

**NINDS CDE Notice of Copyright
Digit Modalities Test (SDMT)**

Availability:	<p>The Symbol Digit Modalities Test (SDMT) is currently a part of the Unified Huntington’s Disease Rating Scale (UHDRS). A modified version of the SDMT is currently a part of the Brief Repeatable Battery of Neuropsychological Tests for Multiple Sclerosis (Rao, NMSS, 1991).</p> <p>The Symbol Digit Modalities Test is copyrighted by Western Psychological Services: Symbol Digit Modalities Test.</p>
Classification:	<p>Supplemental: Highly Recommended: Multiple Sclerosis (MS)</p> <ul style="list-style-type: none"> • Highly recommended for studies involving neuropsychological testing for adult and pediatric MS patients. <p>Supplemental: Highly Recommended: Huntington’s Disease (HD)</p> <ul style="list-style-type: none"> • Highly recommended for cognitive assessments in HD studies. <p>Supplemental: Cerebral Palsy (CP) and Traumatic Brain Injury (TBI)</p>
Short Description of Instrument:	<p>Summary/Overview of Instrument: The SDMT measures the time to pair abstract symbols with specific numbers. The test requires elements of attention, visuoperceptual processing, working memory, and cognitive/psychomotor speed. The SDMT is a measure of divided attention, visual scanning, and motor speed. This measure involves a coding key consisting of 9 abstract symbols, each paired with a number ranging from 1 to 9. The subject is required to scan the key and write down the number corresponding to each symbol as fast as possible. The number of correct substitution within 90 seconds is recorded. In the written version of the test the subject fills in the numbers that correspond to the symbols. In the oral version the examiner records the numbers spoken by the subject.</p> <p>Construct measured: Processing speed, attention.</p> <p>Generic vs. disease specific: Generic.</p> <p>Intended use of instrument/purpose of tool: (cross-sectional, longitudinal, diagnostic, etc.): This test has been shown to predict group membership defined by processing speed deficits, such as brain-injured versus control samples, and has been used as a sensitive outcome in studies identifying predictors of longitudinal decline in elders.</p> <p>This measure can be used in ages 8 to 91. It can be used in broad spectrum of TBI severity and type of injuries as long as the subject is sufficiently functional to be testable.</p> <p>Means of administration: (paper and pencil, computerized): Written (oral form also available).</p> <p>Trained examiners. A written or oral version of the test may be administered. Test can be completed in under 5 minutes.</p> <p>Location of administration: (clinic, home, telephone, etc.): Clinical Setting.</p> <p>Intended respondent: (patient, caregiver, etc.): Patient.</p> <p># of items: N/A.</p> <p># of subscales and names of sub-scales: N/A.</p>

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<p>Scoring:</p>	<p>Scoring: (include reference to detailed scoring instructions, including calculation of a total score and subscale scores, and any limitations of scale or scoring posed by item nonresponse): The score is the number of correctly coded items from 0–110 in 90 seconds.</p> <p>Standardization of scores to a reference population: (z scores, T scores, etc): Manual norms have been criticized because they are based on a sample of convenience and were collected in the 1970’s. Other published norms are available based on age, education, and sex.</p> <p>If scores have been standardized to a reference population, indicate frame of reference for scoring: (general population, HD subjects, other disease groups, etc). General population.</p> <p>For multiple sclerosis most clinical research has employed the oral response form exclusively.</p>
<p>Measurements:</p>	<p>Type of scale used to describe individual items and total/subscale scores (nominal, ordinal, or [essentially] continuous): Continuous.</p> <p>If ordinal or continuous, explain if ceiling or floor effects are to be expected if the measure is used in specific HD Subgroups. No ceiling or floor effects. Individuals with advanced HD may struggle to write legibly due to motor disability.</p>
<p>Psychometric Properties:</p>	<p>Reliability:</p> <p>Test-retest or intra-interview (within rater) reliability (as applicable): The test demonstrates strong reliability and validity coefficients (6-year interval). Test-retest reliability in other studies ranges between 29 days to 2 years ($r=.70$ to $.91$) (Smith, 1991).</p> <p>Test-retest reliability in MS over two-weeks ranges from 0.85 to 0.98 (Benedict et al. 2008; 2012)</p> <p>Inter-interview (between-rater) reliability (as applicable): N/A. Internal consistency: N/A.</p> <p>Statistical methods used to assess reliability: Reliability coefficient.</p> <p>Reliability data from the CAB study will be available by end of 2012 for 100 control, 100 pre-manifest, and 50 early HD subjects.</p> <p>Validity: Content validity: SDMT correlates with oral versions ($r=.78$) (Smith, 1991). Construct validity: SDMT correlates well with the Wechsler Digit Symbol subtest ($r=.62$ to $.91$) (Hinton-Bayre et al., 1999).</p> <p>Known Relationships to Other Variables: (e.g., gender, education, age): Performance improves with IQ (Nielsen, 1989) and declines with age (Selnes, et al., 1991).</p>

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Rationale/ Justification:	<p>Strengths: Sensitive to changes in pre-manifest HD in cross-sectional and longitudinal studies. Easy to administer and score. Multiple forms available.</p> <p>Weaknesses: More severe motor impairment may influence results. An oral form of the test is also available, although much less is known about this version in HD.</p> <p>Special Requirements for administration: Stopwatch/clock.</p> <p>Administration Time: less than 5 minutes.</p> <p>Translations available (e.g., Spanish, French, Other languages): Involves only geometric figures and numbers, and therefore can be administered to people who do not speak English.</p>
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References:	<p>Key References:</p> <p>Smith, A. Symbol Digit Modalities Test (SDMT) [Internet]. Western Psychological Services. 1973 [cited 22 June 2016]. Available from: http://www.wpspublish.com/store/p/2955/symbol-digit-modalities-test-sdmt.</p> <p>Smith A. Symbol digit modalities test: Manual. Los Angeles: Western Psychological Services, 1982.</p> <p>Smith A. Symbol digit modalities test: Manual. Los Angeles: Western Psychological Services, 1991.</p> <p>Rao SM, Cognitive Function Study Group of the National Multiple Sclerosis Society. A manual for the Brief Repeatable Battery of Neuropsychological Tests in multiple sclerosis Milwaukee, WI.: Medical College of Wisconsin, 1990.</p> <p>Rao SM. Neuropsychological Screening Battery for Multiple Sclerosis. New York: National Multiple Sclerosis Society, 1991.</p> <p>Additional References:</p> <p>Akbar N, Honarmand K, Kou N, Feinstein A. Validity of a computerized version of the symbol digit modalities test in multiple sclerosis. <i>J Neurol</i>. 2011;258(3):373–379.</p> <p>Benedict RH, Smerbeck A, Parikh R, Rodgers J, Cadavid D, Erlanger D. Reliability and equivalence of alternate forms for the Symbol Digit Modalities Test: implications for multiple sclerosis clinical trials. <i>Multiple Sclerosis (Houndmills, Basingstoke, England)</i>. 2012;18(9):1320–1325.</p> <p>Benedict RH, Duquin JA, Jurgensen S, Rudick RA, Feitcher J, Munschauer FE, Panzara MA, Weinstock-Guttman B. Repeated assessment of neuropsychological deficits in multiple sclerosis using the Symbol Digit Modalities Test and the MS Neuropsychological Screening Questionnaire. <i>Multiple sclerosis (Houndmills, Basingstoke, England)</i>. 2008;14(7):940–946.</p> <p>Boringa JB, Lazeron RH, Reuling IE, Ader HJ, Pfennings L, Lindeboom J, de Sonneville LM, Kalkers NF, Polman CH. The brief repeatable battery of neuropsychological tests: normative values allow application in multiple sclerosis clinical practice. <i>Multiple Sclerosis (Houndmills, Basingstoke, England)</i>. 2001;7(4):263–267.</p> <p>De Monte VE, Geffen GM, May CR, McFarland K. Improved sensitivity of the rapid screen of mild traumatic brain injury. <i>J Clin Exp Neuropsychol</i>. 2010;32(1):28–37.</p>
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References:	<p>Hinton-Bayre A, Geffen G. Comparability, reliability, and practice effects on alternate forms of the Digit Symbol Substitution and Symbol Digit Modalities tests. <i>Psychol Assess.</i> 2005;17(2):237–241.</p> <p>Knopman DS, Mosley TH, Catellier DJ, Coker LH. Fourteen-year longitudinal study of vascular risk factors, APOE genotype, and cognition: the ARIC MRI Study. <i>Alzheimers Dement.</i> 2009;5(3):207–214.</p> <p>Nielsen H, Knudsen L, Daugbjerg O. Normative data for eight neuropsychological tests based on a Danish sample. <i>Scan J Psychol.</i> 1989;30(1):37–45.</p> <p>Selnes OA, Jacobson L, Machado AM, Becker JT, Wesch J, Miller EN, Visscher B, McArthur JC. Normative data for a brief neuropsychological screening battery. Multicenter AIDS Cohort Study. <i>Percept Mot Skills.</i> 1991;73(2):539–550.</p> <p>Stout JC, Paulsen JS, Queller S, Solomon AC, Whitlock KB, Campbell JC, Carlozzi N, Duff K, Beglinger LJ, Langbehn DR, Johnson SA, Biglan KM, Aylward EH. Neurocognitive signs in prodromal Huntington disease. <i>Neuropsychol.</i> 2011;25(1):1–14.</p> <p>Strauss E, Sherman EMS, Spreen O, editors. <i>A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary 3rd Edition</i> ed. New York: Oxford University Press; 2006.</p> <p>Wechsler D. (1997). Wechsler Adult Intelligence Scale® - Third Edition (WAIS®-III) [Internet]. Pearson Education, Inc. 1997 [cited 22 June 2016]. Available from: http://www.pearsonclinical.com/psychology/products/100000243/wechsler-adult-intelligence-scale--third-edition-wais-iii.html.</p>
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