

NEUROCOGNITIVE TESTS:

Hopkins Verbal Learning Test-Revised (HVLTR)

Trail Making Test (TMT)

Controlled Oral Word Association (COWA)

This summary was last revised 5 January 2011.

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Brief overview:

A Neurocognitive Chair is required in order to have a neurocognitive outcome on a protocol. The neuropsychologist should be consulted to help determine relevant issues of study design such as test selection, testing time points, outcome hypotheses, analytical approaches, etc; and, the Neurocognitive Chair is required in order to obtain permission to use the tests from the test publishing companies.

Neurocognitive tests are objective, standardized tests of neurologic/cognitive function. The HVLTR, TMT and COWA have been used in numerous RTOG studies to assess cognitive function. However, there are numerous other tests of cognitive function that vary in many characteristics including psychometric properties (reliability, validity etc) as well as the domains of cognition they assess. The study neuropsychologist should determine the optimal test(s) for each study. The HVLTR is a test of verbal learning and memory. The TMT measures information processing speed and executive function. The COWA is a measure of verbal fluency that requires expressive language and executive functions. A number of outcome variables can be obtained and evaluated from each of the tests. Published normative data is available for each test to standardize patient performance after adjusting for relevant demographic characteristics.

Psychometric properties/Validation:

Numerous published articles and books have described the psychometric properties and validity related evidence in support of these measures and their respective measurement of domains of cognitive function (for example ^{1, 2, 3, 4, 5}).

Normative data:

Numerous normative studies have been published for each test (for example ^{1, 2, 3, 4, 5}). The following normative studies have been used to evaluate test performances in several RTOG trials^{2, 4, 5}. The study neuropsychologist should determine the optimal published normative data to use for each study.

Clinically significant changes:

One way to determine clinically significant changes is to use a distribution-based statistical method such as the Reliable Change Index (RCI)⁶. The RCI is derived from the standard error of measurement of each test and represents the 90% confidence interval for the difference in raw score from baseline to the next assessment that would be expected if no real change occurred. Changes that exceed the RCI represent a decline or improvement in performance. The equation for calculating the RCI is as follows:

$$RCI = 1.64(SEdiff), \text{ where } SEdiff = [2(SEM^2)]^{1/2} \text{ and}$$

$$SEM = SD_1[(1-r_{xy})^{1/2}]$$

where SEdiff is the standard error of difference, SEM is the standard error of measurement, SD is the standard deviation, and r_{xy} is the test-retest reliability statistic. The following published studies have been used to derive RCI for the HVLTR, TMT and COWA (insert references). Note, the RCI belongs to a family of similar statistical methodologies to determine a

clinically meaningful effect at the within subject level. The study neuropsychologist should be consulted to determine the optimal methodology to use for the purpose of each study.

How to obtain Permission to Use:

The HVLT-R and COWA are owned and copyright protected by Psychological Assessment Resources, Inc (PAR). These tests require Qualification Level C (below) training and experience. PAR has a formal application and review process that you must go through to receive Permission to Use the tests in your research – contact PAR directly for details:

<https://www4.parinc.com/Products/PermissionsAndLicensing.aspx> , 1-800-331-8378.

PAR grants Permission to neuropsychologists based on the criteria listed below that were copied from their web site - they do not grant permission to other professionals:

“In accordance with the *Standards for Educational and Psychological Testing* and PAR’s competency-based qualification guidelines, many tests and other materials sold and licensed by PAR are available only to those professionals who are appropriately trained to administer, score, and interpret psychological tests. Please refer to our website at www.parinc.com for the Qualification Level of the product(s) stated in your Agreement.

Qualification Level: C

All qualifications for Level B **PLUS** an advanced professional degree that provides appropriate training in the administration and interpretation of psychological tests; **OR** license or certification from an agency that requires appropriate training and experience in the ethical and competent use of psychological tests.

Qualification Level: B

A degree from an accredited 4-year college or university in psychology, counseling, speech-language pathology, or a closely related field **PLUS** satisfactory completion of coursework in test interpretation, psychometrics and measurement theory, educational statistics, or a closely related area; **OR** license or certification from an agency/organization that requires appropriate training and experience in the ethical and competent use of psychological tests.”

List any fees for usage:

PAR charges a fee for these tests. Please contact PAR for current pricing. Any protocol concept must identify an independent funding source since the RTOG Core Grants do not cover the purchase of the instruments.

Languages available:

Please contact PAR for available translations.

Instructions for test administrator certification (CRA Credentialing, etc):

Test administrator training and certification is critically important to ensure proper standardized test administration. Without this, valid interpretation of the data is not possible. The study neuropsychologist is responsible for determining and implementing the required training and certification requirements for each study.

Quality assurance for administration (If needed):

Routine QA review is encouraged based on past experience with these outcomes tools in RTOG trials. The study neuropsychologist is responsible for determining and implementing the required QA requirements for each study.

Scoring of tests:

Detailed scoring rules are included in the Test Administration Manuals available to neuropsychologists that receive Permission to Use the tests from PAR. The study neuropsychologist is responsible for ensuring that the tests are accurately scored and standardized for each study. The study neuropsychologist is also responsible for ensuring accurate interpretation of the test results.

References:

1. Mitrushina, M, Boone, KB, et al. *Hanbook of Normative Data for Neuropsychological Assessment, Second Edition*. New York, Oxford University Press, 2005.
2. Benedict RHB, Schretlen D, Groninger L, Brandt J. Hopkins Verbal Learning Test--Revised: Normative data and analysis of inter-form and test-retest reliability. *The Clinical Neuropsychologist*. 1998;12:43-55
3. Benton AL, Hamsher KDS. Multilingual aphasia examination. Iowa City, AJA Associates, 1989

4. Levine AJ, Miller EN, Becker JT, Selnes OA, Cohen BA. Normative data for determining significance of test-retest differences on eight common neuropsychological instruments. *Clin Neuropsychol*. 2004;18:373-384
5. Ruff RM, Light RH, Parker SB, Levin HS. Benton Controlled Oral Word Association Test: reliability and updated norms. *Arch Clin Neuropsychol*. 1996;11:329-338
6. Jacobson NS, Truax P. Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. *J Consult Clin Psychol*. 1991;59:12-19.