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What to expect from a Neuropsychological Exam

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DISCLOSURE OF FINANCIAL RELATIONSHIP

Michael G. Mercury PhD

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Trade Names
The presentation will include discussion of trade names of tests in order to improve communication. Neither Dr. Mercury, or any member of their immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers or of any of the services to be discussed.

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Objectives

1. The Neuropsychological Exam
2. Examination of Cognitive Function
3. Conceptualization of the Neurological Disorder

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The Neuropsychological Exam

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Resources regarding the Neuropsychological Exam

Concern about cognitive ability, most often memory (e.g., from clinical interview, family members, health care team)

History and physical examination: signs or symptoms of possible thyroid disease, malignancy, vitamin B₁₂ or other nutritional deficiency, urinary tract infection, alcohol or drug abuse, medication adverse effect or interaction, neurologic disease (e.g., stroke), depression, delirium

Laboratory evaluation: comprehensive blood chemistry and hematology panels, thyroid function tests, vitamin B₁₂ level; other laboratory tests, urine analysis, depression screens, and neuroimaging studies as indicated

Cause identified?

- Yes: Treat specific cause
- No: Cognitive screening test to assess for impairment
 - Impairment unlikely or possible: Reassure and monitor over time and/or refer to a neuropsychologist
 - Impairment likely: Treat if etiology is known and/or refer to a neuropsychologist

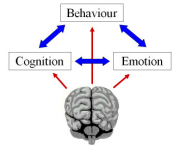
Approach to the patient in whom there is concern about dementia. Adapted with permission from Moore TG, Tu AV, Quast LJ. Neuropsychological evaluation in primary care. Am Fam Physician. 2010;82(5):495.

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What is Neuropsychology?

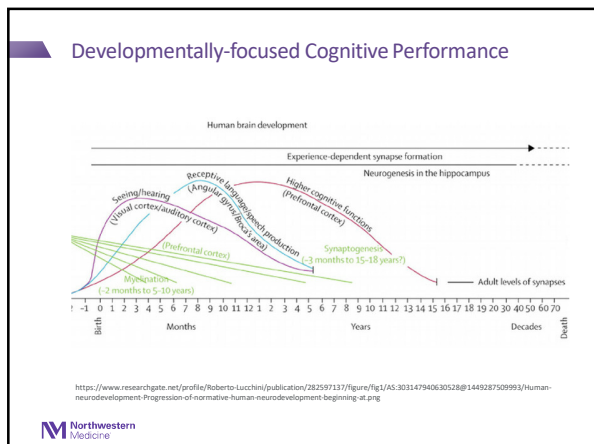
- **Neuropsychology:** The study of the relationship between behavior, emotion, and cognition on the one hand, and variations in brain function produced by genetics, injury or disease, on the other hand, as interpreted in the context of human brain development and the environment.
- **Cognition:** Acquisition of knowledge and understanding through thought, experience, and the senses resulting in a perception, sensation, notion or intuition.
- **Psychometrics:** Quantifying brain behavior relationships through objective measure and statistical analysis



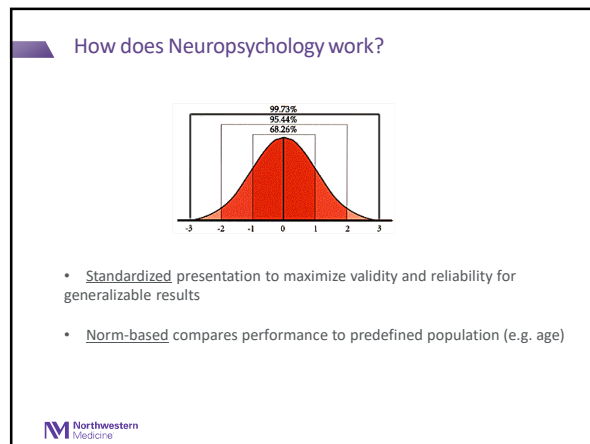
<http://www.psychiatry.wisc.edu/department/neuropsychology/>
<http://www.psychiatry.wisc.edu/department/neuropsychology/>
Benton & Swan (2007) Clinical Neuropsychology. Alfred Hitchcock/Mercury, Kahoe, Tichan, Deane, Liberman

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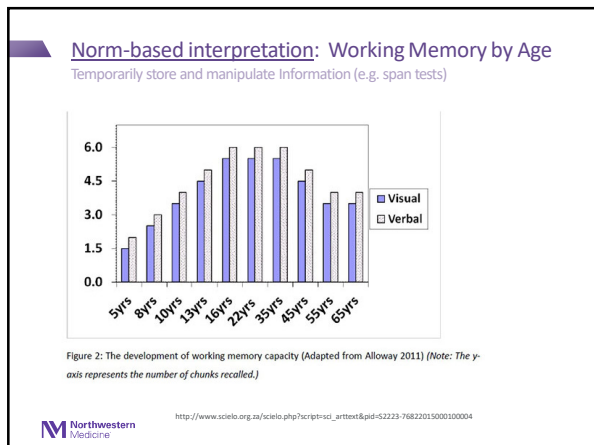
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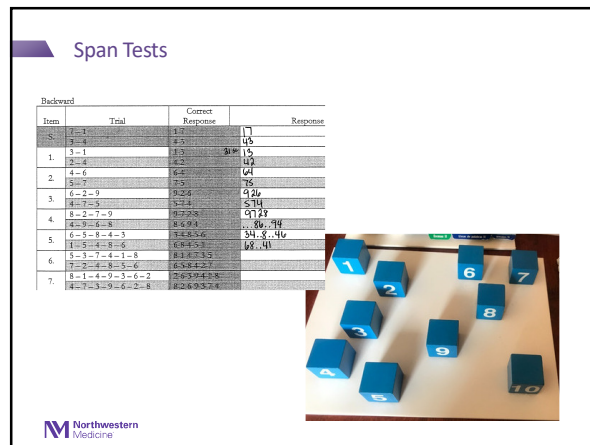
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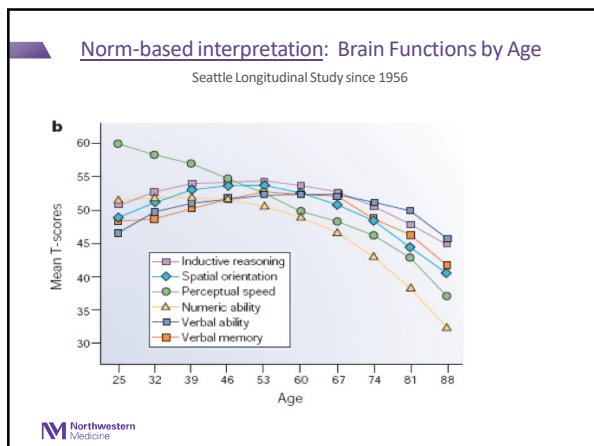
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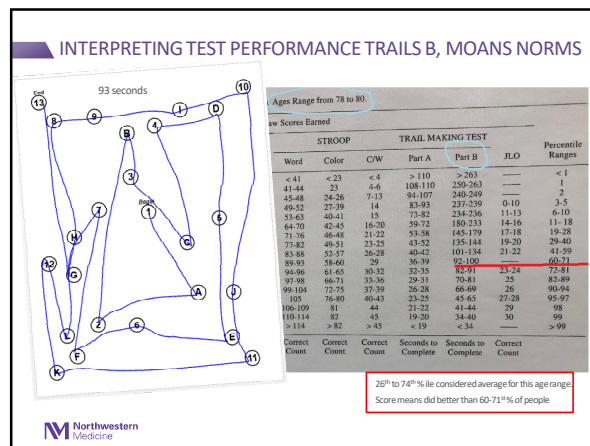
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Neuropsychological Score Interpretation

- Test scores do not necessarily reflect everyday behavior

Standard Score	z	Percentile	T	Description	Present Description
130-150	≥+2.00	≥98	≥70	Very Superior	Exceptionally high score
121-129	+1.34 -- +1.99	91-97	64-69	Superior	Above average score
111-120	+0.68 -- +1.33	75-90	57-63	High Average	High average score
90-110	-0.67 -- +0.67	26-74	43-56	Average	Average score
80-89	-1.33 -- (-0.68)	12-25	37-42	Low Average	Low average score
70-74	-2.16 -- (-1.70)	5-11	34-36	Borderline/Mild	9-24 P Low average
65-69	-3.00 -- (-2.17)	2-4	31-33	Mild/Moderate	Below average score
65-67	-2.32 -- (-2.20)	1-1.99	29-30	Moderate/Severe	Below average score
≤65	≤(-3.00)	<1	≤28	Severe impairment	Exceptionally Low score


- The Boston Process to test interpretation focuses on what led to the score (behavior, medical condition etc.) which, when combined with feedback with the patient and collaterals can better inform the patient's cognitive status.



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Neuropsychological Testing is not Psychological Testing


- **Psychological Testing:** Projective and objective tests to measure and observe person's behaviors, emotions, and thoughts for diagnosis and treatment of *mental health* conditions.
- **Mental Health Disorders** can have specific neuropsychological consequences:
 - Anxiety: selective attention and working memory
 - Depression: executive and memory dysfunction



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Who is a Neuropsychologist?


- A psychologist (PhD or PsyD) who has completed a two year, postdoctoral fellowship (APA, APPCN or equivalent) = Board Eligible
- Board Certification (26% Neuropsychologists, 4% licensed psychologists)



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What is not a Neuropsychological Exam?


- A test battery composed of the following:
 - IQ test (e.g. WAIS)
 - Memory test (the whole WMS)
 - Trails A & B
 - Depression questionnaire (e.g. BDI-II)
 - Objective psychological test (e.g. MMPI)
- The above may be part of a neuropsychological exam but the above would not constitute a neuropsychological evaluation




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Resources regarding the Neuropsychological Exam

- Michels et al. (2010). Neuropsychological Evaluation in Primary Care, Am Fam Physician 82(5): 495-502.
- Schroeder et al. (2019). Neuropsychological evaluations in adults. Am Fam Physician 99 (2): 101-108.



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Examination of Cognitive Function

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Neuropsychology


- Consultative, Diagnostic Service
 - Baseline and Level of functioning
 - Differential Diagnosis (primarily outpatient)
- Specialization
 - Pediatric
 - Adult
 - Geriatric
 - Specialty



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Components of the Neuropsychological Evaluation


- Subjective
 - Reason for referral and review of records
 - Interview of patient and collateral(s)
- Objective
 - Review of Records
 - Functional status [i.e. adaptive behavior (Peds) and ADLs, IADLs (Adult, Geriatrics)]
 - Neuropsychological testing
 - Other testing (e.g. achievement)
 - Emotional/behavioral questionnaires for patient
 - Questionnaires for collateral(s)



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Components of the Neuropsychological Evaluation

- Assessment
 - Most salient deficit
 - Working diagnosis based on functional status and neuropsychological profile]
 - Differential diagnoses
- Plan
 - Recommended next steps
 - Referral to specific specialties (e.g. social Work, sleep, audiology)
 - Feedback to patient and collateral to identify and explore discrepancies between test results and real-world experience/concerns
 - Practical recommendations for patient
 - Collateral education re how to respond to patient's neuropsychological difficulties




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Pediatric Neuropsychological Exam

Pediatric Case

- Marcy is a 5-year-old, Caucasian female who was originally referred for services following screening using the Developmental Indicators for Assessment of Learning (DIAL). She evidenced some difficulties in language (naming) and concepts (color, sorting shapes).
- Therapists felt she was not benefitting to the degree expected and referred Marcy to the school psychologist for evaluation. The school psychologist administered tests including the WPPSI and WJ and ultimately recommended the parents talk to the pediatrician about a neuropsychological evaluation.




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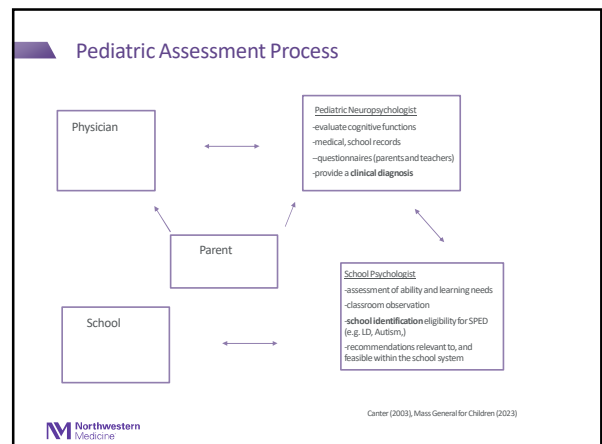
Pediatric Neuropsychological Exam

Information goes to the requesting physician, parent (caregiver), school

- P.L. 93-112 (1973): Section 504, guarantees participation in education
- P.L. 94-142 (1975): Individuals with Disabilities Education Act, or IDEA
- P.L. 99-457 (1986): expanded to infants and preschool children
- Context rapidly evolves from medical to educational
 - IFSP (birth to 3): Individualized Family Service Plan (individualized early intervention)
 - IEP (3-21): Individualized Education Programs (special education)
- IFSP and IEP specify
 - Individualized goals (based on assessment results and parent concerns)
 - Amount of time mainstreamed



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Pediatric Neuropsychological Exam

Initially medically based and then educationally based until age 21

- Birth to Three specific:**
 - Review screening measure results (e.g. DIAL; recommended by MN Dept. of Health)
- Birth to 21**
 - Parent fills out forms that have been sent ahead of time
 - Observe parent doing something with the child (± video)
 - Interview parent with child and separately
 - Identify relevant daycare staff, teacher(s), school therapist(s) to fill out forms.
 - Review available evaluations (e.g. School Psychology, Speech, Special Education)
 - Developmentally appropriate neuropsychological tests



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Functional Status (Pediatrics) :

Vineland Adaptive Behavior Scales
Ages 0-90+ Parent/Caregiver; 3-18 Teacher (age 18 used for 19-21)




Table 15.3 Sample Items from the Vineland Adaptive Behavior Scales


Age, Years	Adaptive Ability
2	Says at least fifty recognizable words. Removes front-opening coat, sweater, or shirt without assistance.
5	Tells popular story, fairy tale, lengthy joke, or plot of television program. Ties shoelaces into a bow without assistance.
8	Keeps secrets or confidences for more than one day. Orders own meal in a restaurant.
11	Uses the telephone for all kinds of calls without assistance. Watches television or listens to radio for information about a particular area of interest.
16	Looks after own health. Responds to hints or indirect cues in conversation.

Source: From Sparrow, Ballo, and Cicchetti, 1984.

Domains	Subdomains
Communication	Receptive Expressive Written
Daily Living Skills	Personal Domestic Community
Socialization	Interpersonal Relationships Play and Leisure Coping Skills
Motor Skills (Optional)	Fine Motor Gross Motor
Multidisciplinary Behavior (Optional)	Internalizing Externalizing Critical Items

Domain	Standard Score	Standard Error	Mean	SD	Range	Reliability (Cronbach's alpha)	Statistical Significance (p-value)	National Percentile Rank	Systematic Error
Communication	96	+3	5	10	1-100	0.92	0.001	95	None
Daily Living Skills	99	+3	5	10	1-100	0.93	0.001	95	None
Socialization	76	+3	5	10	1-100	0.88	0.001	85	Minor

Other: ABAS-3 (Adaptive Behavior Assessment System, ages birth-89:11)



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Pediatric Neuropsychological Assessment

Ability Testing

Bayley-4 16 days-42 months
KABC-II NU 3-18
SB-5 2-85+
WPPSI-IV 2.5-7.7
WISC-V 6.0-16:11
WAIS-IV 16.0-90:11


Achievement Testing

WIAT-4
Ages 4-50:11

WJ III
Ages 5-95

Specialized Testing

CTONI nonverbal
ADOS-2 autism
VMI visuospatial
PPVT naming
WRAML3 memory
Connors CPT3 attention



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Pediatric Conditions Seen by Neuropsychology

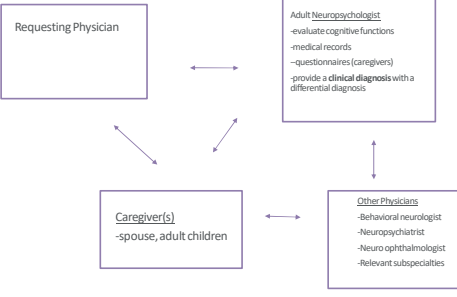
- Accidents at birth
- Low Birth Weights/prematurity
- hydrocephalus
- Spina Bifida
- Cerebral Palsy
- Intellectual Disability
- Brain injury (accident, stroke, infection)
- Toxic exposure (lead, drugs, fetal EtOH)
- Brain tumor
- Leukemia
- Chemotherapy/radiation
- Seizure Disorder/Epilepsy
- Autism Spectrum Disorders
- Pre-surgical



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Adult and Geriatric Assessment Process

Medically based evaluation




Requesting Physician

Adult Neuropsychologist
-evaluate cognitive functions
-medical records
-questionnaires (caregivers)
-provide a clinical diagnosis with a differential diagnosis.

Caregiver(s)
-spouse, adult children

Other Physicians
-Behavioral neurologist
-Neuropsychiatrist
-Neuro ophthalmologist
-Relevant subspecialties



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Functional Status (Adult/Geriatric)

LAWTON IADLs AND KATZ ADLs

The Lawton Instrumental Activities of Daily Living Scale

A. Ability to Use Telephone

B. Shopping

C. Food Preparation


D. Responsibility for Own Finances

E. Transportation

F. Ability to Handle Emergencies

Katz Index of Independence in Activities of Daily Living

Activities	Independence (5 points)	Dependence (0 points)
Bathing	Bathes self completely or needs help in bathing only in a single part of the body, such as the back, perineum or disabled extremity.	Needs help with bathing more than one part of the body getting in or out of the bathtub or shower; requires total bathing.
Dressing	Gets clothes from closets and drawers, and puts on clothes and outer garments complete with fasteners, crav, and hair-bring shoes.	Needs help with dressing off or needs to be completely dressed.
Transferring	Moves in and out of bed or chair unaided; transfers in and out of bed or chair (alone or with help) are acceptable.	Needs help in moving from bed to chair or requires a complete transfer.
Feeding	Prepares complete meal over stove and table.	Needs help in feeding or requires assistance in feeding.



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Common Adult/Geriatric Diagnoses

General Stroke Injury – Concussion, TBI MS Movement Disorders Seizure	Geriatrics Normal Aging Mild Cognitive Impairment Dementia	Specialized Forensics – accident Return to work Accommodations Capacity Presurgical – seizure, brain tumor, DBS
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Adult/Geriatric Neuropsychological Assessment

Screening Measures MoCA, MMSE, RBANS, DRS Effort Tests VSVT, TOMM Intelligence/Premorbid WAIS-IV, TOPF Achievement Testing WIAT-4, WI III, Nelson-Denny	Sensory/Motor Grooved Pegs, Grip Attention/Concentration Digit Span, PASAT Executive Clock, Trails, WCST Language BNT, COWA, Animals	Visuospatial Green Cross, ICLO Memory CVLT, WMS-III, BVMIT-R Emotional/Personality BDI-II, GDS, BAI
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The Neuropsychology Exam

A golden hammer can break an iron door.

The American Liner New York struck a mine near Liverpool Monday Evening. In spite of a blinding snowstorm and darkness, the sixty passengers, including 18 women were all

Name:	Sex:	I	II	III	IV
Education:	Occup:				
Drum	.....	.....	.....	.....	.....
Curtain	.....	.....	.....	.....	.....
Bell	.....	.....	.....	.....	.....
Coffee	.....	.....	.....	.....	.....
School	.....	.....	.....	.....	.....
Parent	.....	.....	.....	.....	.....
Moon	.....	.....	.....	.....	.....
Garden	.....	.....	.....	.....	.....
Hat	.....	.....	.....	.....	.....
Famer	.....	.....	.....	.....	.....
Noise	.....	.....	.....	.....	.....
Turkey	.....	.....	.....	.....	.....
Color	.....	.....	.....	.....	.....
House	.....	.....	.....	.....	.....
River	.....	.....	.....	.....	.....
International	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....
.....

RECOGNITION*

	Yes	No	Yes	No
Coffee	.....	.....	.....	.....
Yes Low	.....	.....	.....	.....
Curtain
Bell
Plus
Curtain
Parent
Face
Spell
Rule
Garden
Hat
Turkey
Spoon
River

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Adult Neuropsychological Exam

Adult Case

- John Roberts is a 49-year-old right-handed Caucasian male recently diagnosed with multiple sclerosis. He is referred by his neurologist at the behest of Mr. Roberts wife. Mrs. Roberts describes unwise financial decisions Mr. Roberts has recently made. She also notes personality change in that he now can easily become irritable with her and the children. Mr. Roberts denies these problems
- Medications: amlodipine, losartan, multivitamin

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Adult Neuropsychological Exam

- Exam tends to be focused on the medical condition that brings the patient in (e.g. behavior change)
- Exam involves
 - General Information form completed before visit
 - One hour interview of patient and caregiver (E-Visit or In-office)
 - 4-6 hours of testing (paper and pencil, computer)
 - 2-4 hours scoring and interpretation
 - Report to requesting physician and patient
 - 1 hour feedback with patient and family, when requested

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Adult Neuropsychological Exam

Does ADHD require a neuropsychological exam?


- ADHD Adult Toolkit (<https://www.aafp.org/family-physician/patient-care/prevention-wellness/emotional-wellbeing/adhd-toolkit.html>)

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Geriatric Case


- Mary Beth Stevens is a 72-year-old, right-handed married Caucasian female with 16 years of education who is referred for a neuropsychological evaluation
- **Memory Loss:** Ms. Stevens reports that her family says she repeats questions. She does not remember she asked before. She did get lost on one occasion going to the grocery store. She is concerned about her memory and feels it may be getting worse. She is also having problems finding the right word when speaking. Father had Alzheimer's which concerns her.
- **Anxiety:** She reports feeling anxious, with worry that interferes with her sleep
- **Medications:** alendronate, atorvastatin, escitalopram, estradiol, losartan.



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Geriatric Neuropsychological Exam


- Exam involves
 - General Information form completed before visit
 - One hour interview of patient and caregiver (E-Visit or In-office)
 - 2-4 hours of testing (paper and pencil, computer)
 - ~2 hours scoring and interpretation
 - Report to requesting physician and patient/caregiver
 - 1 hour feedback with patient and family, when requested



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Geriatric Neuropsychological Exam

- Exam is focused on the individual's profile with regards to:
 - Normal aging
 - Consider present exam baseline and repeat testing in 12-18 months
 - No disease identified but not normal functioning in the real world
 - Consider present exam baseline and repeat testing in 12-18 months
 - MCI
 - Likely underlying disease
 - Dementia
 - Possible lack of insight
 - Likely underlying disease



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Dementia Types

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Dementia is an Umbrella Term:


ALZHEIMER'S 50% - 75%

VASCULAR 20% - 30%

LEWY BODY 10% - 25%

FRONTOTEMPORAL 10% - 15%

<https://www.dfwsheridan.org/types-dementia>



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Geriatric Neuropsychological Exam

Does Decisional Capacity Require Neuropsychology

- Barstow et al. (2018). Evaluating Medical Decision-Making Capacity in Practice (<https://www.aafp.org/pubs/afp/issues/2018/0701/p40.html>)

Informed consent involves providing patients with accurate and adequate information about the risks, benefits, and alternatives of a treatment in a manner that is free from coercion. . . . Patients must be able to (1) demonstrate understanding of the benefits and risks of, and the alternatives to, a proposed treatment or intervention (including no treatment); (2) demonstrate appreciation of those benefits, risks, and alternatives; show reasoning in making a decision; and (4) communicate their choice.

- Aid to Capacity Evaluation (ACE; Etchells, 1996; <https://jcb.utoronto.ca/wp-content/uploads/2021/03/ace.pdf>)
- The Confusion Assessment Method (CAM; Inouye 2003; https://americandeliriumsociety.org/wp-content/uploads/2021/08/CAM-Long_Training_Manual.pdf;
- Delirium in Older Persons: Evaluation and Management (Kalish et al., 2014; <https://www.aafp.org/pubs/afp/issues/2014/0801/p150.html>)



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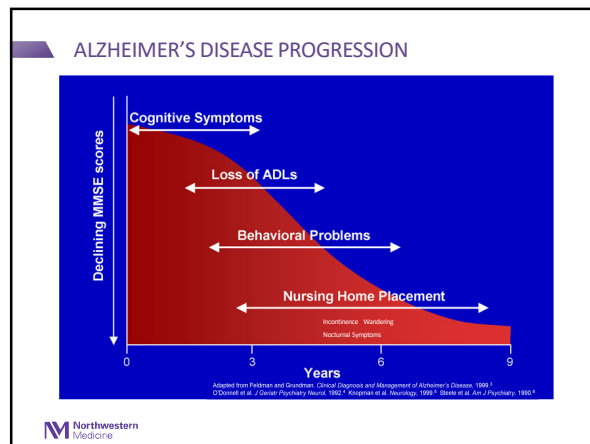
ALZHEIMER'S ASSOCIATION

- Alzheimer's Association (<https://alz.org/>)

- Help & Support in the purple banner at the top of the page
- 24/7 Helpline 800-272-3900 (not just for emergencies)

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FREE PUBLICATIONS

National Institute on Aging (<https://order.nia.nih.gov/>)

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Classifying Dementia – Patients ask “What Stage”

Reisberg (1997) Functional Assessment Staging Test (FAST)

Stage	Stage Name	Characteristic	Expected Untreated AD Duration (months)	Mental Age (years)	MMSE (score)
1	Normal Aging	No deficits whatsoever	—	Adult	29-35
2	Possible Mild Cognitive Impairment	Subjective functional deficit	—	—	28-29
3	Mild Cognitive Impairment	Objective functional deficit interferes with a person's most complex tasks	84	12+	24-28
4	Mild Dementia	ADLs become affected, such as bill paying, cooking, cleaning, etc.	24	8-12	19-23
5	Moderate Dementia	Needs help selecting proper attire	18	5-7	15
6A	Moderately Severe Dementia	Needs help putting on clothes	4.8	5	9
6B	Moderately Severe Dementia	Needs help bathing	4.8	4	8
6C	Moderately Severe Dementia	Needs help walking	4.8	4	5
6D	Moderately Severe Dementia	Urinary incontinence	3.6	3.4	3
6E	Moderately Severe Dementia	Fecal incontinence	9.6	2-3	1
7A	Severe Dementia	Speaks 5-6 words during day	12	1.25	0
7B	Severe Dementia	Speaks only 1 word clearly	18	1	0
7C	Severe Dementia	Can no longer walk	12	1	0
7D	Severe Dementia	Can no longer sit up	12	0.5-0.8	0
7E	Severe Dementia	Can no longer ambulate	18	0.2-0.4	0
7F	Severe Dementia	Can no longer hold up head	12+	0-0.2	0

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Classifying Dementia – Patients ask “What Stage”

The Clinical Dementia Rating (CDR®) Dementia Staging Instrument

CDR™ Scoring Table

CLINICAL DOMAINS (max 25%)	Score				
	0	0.5	1	2	3
Memory	No memory loss or slight impairment (forgetfulness)	Consistent slight forgetfulness, e.g., forgets names, "forget" to get things	Moderate memory loss, forgets names, dates, recent events, often requires help with everyday activities	Severe memory loss, forgets names, dates, recent events, often requires help with everyday activities	Severe memory loss, forgets names, dates, recent events, often requires help with everyday activities
Orientation	Fully oriented	Few orientation errors (e.g., right, left, up, down)	Moderate difficulty with orientation, e.g., right, left, up, down	Severe difficulty with orientation, e.g., right, left, up, down	Disoriented to person only
Judgment & Problem Solving	Severe memory problems, but judgment intact	Slight impairment in judgment, e.g., shopping, banking, and finances	Moderate difficulty in judgment, e.g., shopping, banking, and finances, but judgment intact	Severe impairment in judgment, e.g., shopping, banking, and finances, but judgment intact	Unable to make judgment or solve problems
Community Affairs	Independent function of all activities	Slight impairment in these activities	Unable to function independently in these activities, e.g., shopping, banking, and finances, but judgment intact	Needs help with these activities, e.g., shopping, banking, and finances, but judgment intact	No pretense of independent function outside home
Home and Hobbies	Excellent in home, hobbies, and intellectual interests and enjoyment	Little or home, hobbies, and intellectual interests slightly impaired	Moderate or home, hobbies, and intellectual interests impaired, but judgment intact	Only minor interest in home, hobbies, and intellectual interests, but judgment intact	No significant function in home
Personal Care	Fully capable of self-care	Needs prompting	Requires assistance in dressing, hygiene, and grooming	Requires assistance in dressing, hygiene, and grooming	Requires much help with personal care (bathing, grooming)

Score only as decline from previous usual level due to cognitive loss, not impairment due to other factors.

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Objectives

- The Neuropsychological Exam
- Examination of Cognitive Function
- Conceptualization of the Neurological Disorder

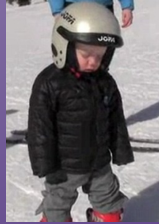
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QUESTIONS



<http://primarycareie.com/wp-content/uploads/2011/04/skier-sleeping.jpg>



<https://www.dailymail.co.uk/news/article-2121134/Boy-falls-asleep-ski-video-Little-Bodes-snow-sleepy-nods-learning-ski.html>

