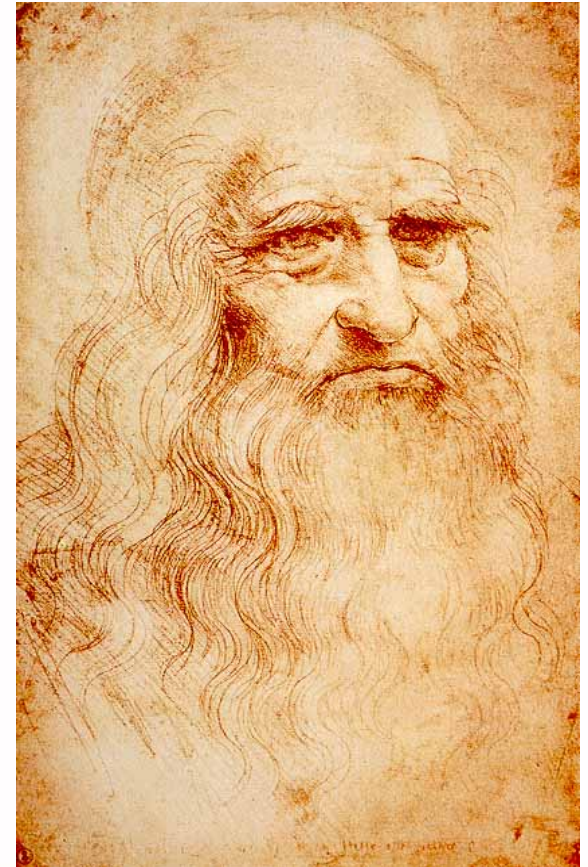
- Review cognitive changes that may be warning signs of possible dementia
- Discuss early detection, benefits and limits of screening tools
- Outline the neuropsychological evaluation process:
 - When to refer
 - What happens
 - Utility of evaluation





Normal age-related changes

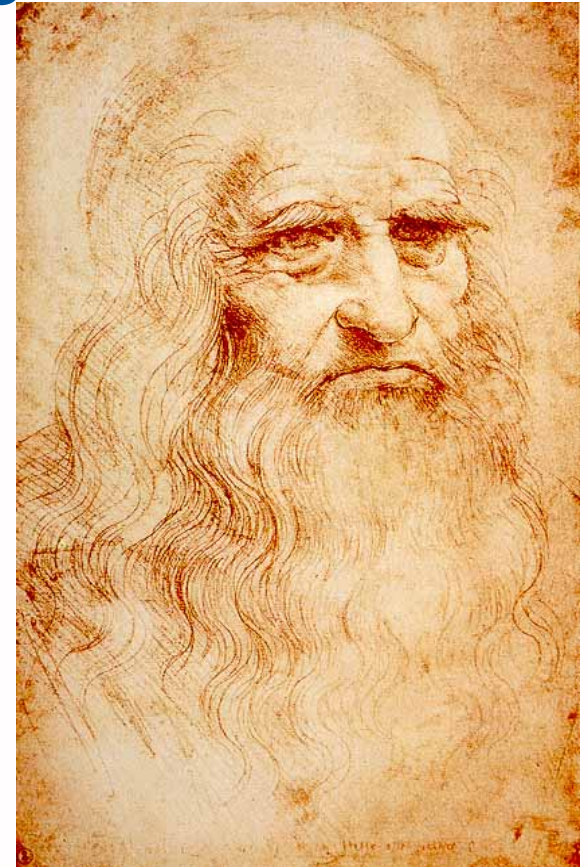
- Age-related changes in cognitive functioning are a normal part of the aging process
- General cognitive slowing is one recognized resource limitation that occurs with aging
- Limits the amount of information and quality of information being processed, leading to generalized decline in capacity in various cognitive functions
- Decline in learning, possibly mediated by slowed cognitive processing, but preserved delayed recall





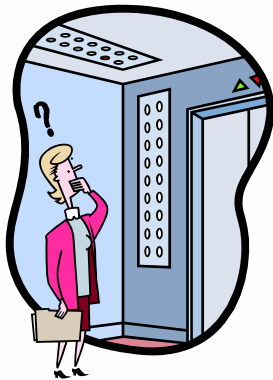
Normal age-related changes

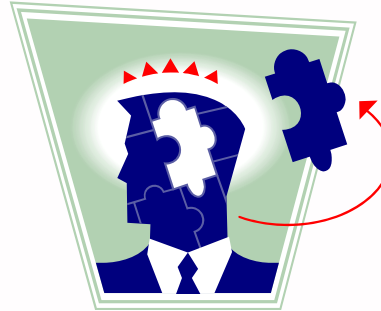
- Prefrontal cortex and associated functions are most vulnerable to even subtle diffuse changes due to their high interconnectivity with the rest of the brain
- Differential decline in frontal functions such as working memory, flexibility, abstract reasoning
- Subtle, do not impact overall function



Signs of potential cognitive impairment

- Forgetfulness, poor temporal recall
- Lack of carry over in new learning
- Confusion, fluctuations
- Word finding difficulties
- Conceptual difficulties
- Distractibility, poor multi-tasking
- Slow speed of information processing
- Problems with spatial orientation
- Visual and perceptual difficulties, agnosia
- Apraxia
- Lack of insight, mood and behavior changes





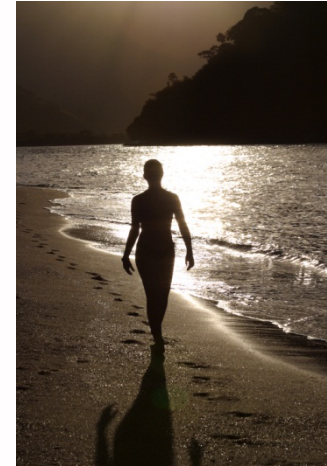
Dementia

- Cognitive decline that exceeds parameters of normal aging and brings about deficits in daily function
- There are various deterrents to test cognition: lack of time, fear of offense, inadequacy of quickly administered tests
- Dementia is under-diagnosed in clinical practice (Knopman and Selnes, 2012)
- Pinto and Peters (2011) report that perhaps as few as 25% of people with dementia or MCI are recognized
- Dementia is a major indirect cause of hospitalization and use of health care resources in the elderly (e.g., failure to thrive, medical crises)
- Challenge is to recognize signs early, refer to appropriate resource for clarification of diagnosis in order to direct treatment and planning



MCI

- Neurodegenerative conditions involve slowly accruing neuron losses that evolve over a number of years before symptoms occur
- There has been increasing interest in the pre-dementia phase of conditions such as AD, FTD, LBD and identification of earliest clinical features before functional changes occur
- Construct of MCI is useful as a clinical stage and risk state where meaningful interventions can take place.
- MCI first used by Flicker et al (1991) to identify individuals who were not cognitively normal for their age with respect to memory function, but did not have overt dementia



MCI

Original 1999 MCI criteria

- Memory complaint preferably corroborated by informant
 - Memory impairment documented according to appropriate reference values
 - Essentially normal performance in non-memory cognitive domains
 - Generally preserved activities of daily living
 - Not demented, (e.g., MSE \geq 24-30)
-
- More specific criteria and broader definition have since been given to MCI (Gauthier et al, 2005)
 - MCI now considered a more heterogeneous condition
 - Functional stability/decline-can be difficult to establish, and not always preserved in MCI

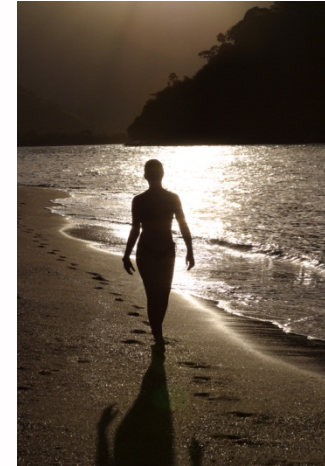
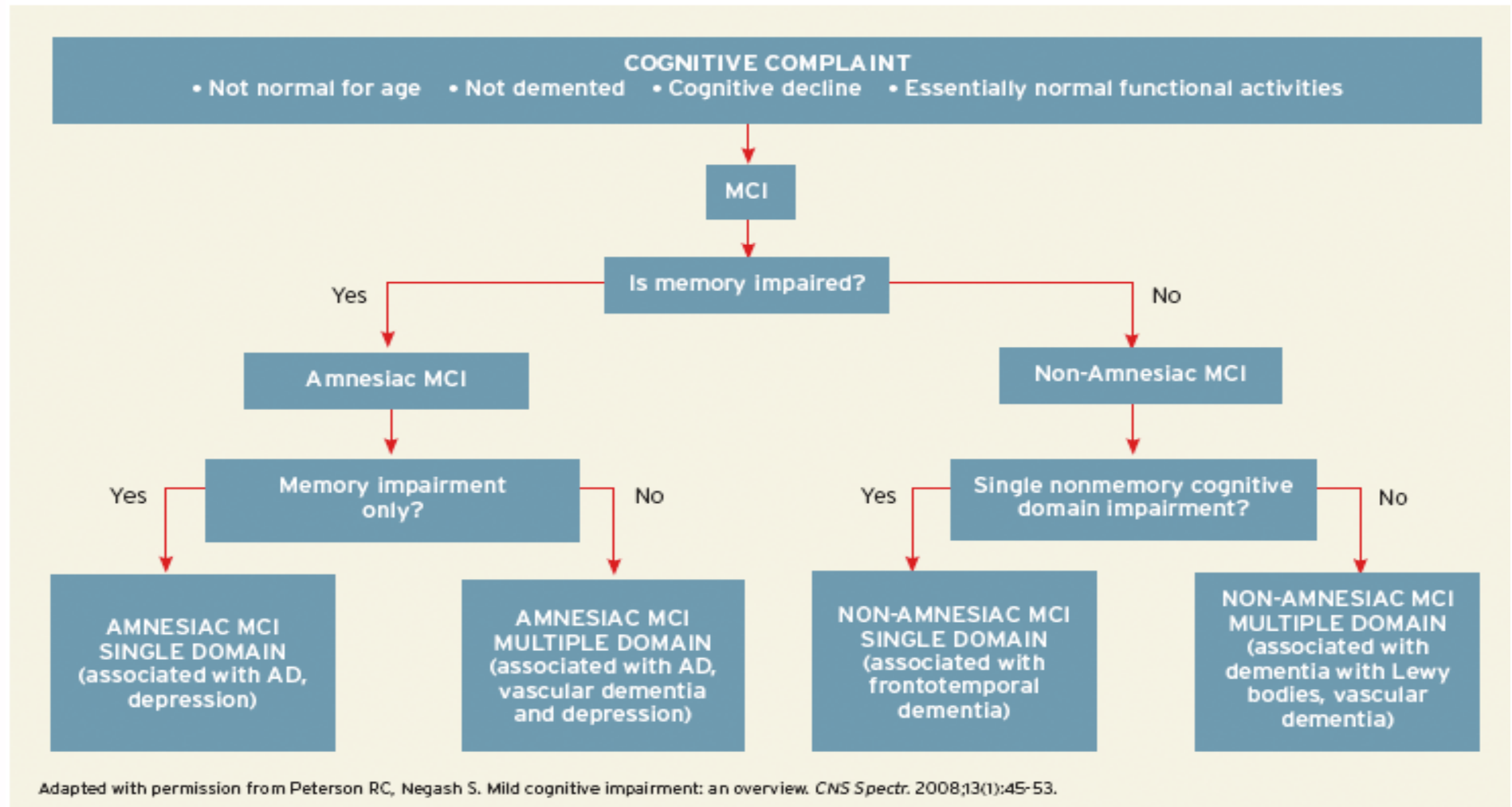




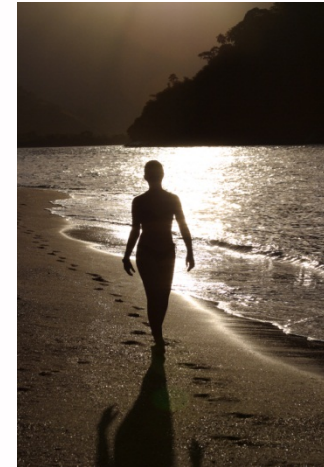
FIGURE 1. Algorithm for MCI diagnosis and subtyping





Variability in MCI criteria

- Operational definition of MCI have varied
- Depend on how many domains are considered, how many measures are administered within a domain and how impairments are measured (Petersen et al, 2005)
- Historical criteria (Petersen, 1999): Memory (Logical memory) falls 1.5 SD below norms; global cognitive function intact (MSE 24 or above); Amnestic MCI
- Typical criteria (Petersen and Morris 2005): Performance on one test within one of several cognitive domains falls below 1.5 SD below normal
- Comprehensive (-2 SD on two tests within any domain); Liberal -1SD on 1 test within a domain
- Conservative: -2SD on two tests within any domain





Diagnosing Dementia

Various potential etiologies are responsible for dementia in the elderly

Alzheimer's Disease is the most common

Diagnostic criteria (McKhann et al 2011)

- Course is characterized by gradual onset, continuing cognitive decline
- Amnestic disorder
- One or more cognitive disturbances in
 - Language
 - Visual spatial
 - Executive/behavioural-disturbances with executive functioning may precede memory loss and cause difficulties with activities of daily living





Diagnosing Dementia

.....Diagnostic criteria for Alzheimer's disease,
(McKhann et al 2011)

- Deficits are not due to other CNS conditions that cause similar cognitive deficits **or..**
- Systemic conditions known to cause dementia

- Deficits do not occur exclusively during the course of delirium
- Disturbance not accounted for by another Axis 1 disorder





Diagnosing Dementia



- Alzheimer's disease
- Typical temporal profile and typical spectrum of clinical features:
- Memory impairment-deficient new learning and recall
- (anterograde memory deficit)
- Remote and biographical information relatively spared at first
- Early AD: spared new learning but impaired delayed recall
- Will see repetitiveness, lack of carry-over, forgetfulness, misplacing items; later, poor orientation to time and place



Diagnosing Dementia

Alzheimer's disease

- Language: word finding difficulties
- Visual spatial difficulties: variable, may not be seen initially(except in variant Posterior Cortical Atrophy); deficits in more complex visual construction, visual spatial synthesis, perception of spatial relationships, figure-ground discrimination; later, agnosia
- Executive: frequent even at early stages and may precede memory problems at a functional level; working memory, mental flexibility, abstract reasoning, fluency, foresight/planning problem solving
- Apraxia develops as a later feature
- Apathy, social withdrawal, disinhibition, irritability, loss of insight





Diagnosing Dementia

Vascular Dementia

- Diverse pathologies
- Difficult to distinguish between pure vascular dementia and combination of CV and neurodegenerative etiologies, except in cases where there is a history and evidence of multiple infarcts
- Very often dementia in the context of vascular disease is associated with a mixture of AD neuropathological changes and small infarctions
- Typically presentation in CVD is more “subcortical”, microvascular





Diagnosing Dementia

Vascular Dementia

- Differential memory impairment between cortical and subcortical dementia
- Primary retrieval deficits, mild encoding deficit, normal retention over time, impaired procedural memory
- Slowness in information processing, longer response latency
- Poor attention and concentration (mental control, initiation, maintenance, ability to shift mental set)
- Visual spatial difficulties
- Impaired ability to manipulate acquired knowledge
- Dilapidation of complex intellectual functions
- Bradyphrenia
- Mood and personality changes





Diagnosing Dementia

Lewy Body Dementia

- Comprises two clinical entities
 - Dementia with Lewy Bodies
 - Parkinson's Disease dementia
- These two differ in the temporal profile of symptoms
- LBD: cognitive impairment precedes parkinsonism or occurs within months of it
- PDD: dementia develops at least one year post Parkinson signs





Diagnosing Dementia

Lewy Body Dementia

Features:

- Gait and balance disturbances
- Dementia
- Visual hallucinations
- Fluctuations in cognitive status

Cognitive picture more closely aligned with “subcortical” presentation than that of AD (slowing, executive difficulties, visual spatial difficulties)





Diagnosing Dementia



Frontal Temporal Dementia

- Abnormalities in executive cognitive functions and behavioral dysregulation
- Memory issues are dysexecutive and include confusion of chronology of events
- Compulsive activities (incessant checking, pacing, collecting, hoarding)
- Press of speech or reduced speech, mutism
- Iterations, perseveration
- Changes in mood
- Sexual inappropriateness, disinhibition
- Lack of initiative, indifference to surroundings, lack of interest



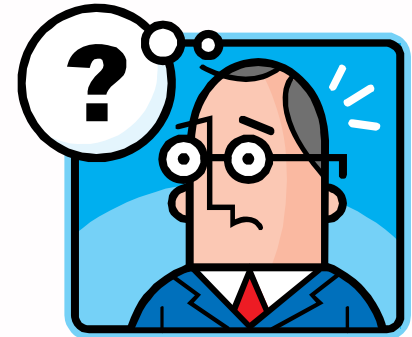
Dementia/MCI

Early detection is important but can be difficult

Firm diagnosis helps provide information for patients and family regarding recent changes in:

- Instrumental activities of daily living
- Behavior
- Intellectual functioning
- Mood

Detection of cognitive impairments can inform more effective interventions by health care professionals





Dementia/MCI

Firm diagnosis allows planning for the future:

- POA
- Potential competency issues
- Long-term care
- End of life care
- Wills
- Assess risks (delirium, driving)
- Medication management, increase benefits of any possible health interventions





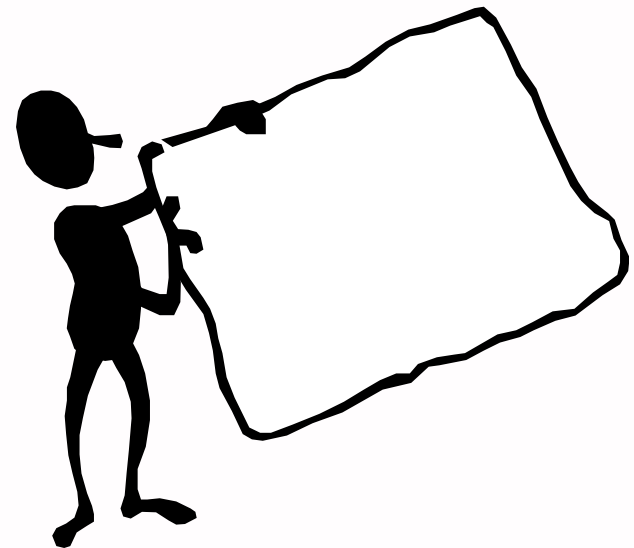
First step: Screening

MMSE and its variants most frequently used screening tool by GPs

Developed from items selected from different neuropsychological batteries

Includes five sections:

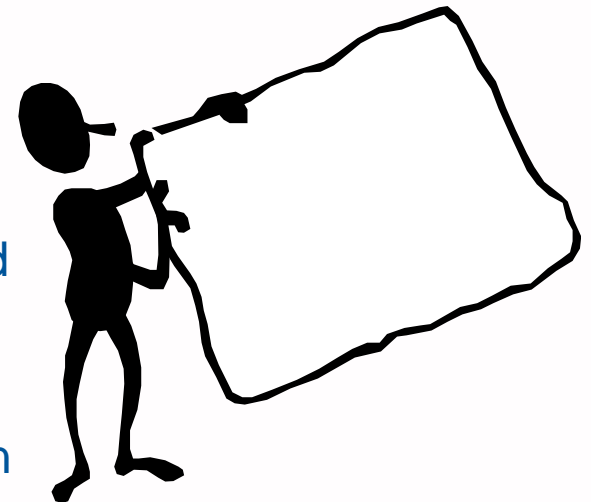
- Orientation
- Registration
- Attention and Calculation
- Recall
- Language





First step: Screening

- Limited sensitivity to frontal and subcortical changes
- Often supplemented with additional measures (Trails, Clock)
- False negatives: patients with high pre-morbid intelligence or education show a ceiling effect
- False negatives: patients with great age, limited education, foreign culture, sensory impairment
- MMSE needs adjustment for age and education





First step: Screening

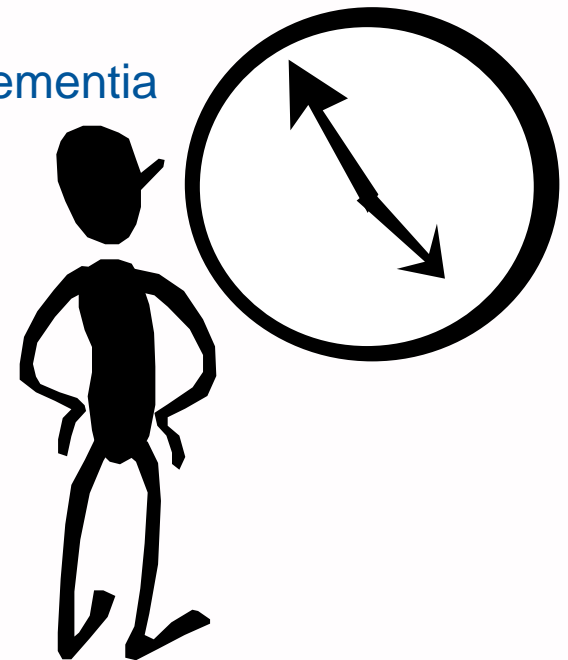
Clock Drawing Test

Originally measured parietal lobe function

Now widely used as a screening instrument for dementia

Various cognitive domains captured by the test:

- Comprehension
- Planning
- Visual memory
- Visual spatial ability
- Motor programming and execution
- Abstraction
- Concentration, Response inhibition





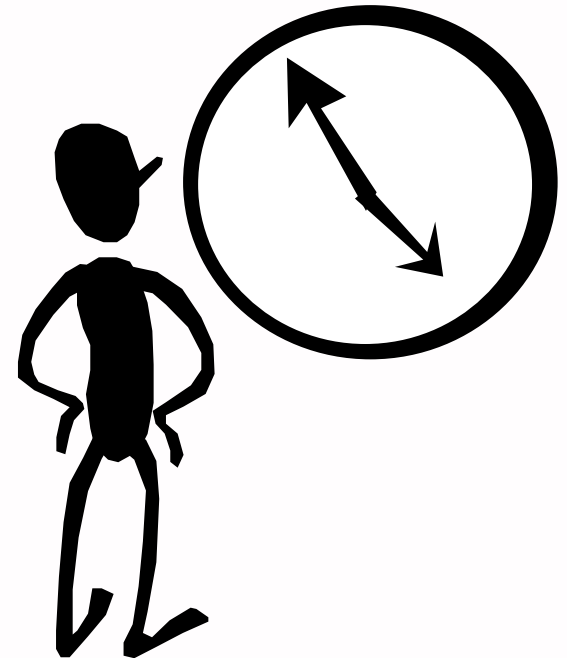
First step: Screening

Clock Drawing Test

- Numerous version varying in administration
- (pre-drawn, self drawn, copy, time setting only)

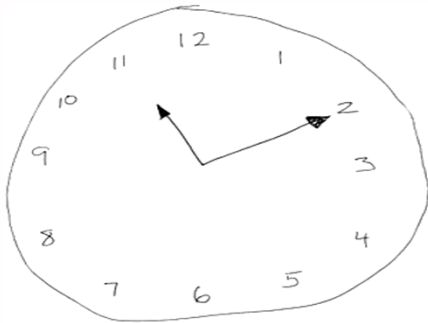
- Numerous scoring systems

- Qualitative errors not always taken into account

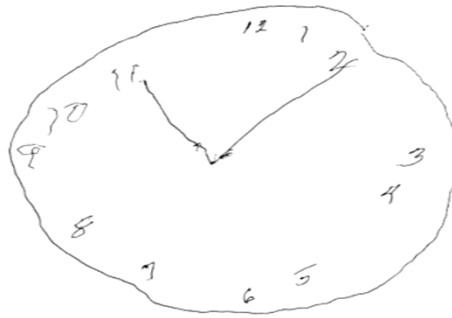




Clock drawing test



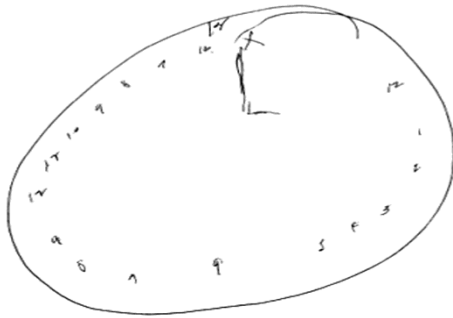
A



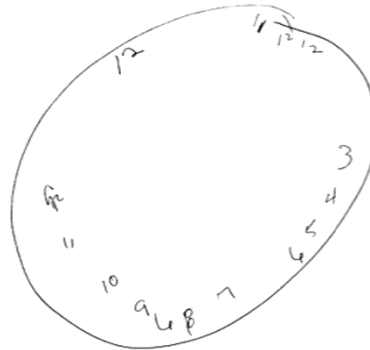
B



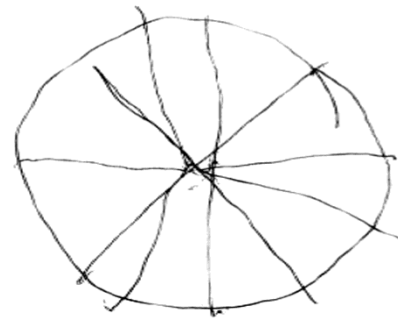
C



D



E



F



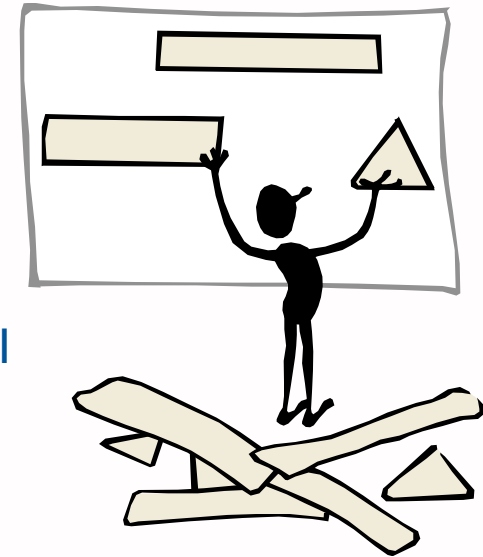
First step: Screening

MoCA: Designed as a brief screening tool for MCI

Less frequently used than MSE (5%)

Evaluates multiple domains affected by dementia

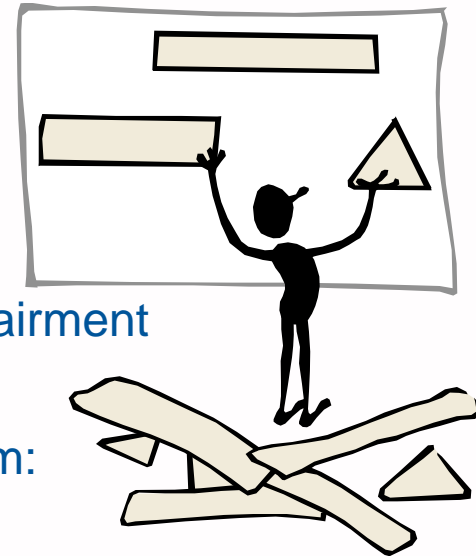
- Short-term memory (5 nouns after 5 minutes)
- Visuospatial (Clock)
- Executive (Modified Trails B; phonemic fluency, verbal abstraction)
- Attention, concentration, and working memory (target detection, serial subtraction, digits forward and backward)
- Language (animal naming, sentence repetition)
- Orientation





First step: Screening

- MoCA: Cut-off score of 25 or below indicates impairment
- Authors of MoCA suggest the following algorithm:
 - Patients with functional decline and cognitive complaints
 - more likely to suffer from dementia -> MMSE
 - if MMSE is normal -> administer the MoCA
 - Patients with no functional decline but cognitive complaints -> administer MoCA





Threats to validity

Factors that may confound mental status test results:

- Culture
- Language
- Pre-morbid ability
- Medication
- Environmental factors
- Physical disability
- Motivation
- Mood

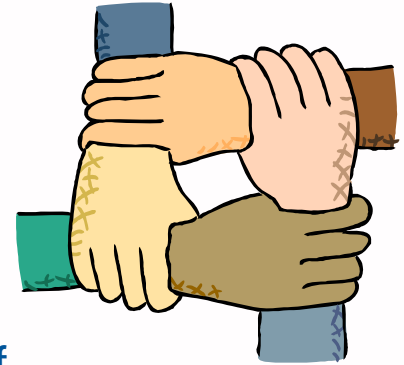


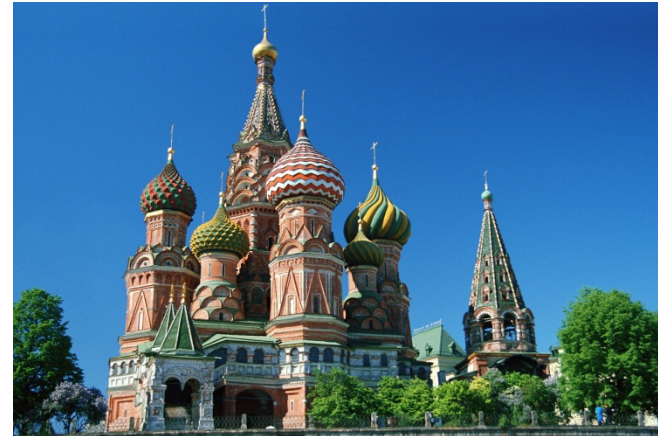


Threats to validity

CULTURE

- People who grew up in conditions of deprivation, lack of medical care, poor nutrition, diminished environmental stimulation, are more likely to have had developmental problems
- Racial differences
 - More likely due to socio-economic background than race per se
 - Some cultures less “test savvy” than others
 - Some tests more culturally biased than others





Threats to validity

LANGUAGE

- Person should be assessed in their language of choice
- This is often but not always language of origin
- Assessment with an interpreter brings challenges in execution and interpretation
- Some tests/ideas are more easily translated than others

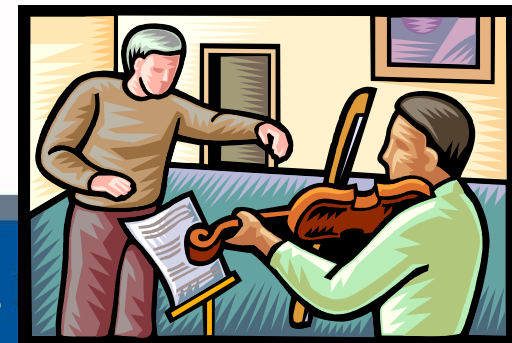




Threats to validity

PRE-MORBID ABILITIES

- Premorbid ability closely tied to academic achievement
- People with less formal education are also less “test savvy”
- Education can greatly influence test performance (some tests have education-based norms)
- Education effect is greater for verbal tasks
- Cognitive reserve helps people cope with brain injury or degeneration





Threats to validity

MEDICATION

- Many medications have neurocognitive effects such as sedation, agitation, memory impairment
- Elderly individuals are more susceptible to brain reactions and take longer to adjust to medication changes





Threats to validity

ENVIRONMENTAL

- Noise and activity in the room
- Interruptions
- Length of test sessions
- “White coat syndrome”





Threats to validity

PHYSICAL DISABILITY

- Diminished visual acuity
 - Cataracts, macular degeneration,
- Hearing problems
 - Hearing aids
- Lateralized sensory deficits
 - Visual field cuts
- Motor problems
 - Tremors
 - Reduced dexterity, fine motor skills



© Ron Leishman * www.ClipartOf.com/439705



Threats to validity

MOTIVATION

- Reduced effort
- Frustration
- Fatigue
- Lack of insight
- Fear
- Denial





Threats to validity

MOOD/PSYCHIATRIC HISTORY

- Depression
- Anxiety
- Psychiatric conditions
 - OCD
 - Schizophrenia

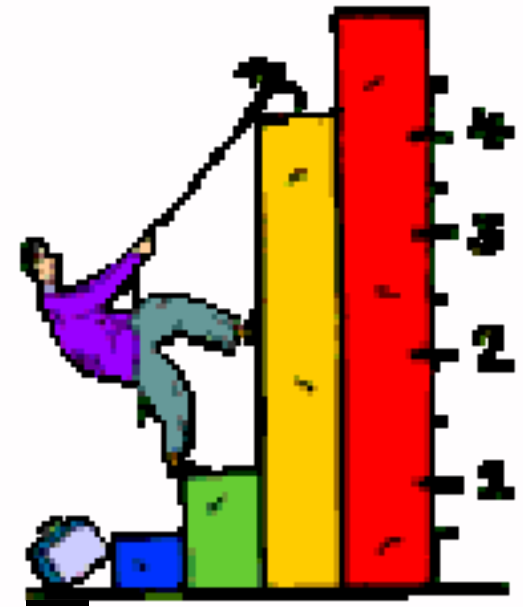




Threats to validity

PRACTICE EFFECTS

- Most tests are vulnerable to practice effects when administered repeatedly
- Tests that have a speed component, require unfamiliar or infrequently practiced response, or have a single solution are more likely to show practice effects
- Tests involving learning show large practice effects
- Different populations will have different levels of practice effects (those with ceiling scores at initial performance will show little effect of practice)
- When practice expected and not shown, may suggest a decline





Next steps..

- If functional and mental status tests are both normal, no further intervention may be required except for a follow up in 6-12 months
- However, if patient is very high functioning, these measures may not be sensitive enough...
- If either functional or status exams are abnormal, neurological, psychiatric, or neuropsychological assessment may be indicated





When to refer to Neuropsychology

(Chui, 2003)

- If mental status exam is normal but functional questionnaire abnormal and patient is high functioning, high education

- Mental status below normal but functional questionnaire normal or..

- patient has little formal education
- low intelligence
- poor command of English
- is of minority or ethnic background
- shows impairment in only one area of cognition



When to refer to neuropsychology?



Questions:

- Are screening results a valid reflection of the person's abilities?
- Has this person's function deteriorated due to decreased intellectual functioning ?
- Does this person have MCI?
- Is the deterioration sufficient to warrant a diagnosis of dementia?
- Are there personality changes related to an organic condition?
- Are cognitive deficits observed consistent with a psychiatric disturbance?
- Is this patient depressed or demented?
- Does this patient have the cognitive capabilities to live independently, drive, participate in a rehabilitation program..?



What is Neuropsychology?

- Human clinical neuropsychology is the study of neural mechanisms underlying human behaviour,
- i.e., the relationship between the brain and behaviour
- The discipline is based on the systematic analysis of disturbances of behaviour following alterations or normal brain activity by disease or damage





Approaches to assessment



Quantitative:

- Neuropsychologist draws conclusions based on scores from standardized testing procedures
- Battery of tests used to assess multiple domains in different ways
- Cut-off scores for impaired versus non-impaired



Qualitative:

- Behavioural observations
- Adapt test battery to test hypotheses, guide clinical exploration
- “Process” as well as score considered



Benefits of neuropsychological assessment

- Valuable in determining diagnosis, prognosis and functional abilities and inform clinical management of patients
- Collecting multiple sources of valid reliable information enhances diagnostic precision and clinical management
- Synthesizes data from the patient interview, informant interview, record review, behavioural observations, objective measures of cognitive, sensory-motor, and emotional factors
- Unique complementary information critical for evaluation of higher order abilities
- More thorough sampling of cognitive domains provides better validity and reliability of diagnosis and provides information about multiple pathologies





Purpose of neuropsychological assessment:



1. Diagnostic Clarification
2. Functional purposes



The Ottawa Hospital | L'Hôpital d'Ottawa



Diagnostic Clarification:

Evidence shows accuracy of diagnosis of dementia increases with neuropsychological evaluation

Comprehensive assessment has greater predictive value than cognitive screens, particularly in individuals with high pre-morbid baseline intellectual abilities, different ethnic or linguistic backgrounds, patients in early phases of illness, patients with atypical degenerative disease

Repeat testing highly sensitive to detecting even subtle changes in cognitive function and response to memory-enhancing medications. Helpful in determining cognitive decline from previous level of performance-clinically meaningful change



Diagnostic Clarification:

- Establish severity of cognitive impairment
- Distinguish dementia from:
 - normal aging
 - delirium
 - depression
 - MCI
- Assist in differential diagnosis of dementia:
 - AD, Vascular, Mixed, LBD, Alcohol-induced...
- Differential diagnosis has been shown to be important for prediction of functional abilities and guiding medication management





Functional Purposes

- Establish level of care recommendations
- Facilitate patient care, rehabilitation
 - Detailed neuropsychological assessment can provide a profile of strengths and weaknesses that can be useful for developing therapeutic approaches and to discharge planning



- Driving





Neuropsychological evaluation

Components:

1. Case review (personal, psychiatric, medical)
2. Previous investigations and diagnostic tests
3. Interview with client, family member
4. Assessment (consider all threats to validity)
5. Recommendations, compensatory strategies





The Ottawa Hospital | L'Hôpital d'Ottawa

Domains assessed in a neuropsychological evaluation

Attention

Information processing speed

Language-comprehension, naming, verbal fluency

Visual spatial construction

Visual perceptual organization

Spatial judgement

Learning and memory-simple versus supra span, verbal, visual, recognition, recall, one versus multiple exposures

Context versus no structure imposed





The Ottawa
Hospital | L'Hôpital
d'Ottawa

Domains assessed in a neuropsychological evaluation

Executive skills:

Problem solving

Multi-tasking, conceptual abilities

Response inhibition

Initiation

Sequencing

Abstraction

Self awareness

Reasoning

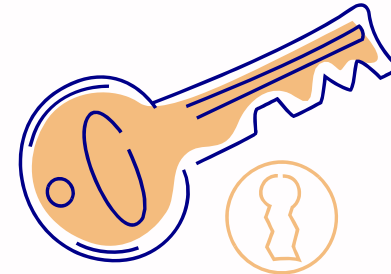
Organization

Self monitoring





Key Points



- Be aware of signs of potential cognitive impairment
- Flag individuals who demonstrate these signs
- Be aware of possible threats to validity
- Refer to neuropsychology as required
- Use information of the cognitive profile to plan appropriate intervention



The Ottawa
Hospital | L'Hôpital
d'Ottawa



Compassionate People. World-Class Care. Des gens de compassion. Des soins de calibre mondial.