HEART & STROKE FOUNDATION | CANADIAN Stroke BEST PRACTICE RECOMMENDATIONS

Table 2B: Summary of Select Screening and Initial Assessment Tools for Vascular Cognitive Impairment in Stroke Patients (Updated 2014)

Assessment Tool and Reference	Purpose	Content & Population	Length of Test	Reliability & Validity	Sensitivity & Specificity
Recommended First Line Screening and Assessment Tools					
Montreal Cognitive Assessment Tool (MoCA) The MoCA is available for free in several languages for educational and clinical purposes at: http://www.mocatest.org/ http://strokengine.ca/assess/module_moca_intro-en.html	Designed as a rapid screen for mild cognitive impairment	**Content:** The items of the MoCA examine attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation **Population:** Can be used in patients with stroke and any individual who is experiencing memory difficulties but scores within the normal range on the MMSE	5-10 minutes	**Reliability:** The MoCA has been demonstrated to have high internal consistency in patients with stroke or vascular dementia in at least 3 studies with Cronbach alpha scores > 0.75 (Cumming et al., 2011; Toglia et al., 2011; Freitas et al., 2012) **Validity:** Convergent: Strong correlations with the Mini Mental State Examination (MMSE) have been reported (e.g. Freitas et al., 2012) Construct: Known groups. One study reported that the MoCA can distinguish between patients with mild cognitive impairment and healthy controls.	**Sensitivity:** Many studies of the MoCA in patients with stroke or vascular dementia report high sensitivity (with most values > 80%) (e.g. Wong et al., 2013; Dong et al., 2012; Freitas et al., 2012; Pendlebury et al., 2012) . However, the optimal cutoff reported varies between studies and ranges from 17 (Freitas et al., 2012) to the standard cutoff of 26. **Specificity:** Most studies report lower specificity for the MoCA (specifically compared to the MMSE), however this ranges from 35% (Luis et al., 2009) to 97% (Freitas et al., 2012) depending on the population and cutoffs used.
NINDS-CSN Harmonization VCI Neuropsychology Protocols	Designed to measure vascular cognitive impairment in stroke	**Content:** Three different versions: 60 Minute - executive/activation function, visuospatial, language/lexical	60, 30, or 5 minute versions available	**Validity:** All three versions of the NINDS-CSN translated to Chinese were tested in a group of ischemic stroke patients and controls (Wong et al., 2013). All protocols differentiated patients from controls (area under ROC for the three protocols between	

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Black SE, Ganda A, Gao F, Gibson E, Graham S, Honjo K, Lobaugh NJ, Marola J, Pedelty L, Rangwala N, Scott CJ, Stebbins GT, Stuss DT, Zhou XJ, Nyenhuis D. Validation of the NINDS-CSN harmonization VCI neuropsychology protocols in an ischemic stroke sample. Stroke, 2011;42:e586-e629.	patients	retrieval, memory and learning, and neuropsychiatric/depressive symptoms. 30 Minute - semantic and phonemic fluency, Digit Symbol-Coding, revised Hopkins Verbal Learning Test, CES-D, and Neuropsychiatric Inventory. 5 Minute - subtests from the Montreal Cognitive Assessment, including a 5-word immediate and delayed memory test, a 6-item orientation task and a 1-letter phonemic fluency test (F). **Population:** Patients with stroke		0.77 to 0.79, p<0.001), and significantly correlated with the functional measures (Pearson r ranged from 0.37 to 0.51). A cut-off of 19/20 on MMSE identified only one-tenth of patients classified as impaired on the 5-min protocol. Cronbach's α across the four cognitive domains of the 60-min protocol was 0.78 for all subjects and 0.76 for stroke patients.	
Additional Screening and Assessment Tools for Vascular Cognitive Impairment and Dementia					
Cognitive- Functional Independence Measure (Cognitive-FIM) http://www.strokengine.ca/assess/fim/ http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=889	Designed to offer a uniform system of measurement for disability based on the International Classification of Impairment, Disabilities and Handicaps.	**Content:** 5 cognitive items: comprehension, expression, social interaction, problem solving, and memory. The level of a patient's disability indicates the burden of caring for them and items are scored on the basis of how much assistance is required for the individual to carry out activities of daily living.	30-45 minutes to administer the full test (Motor and Cognitive)	**Reliability:** In a review of 11 studies, Ottenbacher et al., 1996 reported a mean inter-observer reliability value of 0.95; a median test-retest reliability of 0.95 and a median equivalence reliability (across versions) of 0.92. Reliability was higher for items in the motor domain than for those in the social/cognitive domain. Internal consistency: - alpha of 0.93 – 0.95 reported at admission vs. discharge (Dodds et al. 1993); alpha = 0.88 to 0.91(Hsueh et al. 2002); Hobart et al. (2001) reported item-to-total correlations ranging from 0.53 to 0.87 for FIM total, 0.60 for FIM motor and 0.63 cognitive FIM –	

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		Population: Patients with stroke, traumatic brain injury, spinal cord injury, multiple sclerosis, and elderly individuals undergoing inpatient rehabilitation. Has been used with children as young as 7 years old.		mean inter-item correlations were 0.51 for FIM, 0.56 – 0.91 for motor FIM and 0.72 – 0.80 for cognitive FIM, alpha = 0.95, 0.95 and 0.89 for FIM, motor FIM and cognitive FIM respectively. **Validity:** Content: The FIM was created based on a literature review of measures and expert panels and was piloted in 11 centers. The Delphi method was applied, using rehabilitation expert opinion to establish the inclusiveness and appropriateness of the items. Criterion: Excellent correlations with the BI; MRS; DRS. FIM scores predict home care required; admission scores many functional outcomes. Construct: FIM scores discriminated between groups based on spinal cord injury and stroke severity, and the presence of comorbid illness both at admission and discharge. Concurrent. Found to have an excellent correlation with the DRS; adequate correlation with the Montebello Rehabilitation Factor Score (MRFS) (efficacy); and a poor correlation with the MRFS (efficiency). Convergent/Discriminant. The Cognition-FIM was found to demonstrate an excellent correlation with the MMSE; adequate correlation with the Lowenstein Occupational Therapy Cognitive Assessment (LOTCA), Office of Population Censuses and Surveys Disability scores, and the revised Wechsler Adult Intelligence	

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				Test-verbal IQ; and a poor correlation with the London Handicap Scale, SF-36 Physical and Mental components, and the General Health Questionnaire. Ecological: The Cognition-FIM demonstrated adequate correlations with the OT-APST.	
Cambridge Cognition Examination (CAMCOG) The CAMCOG can be obtained by purchasing the entire CAMDEX from the Cambridge University Department of Psychiatry http://strokengine.ca/assess/module_camcog_intro-en.html	Designed to be a standardized assessment instrument for diagnosis and grading of dementia	**Content:** The CAMCOG consists of 67 items. It is divided into 8 subscales: orientation, language (comprehension and expression), memory (remote, recent and learning), attention, praxis, calculation, abstraction and perception. R-CAMCOG was developed as a shortened version of the original CAMCOG. **Population:** The CAMCOG can be used with, but is not limited to clients with stroke.	Original CAMCOG: 20 to 30 minutes R-CAMCOG: 10 minutes	**Reliability:** No studies have examined the internal consistency of the CAMCOG in clients with stroke. No studies have examined the reliability of the CAMCOG in clients with stroke. **Validity:** Predictive Validity. At least 6 studies have examined the predictive validity of the CAMCOG and reported that the CAMCOG can be predicted by age, the R-CAMCOG, the MMSE and cognitive and emotional impairments. Additionally, the CAMCOG was an excellent predictor of dementia 3 to 9 months post-stroke (de Koning et al., 1998). Another study demonstrated one year post stroke, the CAMCOG dimensions of orientation (b = – 0.21), Perception (b = – 0.16) and Memory (b = – 0.16), were significant predictors of health status (Verhoeven et al., 2011) Convergent validity: Excellent correlations have been reported between the CAMCOG and the R-CAMCOG and the MMSE shortly after and 1 year post-stroke. Correlations between the CAMCOG and the FIM Measure range from adequate after stroke to poor at 1 year post-stroke (Winkel-Witlox et al., 2008). Correlations have also been demonstrated with the Raven's Test and Weigl Test (0.59, 0.65) (Leeds et al., 2001)	**Sensitivity & Specificity:** The CAMCOG has been demonstrated to be a more accurate screening tool than the MMSE (area under the curve for CAMCOG, 0.95; for MMSE, 0.90) (de Koning et al., 1998) The diagnostic accuracy at the pre-specified cut-off point for the R-CAMCOG of 33/ 34 was established through receiver operating characteristic (ROC) analyses (sensitivity 66%, specificity 94%). At a cut-off point of 36/37 sensitivity would be 83% and specificity 78% (de Koning et al., 2005). .

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Frontal Assessment Battery Dubois, B. ; Litvan, I.; The FAB: A frontal assessment battery at bedside. Neurology. 55(11): 1621-1626, 2000. http://www.docstoc.com/docs/46935262/Frontal-Assessment-Battery---Content_-instructions_-and-scoring Oguro, H., Yamaguchi, S., Abe, S., Ishida, Y., Bokura, H., & Kobayashi, S. (2006). Differentiating Alzheimer's disease from subcortical vascular dementia with the FAB test. *Journal of neurology*, *253*(11), 1490-1494.	Designed to be a brief tool to be used at the bedside or in a clinic setting to discriminate between dementias with a frontal dysexecutive phenotype and Dementia of Alzheimer's Type (DAT).	**Content:** conceptualization, mental flexibility, programming, sensitivity to interference, inhibitory control, and environmental autonomy	~ 10 minutes	**Reliability**: Chinese FAB: In stroke patients with small sub-cortical infarct (Mok et al., 2004), the CFAB had low to good correlation with various executive measures: MDRS I/P ($r = 0.63$, $p < 0.001$), number of category completed ($r = 0.45$, $p < 0.001$), and number of preservative errors ($r = -0.37$, $p < 0.01$) of WCST. Among the executive measures, only number of category completed had significant but small contribution (6.5%, $p = 0.001$) to the variance of CFAB. A short version of CFAB using three items yielded higher overall classification accuracy (86.6%) than that of CFAB full version (80.6%) and MMSE (77.6%). In another test, which compared the Chinese FAB to the Mattis Dementia Rating Scale Initiation/Perseveration subset: Both tests showed comparably good ability in Receiver Operating Characteristics curves analysis (AUCMDRS I/P = 0.887; AUC FAB = 0.854, $p = .833$) in discriminating between controls and patients and correctly classified over 78% of subjects. Verbal fluency and motor programming contributed most to the discriminating power in the two tests. Validity: Chinese FAB: Internal consistency (alpha = 0.77), test-retest reliability (rho = 0.89, $p < 0.001$), and inter-rater reliability (rho = 0.85, $p < 0.001$) of CFAB were good (Mok et al., 2004)	
Mini-Mental State Exam (MMSE) http://strokengine.ca/assess/module_mmse_intro-en.html	Designed to screen for cognitive impairment .	**Content:** The MMSE consists of 11 simple questions or tasks that look at various functions including: arithmetic, memory and orientation.	~ 10 minutes	**Reliability:** Out of 9 studies examining the internal consistency of the MMSE, 3 reported poor internal consistency, 1 reported adequate internal consistency, 2 reported poor to excellent internal consistency, 2 reported excellent internal consistency, 1 reported excellent internal	

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		Population: Population While originally used to detect dementia within a psychiatric setting, its use is now widespread and is available with an attached table that enables patient-specific norms		consistency in patients with Alzheimer's Disease and poor internal consistency in patients with cognitive impairment. Out of 6 studies examining the test-rest reliability of the MMSE, 2 studies reported excellent test-rest, 1 reported adequate test-retest, 1 reported adequate to excellent test. retest, 1 reported poor to adequate test-rest, 1 reported poor test-retest. Out of 3 studies examining the inter-rater reliability of the MMSE, 1 reported excellent inter-rater, 2 reported adequate inter-rater. **Validity:** Criterion: The MMSE can discriminate between patients with Alzheimer's Disease and frontotemporal dementia; can discriminate between patients with left- and right-hemispheric stroke. Construct: Concurrent. MMSE had a poor correlation with the Mattis Dementia Rating Scale; poor to excellent correlations with the Wechsler Adult Intelligence Test; adequate correlation with the FIM; significant correlations with the Montgomery Asberg Depression Rating Scale and the Zung Depression Scale. Predictive. MMSE scores found to be predictive of functional improvement in patients with stroke following rehabilitation; discharge destination; developing functional dependence at a 3-year follow-up interval; ambulatory level; length of hospital stay such that for patients with moderate dementia; death. Floor/Ceiling effects: Folstein, Folsten, and McHugh (1998) reported that the MMSE demonstrates marked ceiling effects in younger intact individuals and marked floor	

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				effects in individuals with moderate to severe cognitive impairment.	
Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) http://www.pearsonclinical.com/psychology/products/100000726/repeatable-battery-for-the-assessment-of-neuropsychological-status-update-rbans-update.html Wagle, J., Farner, L., Flekkøy, K., Bruun Wyller, T., Sandvik, L., Fure, B., ... & Engedal, K. (2011). Early post-stroke cognition in stroke rehabilitation patients predicts functional outcome at 13 months. *Dementia and geriatric cognitive disorders*, *31*(5), 379-387.	Designed to be a brief neurocognitive battery with four alternate forms	**Content:** The content of the RBANS consists of neurocognitive test paradigms including tests for: immediate memory, visuospatial/construction al, language, attention, and delayed memory. **Population:** Not specific	25 min	**Reliability:** NA in a stroke population **Validity:** Construct validity: Supported by strong convergent validity demonstrated for the Language, Visuospatial/Constructional, Immediate Memory and Delayed Memory indexes in individuals with stroke (Larson, 2005). Attention index did not demonstrate significant convergent validity. Discriminant Validity: Challenged by the finding that the RBANS Attention, Visuospatial/Constructional and Immediate Memory indices correlate with several measures of language ability in individuals post stroke (Larson, 2005). Further challenged by the finding that the RBANS had difficulty differentiating between Alzheimer's Disease and Subcortical Vascular Dementia (McDermott & DeFilippis, 2010)	Sensitivity & Specificity: In a group of participants with Subcortical Vascular Dementia, RBANS found to have higher specificity (subtest range: 76.9 – 92.3%) than sensitivity (subtest range: 48.3 – 62.1%) (McDermott & DeFilippis, 2010).

NOTE: Patient factors such as communication challenges should be taken into account during screening and assessment. Refer to Recommendation 2.3A for additional information.