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Cognitive profiling in traumatic head and brain injury: Recommendations for civil and criminal trials

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SUMMARY

AUTHORS' CONTRIBUTION: (A) Study Design · **(B)** Data Collection. **(C)** Statistical Analysis · **(D)** Data Interpretation · **(E)** Manuscript Preparation · **(F)** Literature Search · **(G)** Funds Collection

Cognitive profiling of litigants/offenders in UK civil and criminal cases who have traumatic head or brain injury often receive inconsistent approaches to their assessment processes. Typically, in clinical neuropsychology, expert witness practitioners and clinical researchers/assessors select standardised tests that will form part of their assessment strategy. Despite selection of tests being based on the client's known clinical presentation, tests may also be selected based on the clinician's experience in the field. Although scientifically-led, it is impossible to rule out the influence of the expert's training and experience bias. Keeping up-to-date with current approaches and continuing professional development is recommended.

Keywords: Assessment; Clinical presentation; Civil; Criminal; Diagnosis; Expert witness testimony; Neurological damage; Neuropsychological assessment; Wechsler adult intelligence scales

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DESCRIPTION

Cognitive profiling of litigants in United Kingdom civil cases and alleged offenders in criminal trials who have traumatic head or brain injury often receive inconsistent approaches to their clinical assessment processes. Typically, in clinical neuropsychology, expert witness practitioners and clinical researchers/assessors will select standardised tests in addition to a structured or semi-structured clinical interview that will form part of their assessment battery strategy. Despite selection of tests being based on the client's known clinical condition or symptoms, tests may also be selected based on the clinician's expertise and experience in the field providing that they are appropriate to the case in hand. Although scientifically-led, it is impossible to rule out the influence of the expert's training and experience bias as with many other clinical assessments by other professionals.

Cognitive profiling of traumatic head and brain injury

Neuropsychology is a hybrid science of brain-behaviour relationships and draws on expertise from psychology, psychiatry, and neurology [1]. As stated, Barth, et al. [2], clinical neuropsychology uses "psychological, neurological, behavioral, and physiological techniques and tests to evaluate the patients' neurocognitive, behavioral, and emotional strengths and weaknesses and their relationship to normal and abnormal central nervous system functioning." The client's history, presentation, medical findings, and neuropsychological test scores, all contribute to the clinical neuropsychologist's picture of the client's ability and disability in relation to the anatomical damage. Cognition, behaviour and emotion are correlated with brain anatomy from brain scans (Computed Tomography or Magnetic Resonance Imagery or similar) and function derived from neuropsychological testing [3].

Deterioration in cognitive functioning is one of the signs of a dementia-process and can lead from a traumatic head or brain injury [4]. In particular, cognitive deterioration can lead to the onset of vascular dementia when small vessel disease and stroke is also involved [5-9] or as the result of mini strokes such as Transient Ischaemic Attacks (TIAs). Selecting suitable neuropsychological tests to assess the presenting symptoms is dependent upon the expert's specialist training in, for example, neurorehabilitation or trauma, and their experience over time. Working in different medical settings can contribute positively to the expert's experience such as in the legal (courts) setting, trauma and emergency rooms, rehabilitation, follow-up in outpatient facilities,

community out-reach services.

Neuropsychological assessment recommendations

It is generally agreed that head and brain injury can lead to disorientation and anterograde memory loss [10,11]. Post-traumatic Amnesia periods can be calculated and may be predictive of long-term recovery [12,13]. Therefore, orientation and memory testing are essential parts to any assessment of memory loss and head or brain injury [14]. Thompson [4] recommends the following for testing patients with global dysfunction such as those who are suspected of suffering from carbon monoxide poisoning, traumatic head and brain injury:

(i) Orientation: Asking specific questions that taps into the client's knowledge and awareness of their current location, home address, personal details (date of birth), names of people they should know including famous figures (e.g., premier, president) and members of their own family.

(ii) Logical memory (Auditory verbal memory): Using the Wechsler Memory Scale [15], the client's memory is tested by reading out loud two fictitious stories and recording the responses of the client. This assesses the patient's ability to remember information and again with a delay of about 20 minutes. Responses can be compared to comparative age-related norms drawn from the general population.

(iii) Current intelligence quotient: Using the Wechsler Adult Intelligence Scale or WAIS [15], the client is assessed and compared with their age-related norms across a number of domains. Intelligence Quotient (IQ) can also be compared with an estimate of their premorbid IQ to see if there has been a change and is attributable to the injury such as a head or brain injury. There are several sub-tests of the WAIS which include measures related to the derivation of the Verbal IQ score (Information; Digit Span; Vocabulary; Arithmetic; Comprehension; Similarities) and those that are related to the derivation of the Performance IQ (Picture Completion, Picture Arrangement, Block Design; Object Assembly; and Digit Symbol). All of these raw scores in turn contribute to the overall Full-Scale IQ which is familiar to the majority of the general population and is often quoted with over-importance. It is common and acceptable to "pro-rate" for specific items such as Vocabulary and Object Assembly sub-tests rather than administering the entire set if there is sufficient evidence to suggest that the client is not particularly compromised in those domains. See[16-18] for discussion on pro-rating the versions of the WAIS.

(iv) Estimate of Pre-Morbid intelligence quotient using the National Adult Reading, Test Nelson, et al. [19], an estimate of the client's premorbid IQ is obtained across verbal, performance and full-scale parameters which can then be compared with current values to discern any significant changes because of insult such as head or brain injury, if appropriately attributable, and compared with normative values.

(v) Verbal Fluency: Controlled Oral Word Association Test is an assessment of verbal fluency and assesses the client's ability to produce words for each of three letters supplied and compared to normative age-related values. Variations of this test include the 'Animals Naming Test' which requires the client to name types of animals each beginning with the letters of the alphabet provided, usually F, A and S, which represent the frequency of words beginning with those letters in the English alphabet. This test is only suitable for those clients whose first language is English or if they are sufficiently proficient or fluent in English.

(vi) Anxiety and depression: Using the well-known Hospital Anxiety and Depression Scale [20], the client is assessed on a number of statements that attempts to describe the client's mood over categories that are considered to demonstrate levels of anxiety and depression.

(vii) Test of memory malingering: This is a memory, recall and retention test that is considered to identify both malingering performances and degree of effort in tests [21]. It is particularly useful in identifying those clients who may be in denial, or who are tyring to exaggerate their responses for financial gain (such as legal compensation) or for the achievement of other psychological gains.

(viii) Trail making test: Trail making test is a psychomotor task that tests information processing ability and visual-motor ability. It has part A, a relatively simple task, followed by part B which is a more complex task. Comparative age-related norms are available [21].

(ix) Clinical interview: This is a skilful tool that can sometimes reveal much more than simple testing paradigms. It is important not to use leading questions and to explore the use of both "open" and "closed" questioning dependent upon the type of information to be obtained. The clinical interview may also seek to obtain important legal answers or to explore the mental state of the person being assessed.

Common misconceptions

There are several common misconceptions in using neuropsychological and psychometric tests. The latter are usually regarded as tests that aim to provide an overall measurement of intelligence or 'IQ' and have limited applicability as they test people on specific measures of ability and are often not transferable to other tasks, situations or cultural environments. An example of a test that measures IQ and is particularly useful for people with limited verbal ability such as intellectual disability, is the Raven Coloured Progressive Matrices [22,23] which should be used with caution. This test has often been over-used or the results are inappropriately interpreted when the person being assessed may be able to participate in more demanding tests or tests that are more appropriately sensitive to the medical condition observed or known for the specific use in patients with focal brain damage and intellectual impairment [24]. Neuropsychological tests, on the other hand, aim to report on the functions

and dysfunctions of the brain, and with the use of brain scanning techniques, behavioural observations and clinical interviews and background history can be highly correlated to brain anatomy and brain damage.

The Wechsler Adult Intelligence Scale (WAIS) was developed by Wechsler [15] in the 1960s with various short forms being created [25]. The WAIS has undergone several modifications: Sturmey, et al [26] (1993) for a discussion of the WAIS-R published in 1981; Silva [27] (2008) for WAIS-III published in 2008; and Canivez, et al. [28] (2010) for WAIS-IV published in 2010. Modifications make it impossible to compare earlier versions with later versions because sub-tests have been omitted, added or their content changed. For example, WAIS-III has three new subtests added to the previous WAIS-R: Matrix Reasoning, Symbol Search, Letter-Number Sequencing, and also changes to Picture Completion, Vocabulary, Similarities, Block Design, Arithmetic, Digit Span, Information, Picture Arrangement, Comprehension, Object Assembly.

The WAIS-IV has three new sub-tests: Visual Puzzles, Figure Weights, Cancellation, and has omitted the sub-tests: Picture Arrangement and Object Assembly. Chronologically newer tests such as the latest variations of the WAIS are not necessarily better tests nor are they necessarily more comprehensive or clinically more useful or appropriate. Caution should be made when selecting newer tests that may serve as commercial opportunity rather than due to progress in clinical research and may have been derived from their testing in culturally different sample populations. (Duggan, et al. [29] for a discussion on cultural norms for the WAIS-IV). Some opponents of this view, i.e., those who view that progress is seen in newer versions of the tests, refer to the 'Flynn Effect' [30]. This refers to the suggested rise in IQ scores over time resulting in norms obsolescence. Although accepted by some researchers, most approaches to estimating IQ have relied upon "scorecard" approaches that make estimates of its magnitude and error of measurement controversial and prevent determination of factors that moderate the Flynn Effect across different IQ tests [31].

Studies in 10 European countries including Denmark, Norway and the United Kingdom have shown the Flynn Effect may have ended or a 'Reverse Flynn Effect' with a decrease in average IQ scores [31]. Conclusions about the Flynn Effect are that either some countries are approaching the limits of cognitive plasticity, are slowing in their progress or that societal structures have not yet been optimised to improve cognitive abilities in midlife and beyond, or a combination of these interpretations. Therefore, stating overall IQs is less useful than comparable age-related norms for individual sub-tests although showing potential discrepancy between estimated premorbid levels and current levels following trauma can be informative of how specific trauma may have affected an individual's change in cognitive abilities over time. Importantly, representing an individual's cognitive profile over several domain-related sub-tests is probably more useful for representing ability and disability especially for civil and criminal matters.

RECOMMENDATIONS

There are considerable benefits of the 1981 edition of the WAIS-R [32] which include the ability to pro-rate sub-tests whilst still deriving an overall IQ and using performance scores of individual sub-tests as a comparison with age-related scores derived from the sample population. It is commonly recognised and agreed that components of the 1987 version of the Wechsler Memory Scale – Revised (from which the logical memory component can be utilised [33], can be used as a stand-alone test with comparable age-related norms whereas the 2009 WMS-IV version [34] is designed to be used with the WAIS-IV version [35]. Probably the most helpful application of WAIS-R and WMS-R tests is to provide a cognitive profile of the subject rather than an overall IQ which is only a means of representing the client's overall score on items presented to him or her. Keeping up-to-date with current approaches and consensus among experts and continuing professional development that may be formal training or experience in trials, is recommended. Intuition and the expert's experience should not be overlooked and together with the scientist-practitioner approach, the expert should apply all of their skills and tools in the assessment process to avoid overlooking important clinical information about the client who presents before them [36,37].

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