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Neuropsychological Perspectives on Decisional Capacity

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1. Case Introductions and Commonalities

Persons whose decisional capacity is being questioned tend to have several issues in common. Most are angry and denying need for protection, they may seem intact and reasonable during interviews, there is often disagreement between petitioner, AIP, family, and medical providers, screening exams (i.e., MMSE) provide little clarity, physician statements may be brief and less than helpful in providing clear information or guidance. Such challenges are especially acute in contested cases and where cognitive impairment may be mild to moderate. Poor-quality information and evidence leaves the decision often subjective and may lead to poor outcomes for the AIP/IP.

2. Aspects of Competence

"*A threshold requirement, imposed by society, for an individual to retain decision making power in a particular activity or set of activities."* (D. Marson, J.D., Ph.D.)

Competence has multiple contexts, such as medical decision making, financial management, driving, etc. Decisional capacity must always be considered in context of

what decision is being made. The policy of *parens patriae* authorizes the state may adopt the role of protector of weaker and more vulnerable members of society. Individuals may have an inherent physical condition which prevents them from caring for themselves, and may act in ways that are contrary to their interests. Such persons are vulnerable through dependency and deserve the protection of the state against the risks of abuse or exploitation.

3. Capacity Through the Lifespan

Societal standards presume capacity at age 18, extending through death unless proven incapacitated. On a practical level, actual capacity may occur before, and sometimes well, after age 18 (if ever), and may be lost well before or well after a judgment of incapacity. Furthermore, persons with chronic and severe mental illness tend to show cyclical capacity based on the waxing and waning nature of their illness. It is difficult to apply a dichotomous "yes" or "no" capacity standard to a moving target, as sometimes this will be appropriate, and other times not.

4. Competence in American Case Law: Example of Medical Decision Making

a) Ability to Understand
b) Ability to Appreciate
c) Ability to Reason
d) Ability to Make a Choice

Several relevant questions arise when reviewing these standards:

a) Is it possible to reliably and directly measure the processes underlying decisional capacity?
b) If so, would having this data inform and improve the judicial process of evaluating and best serving the rights and needs of the AIP?

As in most cases involving complex human behaviors and social dynamics, the answers are nuanced. Many basic higher cognitive functions can be validly and reliably measured, but no test is perfect. However, the general legal standards as noted above are very difficult to measure in direct fashion. Would it be helpful to do so? Most of the time, yes. The most valid test will always likely remain an established pattern of behavior.

5. The Role of Neuropsychology

Neuropsychologists measure human behavior and mental processes, with special consideration of how these measurements related to normal and abnormal brain functioning. The processes of understanding, appreciating, reasoning, and accurate communication of desire/intent are all products of higher cognitive processes.

Judgments regarding capacity a person's capacity to "X" may be made subjectively, but accuracy may be enhanced with more objective information about the person's actual cognitive performance.

Understanding, Appreciation, Reasoning, and Communication are intuitive and helpful heuristics, but almost impossible to assess in discrete fashion using existing tools of cognitive psychology. These processes are complex and multi-layered, both psychologically and neuroanatomically. These processes do not neatly fit into identified neurocognitive domains or neuroanatomical regions of functioning.

6. What We Can Measure about Higher Cognitive Functions

a) Memory
    i. Verbal, visual, semantic, episodic, procedural
b) Language /Verbal Comprehension
    i. Vocabulary, reasoning and abstraction using words, expression, fluency, naming
c) Perceptual and Fluid Reasoning
    i. Reasoning and abstraction using images, perceptual accuracy, eye-hand coordination
d) Attention /Working Memory
    i. Basic and complex attention, multitasking
e) Speed of Information Processing
f) Motor speed and dexterity
g) Academic skills
    i. Reading, spelling, math
h) Executive Functioning

The Role of Executive Functioning (EF)

EF constitutes somewhat a "mystery bag" of interrelated cognitive operations. This domain serves as command and control processes of the brain, managing mental processes that enable a person to solve problems, react well to novel and unexpected situations, select and engage in behaviors necessary to meet a goal, and inhibit behaviors that compromise welfare. Based on injury study and functional neuroimaging, we know that many EF activities are derived from functions of the human frontal lobe, which is the last brain area to mature, and—unfortunately—one of the first to regress in the face of developing dementia.

Key EF Elements

a) Inhibitory Control
    i. Impulse control, self-discipline, and attention
b) Working Memory
    i. Holding information in mind long enough to consider and make a reasoned decision

c) Cognitive Flexibility
    i. Creative problem solving, multitasking, having an exit strategy when things are failing.

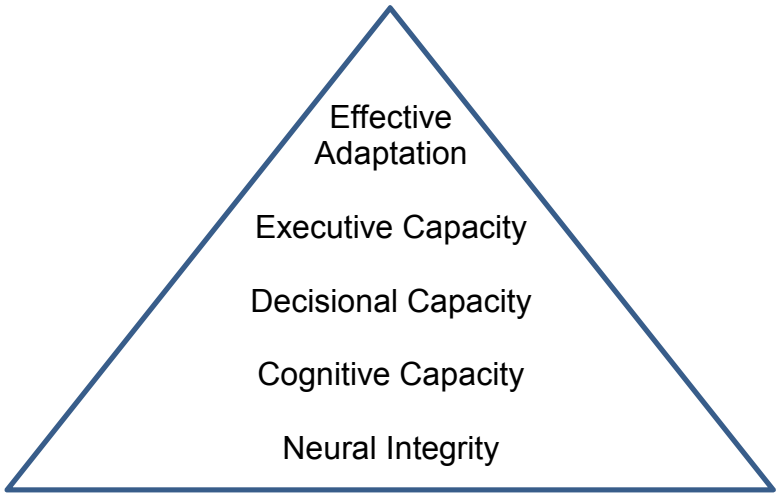
7. The Notion of Executive Capacity: The ability to execute one's decisions

Based on some core components:

a) Recognizing a problem,
b) Having a plan,
c) Adapting the plan in response to changing or unexpected circumstances, or plan to manage impending failure,
d) Inhibiting inappropriate or contradictory behaviors,
e) Delegating to appropriate surrogates when one cannot carry out needed actions.

A person can make basic decisions, but lack the executive capacity to translate these decisions into the proper actions and the proper time, lose "set" and become distracted before carrying them out, or fail to exercise foresight necessary to estimate future consequences of immediate decisions.

Observation of human behavior provides relatively obvious evidence that people can seem to know and voice the right ideas and decisions, yet seem grossly incapable of carrying these out. This suggests that decisional capacity is only one chain in the link of effective functioning. It is subserved by basic neural integrity supporting necessary cognitive functions that support understanding, appreciation, reasoning, and communication. However, decisional capacity then serves executive capacity, which in turn serves successful adaptation to one's environment.



EF turns out to be very hard to directly measure. Executive functions are the product of coordinated activity throughout the brain, and are not held exclusively within regions of the frontal lobe. A variety of mental tests seem to tap executive abilities, but there seems to be no "pure" measure of the domain. Currently, assessing these skills can only be done through testing basic mental skills which tend to rely heavily on executive

processes for success. While testing technology continues to advance via new discoveries in cognitive neuroscience, this is likely the best we will ever be able to do.

8. Do Neuropsychological Tests Predict Functional Capacity?

NP test instruments do not purport to assess competency as a whole, but rather sample the cognitive functions serving as the foundation for effective living and decision making. Although capacity is not perfectly predicted by NP tests, there is a clear relationship between iADL competence and the presence, type, and extent of cognitive impairment. The MMSE (Karlawish et al, 2005) demonstrates this, as do tests specifically addressing semantic memory and executive function (Marson et al, 1995; Marson et al, 1996; Cahn-Weiner et al, 2007). A clear and positive association between competence and disease awareness has also been reported (Cairns et al, 2005). This not surprising, as the capacity to act requires some degree of awareness.

9. Some Dilemmas in Real-World Assessment of the AIP

We have the technology, but a thorough assessment of each area requires a complex and lengthy battery. Clinical examinations of often frail elderly under less-than-ideal conditions makes this nearly impossible. Clinical discretion is required when deciding on an approach to assessment, including which domains are assessed and how. Essentially, every job is a custom job. The scientific task remains to identify what are the most important, critical, and/or predictive cognitive functions necessary to decision-making, and then how to measure these accurately across any potential AIP being examined.

10. Impact of Injury and Disease on Decisional Capacity

Abilities across the full range of cognitive, decisional, and executive functions are impacted by normal aging, developmental delays, head injuries, dementia, and other neuropsychiatric disorders.

a) Decisions are a product of mental activity.
b) Most actions are regulated by mental activity.
c) Illnesses impacting mental activity alter decision making ability.
d) Dementia, developmental disorders, and many neuropsychiatric disorders--by definition--alters mental ability and behavior.

What is Dementia?

A general term describing deficits in memory and at least one other area of mental functioning. Deficits must be adversely impacting functioning. Dementia refers to a syndrome of symptoms, not to the cause of the symptoms.

Like “capacity to do _____,” dementia always refers to another disease process, or “dementia due to _____.” Dementing syndromes can be temporary, permanent but

stable, or progressive. Neurodevelopmental disorders such as intellectual disability or autism generally do not fall under the category of dementia. Dementia is reserved for acquired deficits occurring after a period of normal functioning, often due to traumatic injury (e.g., TBI) or brain-altering disease (e.g., Alzheimer's) processes.

Common Dementias

a) Alzheimer's disease
b) Cerebrovascular disease (stroke, multi-infarct)
c) Lewy-Body disease
d) Frontotemporal lobar degeneration (FTD)
e) Parkinson's disease
f) Traumatic brain injury
g) HIV/AIDS
h) Various encephalopathies (200+)
i) Some chronic psychiatric disorders

The Problem of *Anosognosia (ay-no-sog-NO-zha)*

Lack of self-awareness, and specifically refers to failure to appreciate one's symptoms and deficits. Cortical dementias, some types of acquired brain injury, and some chronic psychiatric disorders are commonly associated with failure to appreciate symptoms and functional deficits. This is a particularly pernicious symptom in terms of iADL failure and source of treatment/service refusal. While sometimes based in psychological denial, most often considered due to dysfunction in portions of the brain governing self-awareness. Self-awareness and personal insight is an EF process.

Capacity for decision making ultimately sources back to basic mental abilities to recognize, remember, comprehend, communicate, apply reasoned judgment, select, and initiate and sustain action. These abilities depend on underlying neural structures. Dementing illnesses render neural structures dysfunctional, progressively impairing these basic abilities and rendering the individual increasingly vulnerable and confused.

Damage to the frontal lobes routinely produces striking deficits in one or more of the above-mentioned areas. A person with executive deficit should necessarily presume to have brain damage specifically in frontal regions. Many "frontal lobe tests" have not proven successful in reliably diagnosing frontal lobe injury, suggesting that EF is largely a whole brain activity.

Cognitive and decision making ability and environmental demand interact to produce behavior. A person with clear executive deficits may have few obvious problems if his or her environment is routine and places little demand on them. Conversely, even minor deficits of this sort can be incapacitating in the face of complex decisions, demands, and social pressures.

11. Case Studies

12. Summary Points

A. There is no neuropsychological “capacimeter.” We do the best we can with the technology available, and every job should be considered a custom job. If you see the same person giving the same battery of tests in every situation, something’s usually wrong.

B. There are published tests of medical and financial competency. However, these are rarely published in commercial form, are mostly used in research and with little testamentary backing, and almost always rely on others filling out a rating scale. The informants in our cases are rarely objective in their opinions.

C. NP test instruments do not purport to assess competency as a whole, but rather sample the cognitive functions serving as the foundation for effective action, most of which are executive in nature.

D. Although capacity is not perfectly predicted by NP tests, there is a clear relationship between iADL competence and the presence, type, and extent of cognitive impairment.

E. The MMSE (Karlawish et al, 2005) demonstrates this, as do tests specifically addressing memory and executive function (Marson et al, 1995; Marson et al, 1996; Cahn-Weiner et al, 2007).

F. A clear and positive association between iADL competence and disease awareness (insight) has also been reported (Cairns et al, 2005).

G. You have to find someone with enough experience in medicolegal cases and testing expertise to make sure the data and report you are getting is credible, useful, and able to stand up to court scrutiny. Most psychologists actually don’t know how to conduct these assessments. The term “neuropsychologist” is rather loose, and most strictly describes persons holding board certification by one of the two primary boards in the U.S. (ABN or ABCN). Otherwise, professionals must be able to demonstrate they have the academic training and at least two years of supervised experience doing these assessments.

H. Assessment of premorbid abilities is a key component to any exam where decline in functioning is being considered. There are established methods for estimating this. Also, degree of effort must be considered.

I. While really bad NP performances are almost always a clear threat to iADLs, occasionally we assess people with basically normal cognitive profiles who clearly cannot or do not make good choices. NP scores are just one piece of the puzzle, and established patterns of behavior continue to be the best predictor of the future.

J. NP testing requires extensive training, judgment, flexibility, adaptability, and broad repertoire of evaluations tools to meaningfully assess the AIP while still maintaining technical and scientific rigor to produce valid and helpful results. Don't do NP testing at home, kids.

K. The use of trained technicians (psychometrists) to administer tests under direction of the neuropsychologist is common and professionally sanctioned. The neuropsychologist is responsible for test data integrity, and providing assurance the technician was competent to give the tests in the same manner as the neuropsychologist would have done, themselves.

L. Neuropsychological tests are considered "secured" tests and rely on examinee naiveté to the content and tasks within the measure. Professional ethics and publisher requirements prevent us from letting you know just exactly what's in a test. We have to keep secrets for them to work.

M. Psychologists tend to be wary of lawyers, who have been known to "advocate" for their clients by coaching them prior to testing with the actual tests in question. This hurts our feelings, and invalidates the results.

N. Third-party observation of formal testing is not allowed by professional ethics.

    1. This is not how the tests were meant to be given, nor on the basis of how they were normed. Giving a test as close to the same manner and conditions as they were developed helps ensure integrity and validity.

    2. Research shows that observers actually change the examinee's scores.

    3. Observation violates tests security by exposing the test content to nonprofessional parties.

    4. This rule includes audio and video recording of testing.

    5. This rule also applies to providing you (the non-NP public) with copies of testing materials used in the assessment. Neuropsychologists are ethically accountable for making sure test data are not used to misrepresent and harm an examinee via misinterpretation or misuse by others. We can only provide copies of these materials to other neuropsychologists, who—presumably—are capable of interpreting them and keeping them secure.

O. Experts in data-driven assessment, neuropsychologists are uniquely capable of contributing to the differential diagnosis and quantification of cognitive impairment and impact on functional behavior. A physician/psychologist diagnosis of "dementia" or "memory loss" alone cannot be considered evidence of decisional incapacity.

P. Neuropsychological data can be vital in resolving discrepancies of self-reported versus observed functioning, and/or disagreements between parties as to the presence, nature, and severity of presumed cognitive deficiency. The neuropsychological exam is thorough and can lend overwhelming credibility to the case at hand, especially in contested cases. Clinical and legal professionals should be vigilant in finding ways to enhance capacity if possible, and thus eliminate the need for or limit the scope of the guardianship.

Q. Bioethical principles emphasize both respect for individual autonomy and beneficence. Many guardianship or other cases where basic rights may be restricted involve conflict between these basic principles. Guardianships are intensely intrusive legal interventions, and are never to be taken lightly. However, failing to act beneficently when needed constitutes a form of abandonment. Constraints on autonomy must be supported by strong clinical evidence rather than conjecture, and considered only when behavioral and neuropsychological evidence of incapacity is clear and convincing.

Appendix

Information Regarding Common Neuropsychological Tests Used in Geriatric Capacity Evaluations

This is not a comprehensive list. Neuropsychologists must select a test battery that best fits the examinee, and are free to choose from hundreds of test options to accomplish the assessment task as long as these tests are accepted based on scientific validity and reliable, and there are appropriate normative bases on which to draw accurate interpretations. This is important in geriatric assessment, as some examiners may give common tests that have no norms for persons of highly advanced age (e.g., giving a test to a 93-year-old when the test's norms only go to age 85), or use tests that do not accommodate sensory-motor deficits common to the frail elderly (e.g., reading aloud a word list to a nearly deaf examinee, or asking a visually-impaired, hemiplegic, or tremulous person to accurately copy a geometric design using pencil and paper).

Allen Cognitive Level Screening: The ACLS is a series of assessment tools employed primarily by occupational therapists working within skilled nursing facilities. The screening tools are designed to provide an initial estimate of cognitive function and validated by further observations of performance. There are six levels ranging from Coma (0.8) to "Normal" (6.0). Each level has three components: Attention, Motor Control, and Verbal Performance. The measure is commonly used when anticipated discharge to a less supervised or restrictive environment, and can assist in judging appropriate levels of care needs following discharge. The ACLS aids persons with cognitive disability and their caregivers about what care level will likely be needed.

Animal Naming Test: A simple measure of semantic verbal fluency relying on mental speed, strategic organization and retrieval of previously learned material, and motor output. The examinee is given one minute to name as many animals as possible. Such tests obviously have a strong verbal component, but also rely heavily on executive functions related to working memory, mental processing speed, organization, and effortful self-initiation.

Boston Naming Test: The BNT is a 60-item measure of language functioning requiring the examinee to verbally name a series of drawings of common objects. The test has traditionally been considered to provide a measure of word retrieval ability, sometimes referred to as wording finding or confrontational naming. Recognizing and naming objects requires complex neural coordination involving mental processes of visual recognition, organizing and accessing previously stored knowledge, and oral output of the results. The BNT correlates highly with measures of overall verbal intellect. Poor performance on the BNT is observed in many clinical conditions, including various left hemispheric injuries, epilepsy, oxygen deprivation, subcortical disease, and white matter infarcts in the brainstem. Depression and psychosis can also reduce BNT performance. Since object naming difficulties ("anomia") tend to be more pronounced in Alzheimer's disease compared to other forms of dementia, BNT performance is often

considered a sensitive indicator of the condition. Poor BNT performance in younger Alzheimer's patients tends to predict more rapid cognitive decline. Since normal BNT performance can be seen in some highly verbal patients with early forms of dementia, average scores do not necessarily rule out a diagnosis of dementia. Memory scores still tend to be more predictive that the BNT when considering which patients will later convert to the full Alzheimer's syndrome.

California Verbal Learning Test: The CVLT-II evaluates multi-trial learning and long-term recall for verbal information. As with many similar learning tests (e.g., the Rey Auditory Verbal Learning Test), the examinee is presented with list of words that may be organized into four categories to facilitate learning and delayed recall. The test-taker is asked to repeat back as many words as possible after hearing the list. This process is repeated across five learning trials. A different list of words is then read, followed by immediate and delayed recall trials of the first list. The CVLT-II collects information about rate of learning, learning strategy, short- and long-term retention and retrieval, recall errors, interference effects, and ability to profit from learning cues. Additional trials include an interference list, short-delay free and cued recall, long-delay free, recognition, and forced-choice recall.

Category Test: The CT measures the examinee's ability to think abstractly, formulate and test theories, remain flexible in the face of complex and novel problems, and capacity to learn from experience. The CT has proven highly sensitive to many types of brain-related injuries and illnesses, and taps skills of both memory and general intelligence. Although originally designed to be a measure of frontal lobe functioning, impaired CT performance shows no consistent relation to a specific location in the brain. Rather, the CT recruits multiple brain areas involving spatial reasoning, attention, learning, and memory, and samples the examinee's ability to recognize patterns, experiment and select best solutions to a problem, and to sustain good problem solving skills. The test requires the examinee to view a series of objects and patterns. The examinee is told that something about the object will remind them of the numbers 1, 2, 3, or 4. For example, an image of two circles may lead the examinee to determine the correct response would be to select the number "2." The same selection principle runs throughout each of the seven subtests of the measure. Once the choice is selected, the examinee is given immediate feedback as to whether they were right or wrong. By using this information, the examinee is instructed to get as many correct as possible. Over the course of 208 trials of varying complexity, the examinee is required to discern which number constitutes the correct choice by both deducing the underlying principle through trial and error, and hold in memory and maintain that response style despite novelty and potential confusion.

Controlled Oral Word Association Test: The COWAT is a simple measure of verbal fluency relying on mental speed, strategic organization and retrieval of previously learned material, and motor output. Measure of these abilities often involve either *semantic* fluency (naming of categories of objects such as foods, animals, clothing, etc.), or *phonemic* fluency (naming words by letter of the alphabet). The examinee is usually given one minute to name as many items as possible. Such tests obviously

have a strong verbal component, but also rely heavily on working memory, mental processing speed, and effortful self-initiation.

Semantic fluency (see Animal Naming Test, above) and phonemic fluency tasks are commonly used in neuropsychological examinations as methods of assessing processes important in speech production. Although conceptually similar, scores on these two tasks are only moderately correlated, indicating that they tend to measure somewhat different underlying brain functions. Brain imaging studies confirm that semantic fluency recruits areas within left temporal cortex, while phonemic fluency places more demands on subcortical brain regions. The cerebellum is also involved in overall fluency ability. Differences in phonemic and semantic fluency have been extensively studied in patients with dementia. In general, patients with Alzheimer's tend to show more pronounced impairment in semantic relative to better phonemic fluency.

Dementia Rating Scale: The DRS-2 assesses five broad areas of higher cognitive functioning including attention, executive functioning, visual-motor coordination, abstract reasoning, and memory. The examinee's performance in each area is compared with a normative sample of healthy peers in the same age cohort, and includes normative data for individuals from 56 to 105 years of age. The DRS-2 also provide a global summary index of functioning. There are 144 maximum available points on the DRS-2.

Draw-a-Clock Test: Sometimes referred to as the Clock-Drawing Test, this task has a long history of use as a screening tool for cognitive impairment in the elderly. Traditional administration of the task requires the examinee to reproduce the round face of a clock, correctly place each numeral, and to place the hands to read a defined time (i.e., ten minutes past eleven). The task typical places few demands on cognitively and visually intact individuals with adequate pencil manipulation capacity. The test requires basic skills in eye-hand coordination, but also places demands on executive functions related to planning, organization, problem-solving, and execution of instructions. Since executive cognitive dysfunction can precede the memory disturbances of dementia, the test appears useful in identifying people with executive dysfunction who may have an otherwise normal MMSE scores. Poor clock drawing is associated with increased risk of mortality from any cause, and holds value as a brief screening tool for moderate/severe cognitive impairment in the elderly despite being relatively poor at detecting milder cognitive impairment.

Geriatric Depression Scale: The GDS is a 30-item self-report inventory of various emotional, social, and physical symptoms commonly associated with depression in elderly individuals. Symptomatic questions (e.g., "*Do you often feel like crying*?") are answered "yes" or "no" by the examinee, making the measure simple enough to be used with ill and/or cognitively impaired individuals. Each symptom endorsed is assigned one point toward the total GDS score. Traditional cutting scores use a range of 0-9 as "normal", 10-19 as "mildly depressed", and 20-30 as "severely depressed."

Independent Living Scales: The ILS is designed to provide a reliable and standardized approach for identifying areas of competence in instrumental activities of daily living in adults demonstrating decline in cognitive functioning.

The measure is comprised of five scales, including:

- Memory/Orientation (basic orientation to date, recalling their address and phone number, recalling a shopping list and date of doctor appointment, etc.),
- Managing Money (counting change, factual information about finances, reading bills and writing checks, balancing accounts, calculating medical co-payments, understanding wills and insurance, etc.),
- Managing Home and Transportation (dealing with home repairs and problems, using public transportation and taxis, addressing envelopes, finding and dialing phone numbers, etc.),
- Health and Safety (summoning emergency personnel, dealing with unexpected visitors, safety precautions when going out, crossing streets, managing minor injuries, personal hygiene, taking medication, etc.), and
- Social Adjustment (basic mood functioning and socialization opportunities).

In addition to a summary index of the above scores, two additional measures are calculated. The ILS Performance/Information index assesses previously learned facts, skills, and knowledge to ensure correct performance. Such issues would include knowing by what date taxes are due, performing calculations, writing checks, addressing an envelope, finding and dialing phone numbers, etc. Performance of these items is based mostly on life experience and common knowledge regarding learned facts and routine procedures. Persons with cognitive limitations due to developmental delay or brain injury may do reasonably well on these items if they have had the opportunity to learn, practice, and master them in the past. Once mastered (e.g., the proper way to fill out a check), these skills tend to be retained despite brain injury.

Conversely, the ILS Problem Solving index provides a measure of how well the individual reasons through and copes with unexpected problems and events. While the Performance/Information index measures capacity to apply previous knowledge to the adequate performance of common tasks, the Problem Solving index reflects the ability comprehend, appreciate, and apply common sense when confronted with novel problems. The performance-based results from the 68 ILS items are more objective and reliable than third-party observations or examinees' self-reports, especially when personal incentives, perceptual biases, and/or lack of symptom insight threaten the validity of self-report.

Montreal Cognitive Assessment: The MoCA is a 30-point cognitive screening measure similar in nature to a broad variety of similar mental status testing tools, including the Mini-Mental Status Examination, St. Louis University Mental Status Examination, etc. As with most screening measures of this type, the examinee is presented with various brief tasks involving orientation, memory, drawing, object naming, etc. Healthy persons rarely score below 26 on the measure. In contrast, persons with well-documented dementia typically achieve scores between 11 and 21. The MoCA is well-accepted in the clinical and scientific literature as a robust and sensitive screening tool for detecting cognitive impairment.

Premorbid Intellectual/Cognitive Functioning: This is not an actual test, but a necessary procedural element of almost all competent neuropsychological exams.

Neuropsychological testing provides a current "snapshot" of an individual's mental functioning, but does not reveal whether or not the test scores represent a change in abilities compared to how the person was functioning prior to the onset of an injury or suspected illness. A relevant example includes a person who has always had intellectual limitations yet been able to demonstrate decisional capacity. Current testing showing cognitive impairment would not be surprising, and should not necessarily be considered evidence in new problems or incapacity. On the other hand, new-found cognitive deficiencies in a person who had previously shown high functioning could be interpreted very differently as compelling signs change from previous functioning.

An individual's level of abilities held prior to injury or illness is commonly referred to as "pre-morbid" capacity. Estimation of premorbid cognitive capacity allows for a reasoned determination of whether or not current test performance likely represents changes from previous levels associated with recent brain damage.

Estimates of premorbid functioning are based on both logical and empirical methods. Demographic factors such as educational and occupational achievement, pre-injury diagnoses of mental deficiency or learning disability, and school/work performance records can provide logical inferences regarding ability.

Objective estimation methods involve looking at the examinee's current performance on measures that not only highly correlate with overall intelligence, but also tend to remain quite stable despite brain injury. For example, vocabulary and word recognition skills often remain intact despite moderate to severe neurologic injury. These skills are learned early in development, relate highly to global mental ability, and tend to be less vulnerable to neurologic disease or damage. Word knowledge and reading ability have traditionally been used to predict an individual's level of cognitive performance before becoming ill or injured. In addition to population-based norms, these estimates provide a personalized standard of performance upon which to compare current test findings.

Repeatable Battery for the Assessment of Neuropsychological Status: The RBANS is a brief but thorough assessment of cognitive functioning in adults ages 20-89. The measure provides sampling of higher cognitive functions such as immediate memory (List Learning and Story Memory), delayed memory (List Recall, List Recognition, Story Recall, and Figure Recall), visual-motor integration (Figure Copy and Line Orientation), language (Picture Naming and Semantic Fluency), and attention (Digit Span and Coding). Performance on each of these indices is combined to produce an RBANS Total Scale Score, which provides a global index of mental status. The overall battery length is less than 30 minutes in order to maximize patient cooperation and to minimize the effect of fatigue on performance. In addition, the RBANS has several parallel forms, allowing for measuring change in the examinee's mental status over time. In my experience, I have found this a reasonable test to use in younger (< 75) and higher-functioning examinees, but is not well suited to older, more frail, and sensory-challenged persons given test difficulty and strong reliance on visual and motor ability.

Rey Complex Figure Test: CFT requires the examinee to copy a complex geometric design using a paper and pencil. There are a maximum of 18 unique elements in the Rey design, with 36 possible points available. Each element is scored a 0, 1, or 2 based on objective criteria in terms of presence, precision, and correct placement. The measure primarily assesses visual-spatial and eye-hand coordination ability, but successful performance is also heavily based on executive functions required for organizational strategy, planning, effort, carefulness, and error correction. Individuals with posterior brain injuries tend to display distortions of the figure, while persons with more frontal injuries show planning difficulties that tend to compromise the overall integrity of the design (e.g., using a piecemeal, fragmented, impulsive, careless, perseverated, or overly-elaborated). The test can also detect deficits related to hemispatial neglect, such as selective omissions or distortion of elements in specific visual fields.

Short Blessed Test: The SBT is a 28-point test similar to the MMSE, but primarily assessing orientation, concentration, and short-term memory. It appears quite sensitive to early cognitive changes associated with Alzheimer's disease. In contrast to the MMSE, only errors are counted. Thus, low scores are better. Scores 0–4 are considered normal, 5-10 represents mild problems deserving further assessment, and scores over 10 suggesting a degree of impairment consistent with dementia and a clear need for additional testing.

Saint Louis University Mental Status: SLUMS is a mental status screening tool. Similar to the traditional Folstein Mini-Mental Status Examination, the SLUMS is a 30-point measure assessing several areas of cognitive performance similar to the MMSE, but supplements with additional measures of attention, calculation, recall, digit span, clock-drawing, and immediate recall. The SLUMS appears to be more effective that the MMSE in diagnosing mild neurocognitive disorder. Scores between 27 and 30 represent normal functioning among educated examinees. Scores between 21 and 26 indicate mild cognitive impairment, and scores below 21 suggest dementia. Persons with less than a high school education are given slight lower cutting scores.

Test Your Memory: TYM test is a self-completed cognitive screening measure consisting of 10 tasks, including information recall, naming of items, clock drawing, and performing mental calculations. There are 50 possible points on the measure. Developed in England, some of the items tend to be culturally specific (i.e., "Who is the Prime Minister?"). Neurologically normal persons typically perform near-perfectly on the test (47 or greater), although normal elderly examinees may score slightly lower. Persons with mild Alzheimer's disease produce an average score of 33. A suggested cut off of < 43 identifies Alzheimer's disease with 93% accuracy.

Texas Functional Living Scale: The TFLS is a brief, performance-based screening instrument designed to assess independence in activities of daily living as well as identify the level of care an individual requires. The test has demonstrated good ecological validity, indicating that scores on the various TFLS measures correspond well to actual behavior in the natural environment. The TFLS assesses the individual's

abilities in four functional domains, including time (the ability to use clocks and calendars), money and calculation (ability to count money and write checks), communication (ability to make a snack and use phones and phonebooks), and memory (ability to remember simple information and to take medications). The TFLS is particularly useful in individuals demonstrating dementia, as it focuses primarily on daily living skills likely to be adversely impacted by cognitive decline.

Tower of London: TOL_{DX} provides a measure of executive skills associated with higher-order problem solving ability. The measure presents a familiar "brain teaser" task where the examinee must rearrange three colored balls from their initial position on three upright and different-length pegs to match a predetermined pattern. The examinee is instructed to do this in as few moves as possible, with additional rules of only moving one ball at a time and not stacking more balls than the peg can physically hold. The patterns and moves required become increasingly complex throughout the 10 trials of the measure. The examinee is scored based on the number of moves required to complete the task, time to completion, and rule violations made in the process.

Trail Making Test: The two-part Trail Making Test is used as a measure of visual tracking and processing speed, as well as executive skills relating to divided attention and mental flexibility. Initially an element of 1940s-era military entrance exams, the measure remains very popular and demonstrates robust sensitivity to many forms of brain injury. Part A of the measure is essentially a “connect the dots” task requiring the examinee to use a pencil to connect in proper order 25 encircled numbers randomly arranged on a page. This task requires good visual tracking and motor quickness. Part B involves connecting a series of 25 encircled numbers and letters in alternating numerical and alphabetical order (i.e., 1-A, 2-B, 3-C, etc.). This task also relies on the visual search and speed elements of Part A, but adds the element of divided attention and efficiently switching from one mental “set” to another. Part B taps these types of executive skills, correlating highly with other measures of focused mental processing speed and cognitive flexibility. The Trail Making Test is sensitive to many types of neurocognitive disorders. Trail Making B performance also shows good predictive validity in vocational and everyday functioning, with better performances usually associated with better work outcomes, benefit from rehabilitation efforts, independent self-care, as well as driving safety.

Wechsler Adult Intelligence Scale: Currently in the 4th edition, the WAIS is a standardized measure of intellectual capacity assessing four broad areas of intellectual functioning across 10 different core subtests. Performances across these scales are compared to a normative sample of healthy, same-age adults. The examinee’s performance on all the measures is then combined to form a Full Scale IQ, which serves as a composite measure of intellectual capacity and aptitude for learning.

The WAIS is a battery of up to 15 different subtests measuring four distinct areas of mental functioning. These areas include:

Verbal Comprehension: This index is a measure of general verbal skills, such as verbal fluency, ability to understand and use verbal reasoning, and verbal

knowledge. It is based on both formal and informal educational opportunities, and requires understanding words, drawing conceptual similarities, and knowledge of general principles and social situations.

Perceptual Reasoning: This index is a measure of non-verbal and in-the-moment reasoning. It assesses ability to examine a problem, draw upon visual-motor and visual-spatial skills, organize thoughts, create solutions, and then test them. It can also tap preferences for visual information, comfort with novel and unexpected situations, or a preference to learn by doing.

Working Memory: The Working Memory Index assesses ability to memorize new information, hold it in short-term memory, concentrate, and manipulate that information to produce some result or aid in reasoning processes. It is important in higher-order thinking, learning, and achievement. It is important for cognitive flexibility and planning ability, as well as learning and ability to self-monitor.

Processing Speed: Processing Speed refers to the speed at which cognitive processes can be carried out. This index assesses skills related to focusing attention, sustaining effort, and quick visual scanning. It requires persistence and planning ability, but is sensitive to motivation, alertness, and difficulty working under a time pressure.

The WAIS is rarely given in its entirety in capacity evaluations. It is very long and demanding. Specific subtests may be extracted for use, commonly the Similarities, Matrix Reasoning, Comprehension, Vocabulary, and Block Design subtests. These subtests provide a good screen of comprehension and reasoning abilities without overtaxing the examinee. The WAIS cannot be used for individuals over the age of 90.

Wechsler Memory Scale: The WMS (currently in the 4th edition) is a comprehensive battery of learning and memory abilities in both verbal and visual domains. Ten primary subtests that comprise the full WMS-IV battery, providing assessment of ability to focus attention and both learn and retain new information. Five primary summary scores describe the examinee's abilities in 1) auditory memory (learning verbally-presented information from stories and word lists), 2) visual memory (learning visually-presented information from designs and drawings), and 3) visual working memory (focusing attention and immediate recall of visual information). Summary scores are also provided for the examinee's general immediate and delayed memory abilities.

Like the WAIS, the WMS-IV is also very long, demanding, and may be "overkill" in devoted some much time to just one aspect of cognition. Specific subtests may be extracted for use, commonly the Logical Memory and/or Visual Reproduction subtests. The Logical Memory subtest is most commonly used. The test requires the examinee to listen to several short stories read aloud, and then to immediately restate as many details from the stories as they can remember. Each story contains 25 unique pieces of information, and the examinee's score is the total units of information repeated. After an approximately 25-30 minute delay, the examinee is asked to spontaneously recall as much information as possible from both stories. This memory test taps recall of verbal

information, which is a cognitive ability important to the communication and retention of various forms of verbal agreements and instructions, conversations with others, financial information, and facts gained from media and written material.

Wisconsin Card Sorting Test: The WCST and a more recent modified version is a widely-used measure of executive functioning relating to cognitive flexibility, problem solving, benefiting from feedback to guide behavior, and altering behavior once it becomes no longer effective. Examinees are asked to match a series of cards containing simple figures (circles, triangles, etc.) that vary in color, shape, and number of shapes to four "key cards."

The test-taker is not told what constitutes the correct sorting principle, and thus must discover this using trial and error with feedback each time as to whether their attempts are correct or incorrect. Once the examinee discovers and masters the sorting principle for ten consecutive sorts, the sorting principle is changed without their knowledge. This requires the examinee to detect a change in procedure and recognize the need to alter their previous strategy and explore other options. The process is repeated for up to six different principles across the 128 items of the full test, or 48 items on the modified version; the latter of which I consider much more humane to use with older populations.

Numerous indices are produced from the measure, including number of categories achieved, rates of error, and degree of perseveration observed (continuing to use a sorting principle despite its obvious ineffectiveness). Many of these behavioral features are displayed by individuals with frontal lobe dysfunction associated with neurologic disease or injury, and with certain psychiatric disorders known to impact frontal brain areas (i.e., psychosis). While the WCST appears reasonably sensitive to frontal lobe dysfunction, its modest reliability in this respect suggests it is essentially a broad-spectrum test that can be influenced by many types of brain injury. The measure also has modest validity in predicting success in activities of daily living.