# Summary of Commonly used Pediatric Stroke Assessment and Outcome Tools

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<td><strong>Global Neurological Function</strong></td>
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<td><strong>PEDIATRIC STROKE OUTCOME MEASURE (PSOM)</strong></td>
<td>Measurement of Neurological deficits post-stroke in sensorimotor, language and cognitive /behavioural /mental spheres Suitable for newborn to teen years.</td>
<td>Standardized neurological examination administered by pediatric neurologist in clinic setting. 115 age-specific items to select according to patient age encompassing infant, child and older child examination. Summary of Impressions: Score 0-10 (maximal deficit) assigns 2 points to each of 5 subscales (right sensorimotor, left sensorimotor, language expression, language reception, cognitive/behavioural. Scores for each sub-scale of 0=no deficit; 0.5=minimal deficit without functional consequence; 1=moderate deficit with slowing of function; 2=severe deficit with missing function for age</td>
<td>20 minute duration to score accompanying neurological examination Infant version and Child version available with Initial examination (including standardized history) and follow-up examination forms for each</td>
<td><a href="https://commondataelements.ninds.nih.gov/Doc/NOC/Pediatric_Stroke_Outcome_Measure_Short_Neuro_Exam_NOC_Request.pdf">https://commondataelements.ninds.nih.gov/Doc/NOC/Pediatric_Stroke_Outcome_Measure_Short_Neuro_Exam_NOC_Request.pdf</a></td>
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<td><strong>Recovery and Recurrence (RRQ) Questionnaire for pediatric stroke</strong></td>
<td>Measurement of Neurological deficits post-stroke in sensorimotor, language and cognitive /behavioural/ mental spheres Suitable for newborn to teen years.</td>
<td>Standardized parental questionnaire administered by research assistant by telephone or in clinic setting. Summary of Impressions: Score 0-10 (maximal deficit) assigns 2 points to each of 5 subscales (right sensorimotor, left sensorimotor, language expression, language reception, cognitive/behavioural. Scores for each sub-scale of 0=no deficit; 0.5=minimal deficit without functional consequence; 1=moderate deficit with slowing of function; 2=severe deficit with missing function for age</td>
<td>The RRQ was developed by converting the PSOM to a questionnaire for telephone interview. There was good agreement between the total PSOM and total RRQ score. Preexisting neurological deficits or chronic illness increased the difference between the total PSOM and total RRQ. The RRQ can characterize post-stroke function when a child cannot return for examination.</td>
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<td><strong>Six Minute Walk Test</strong></td>
<td>Measures individual walking capacity and endurance</td>
<td>The total distance (i.e., metres or feet) walked during the trial period is measured and recorded. The number and duration of rests can also be measured. <strong>Administration</strong>: Observation; 6 minutes to complete.</td>
<td>Age, height, and weight need to be considered when interpreting results. The 6MWT has not been validated in the paediatric stroke population. Systematic review of studies evaluating the methodological quality and quality criteria of the measurement property of the 6MWT among chronic paediatric conditions (cystic fibrosis, cerebral palsy, obesity, juvenile idiopathic arthritis, spina bifida, Duchenne muscular dystrophy, congenital heart disease, idiopathic adolescent scoliosis, spinal muscular atrophy, pulmonary hypertension and end-stage renal disease) found that it is unclear that the 6MWT provides reproducible test results. Results should be interpreted with caution and alternative measures must be considered.</td>
<td>Direct link to tool: Cost-Free (adult electronic version at <a href="http://www.uhn.ca/TorontoRehab/Health_PROFESSIONALS/Documents/TR_HCP_SUPP_CBMScale.pdf">http://www.uhn.ca/TorontoRehab/Health_PROFESSIONALS/Documents/TR_HCP_SUPP_CBMScale.pdf</a>#search=community%20balance%20and%20mobility%20scale) or paediatric version which has slightly different instructions for youth to better understand by emailing Virginia Wright at <a href="mailto:wwright@hollandbloorvine.ca">wwright@hollandbloorvine.ca</a>)</td>
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| **Community Mobility and Balance Test (CB&M)** | Measures fine motor control of the upper extremity; a measure used to detect high balance and mobility deficits. | The CB&M consist of 13 challenging tasks with 6 task performed on both sides. Scoring is done using the first trial for each item, with a maximum possible score of 96.  
- Items scores range from 0 to 5 and reflect progressive task difficulty  
- A score of 0 indicate complete inability to perform the task  
- A score of 5 indicates the most successful completion of the item possible.  
**Examples of items are:**  
- **Walking & Looking** - tests the ability to maintain a straight trajectory while keeping fixation on a visual target as would occur in walking and looking around any environment. | This assessment is meant to assess performance in a functional setting and therefore should be tested in the footwear a person would use in the community. Parents need to be informed prior to the test that the child should wear a running style shoe. The CB&M showed excellent reliability in school-aged children and adolescent with traumatic brain injury. Reliability was comparable for live and videotaped rating approaches, meaning that the easier and less expensive live-rating can be recommended. The construct validity of the CB&M has yet to be evaluated in this population. This measure has not been validated in the paediatric stroke population. | Direct link to tool: Cost-Free (adult electronic version at [http://www.uhn.ca/TorontoRehab/Health_PROFESSIONALS/Documents/TR_HCP_SUPP_CBMScale.pdf](http://www.uhn.ca/TorontoRehab/Health_PROFESSIONALS/Documents/TR_HCP_SUPP_CBMScale.pdf)#search=community%20balance%20and%20mobility%20scale) or paediatric version which has slightly different instructions for youth to better understand by emailing Virginia Wright at wwright@hollandbloorvine.ca) |
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|                            |         | • Running with Controlled Stop and Hopping Forward – these two items test the ability to generate significant power/momentum and then stabilize in a final position without use of excessive balance reactions  
• Lateral Foot Scooting – tests the ability to elicit and control a change-in-support balance reaction, pivoting the forefoot or heel, while traversing a 40 cm distance  
• Forward to Backward Walking and Crouch & Walk – these two items test the ability to maintain walking while changing direction or position (to pick up an object), respectively, as would occur when maneuvering in the home or community environment | Administration: All tasks are performed without ambulation aides; although patients are permitted to wear an orthotic. Length of test is 31 to 60 minutes. The following equipment is required:  
• A 8-m track  
• stop watch  
• Laundry basket  
• 2lb and 7lb weight  
• Visual target  
• Bean bag | |

Assisting Hand Assessment (AHA)  
Kruminde-Sundholm et al., 2007.  
Greaves et al. 2010.  
The AHA measures and describes how children with an upper limb disability in one hand use their  
The AHA measurement contains twenty-two items each scored with a four-point rating scale. The range of the sum scores is 22-88 points. A scaled score is obtained which is a conversion of the raw scores into a percentage, thus, the scaled scores range from 0-100. The 22 The test is developed for use with children who have a unilateral disability, i.e., who have one well-functioning and one less well functioning hand. Children with hemiplegic Cerebral Palsy or sequelae from obstetric brachial plexus palsy (OBPP) are appropriate candidates  
There are two versions of the test:  
-Small Kids AHA: The test session consists of play involving handling and exploring objects |
### Assessment Tool references

**Eliasson et al. 2005.**

**Purpose**

Affected hand collaboratively with the non-affected hand in bimanual play.

**Items and Administration**

Items describe different types of object-related actions of the assisting hand under the following headings:

- General use
- Arm use
- Grasp and release
- Fine motor adjustments
- Coordination and pace

The general meaning of the rating scale categories is: 4 = effective, 3 = somewhat effective, 2 = ineffective, 1 = does not do.

**Administration**

The AHA is performed as an enjoyable, approximately 15 minutes play-session. The session is video recorded and the scoring is done as a second step from viewing the video. The AHA test kit consists of a number of specific toys gathered in a children’s suitcase. To become a certified AHA rater a 3-day training course and the completion of a number of calibration cases is required.

**Additional Considerations**

For the AHA, the AHA has been used as the principal outcome measure in a study evaluating Constraint Induced Movement Therapy in young children with hemiplegia. Note: This measure has not been specifically validated in the paediatric stroke population.

**Availability**

Available from the AHA test kit for children 18 months to 5 years of age.

- **School Kids AHA:** The same objects are used but in an age appropriate context using board games for children 6-12 years of age.

For information about AHA training and kits, contact via e-mailing AHA-project@kbh.ki.se or by mail to Handfast AB, Fogdevreten 2 B, SE 171 77 Stockholm.

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**Quality of Upper Extremity Skills Test (QUEST)**


Thorley et al., 2013.


Klingels et al. 2008.


Thorley et al., 2012.

QUEST measures the movement pattern and hand function.

**QUEST**

Quest consists of 36 items evaluating 4 domains:

1. Dissociated movement
2. Grasp
3. Protective extension
4. Weight bearing

QUEST includes 19 items with one level of response for movement of shoulder, elbow, wrist, and independent movements, and arm position during grasp/release. There are 6 items with 3 to 5 levels of response for posture during grasp; 5 items with 6 levels of response for weight bearing in prone, prone with reach, sitting with hands forward, sitting with hands by side, and sitting with hands behind. Finally, 3 items with 6 QUEST items are related to quality of movement, and not to chronological age. This tool was developed for the paediatric cerebral palsy population. QUEST was used with children aged 18 months to 18 years of age. The ability of the test to detect change, however, is less clear and there is little support for its discriminative properties. Calculating total scores is discouraged. Reporting QUEST results separately for domains and each limb is recommended. Posture items in the grasp domain had little relationship with total scores and it is recommended that they be removed from the test.

QUEST has not been validated in the paediatric stroke population.

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<td><strong>Canadian Occupational Performance Measure (COPM)</strong></td>
<td>COPM is an assessment tool that measures an individual’s perceived occupational performance in the area of self-care, productivity and leisure. The COPM was adapted for the paediatric population by deleting paid/unpaid work and household management categories and having parents act as proxies to rate child performance and their own satisfaction</td>
<td>COPM consists of a 5-step process nested within a semi-structured interview, conducted by an occupational therapist. Interview focuses on identifying activities within each performance domain that the client wants, needs, or is expected to perform.</td>
<td>The COPM was designed for use with all clients, across ages and regardless of diagnosis. The COPM may require modification for children under 8 to accommodate their development level and ability to understand abstract concepts. To date, it has not had formal validation in the paediatric stroke population. The interview process is essential in eliciting relevant information and devising patient-centered therapeutic interventions. However, the interview process is not standardized; thus both the quality and adequacy of information obtained from interviews may vary considerably between interviewers</td>
<td>Available for purchase: <a href="http://www.thecopm.ca/buy/">http://www.thecopm.ca/buy/</a></td>
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<td><strong>Beery-Buktenica Developmental Test of Visual-Motor Integration BEERY™ VMI</strong></td>
<td>The VMI is an assessment measure used to assess visual-motor function. In particular, the VMI:</td>
<td>The VMI consists of three subsections: 1. Visual motor integration –The child is provided with a sequence of images and is asked to copy from a model, beginning with a simple line and progressing gradually to more complex geometric shapes</td>
<td>The VMI is considered to be a well-established assessment measure. The VMI is a culture-free, non-verbal assessment, making it useful with individuals of diverse environmental, educational, and linguistic backgrounds. The VMI was standardized on a national</td>
<td>Available for purchase: <a href="http://www.pearsonclinical.co.uk/Psychology/ChildCognitionNeuropsychologyandLanguage/ChildPerceptionandVisuomotor">http://www.pearsonclinical.co.uk/Psychology/ChildCognitionNeuropsychologyandLanguage/ChildPerceptionandVisuomotor</a></td>
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| 1. Assesses how the visual perceptual and fine motor control systems coordinate with one another.
  2. Assesses how the visual system specifically is perceiving the information it receives,
  3. Assesses an individual level of motor control | 2. Visual perception – The child is again presented with a series of progressively complex geometric images, and then asked only to identify each item’s identical match from a set of similar shapes.
  3. Motor coordination – Beginning with a basic line and advancing to more challenging forms, the child is provided with specific directions to trace the interior of each shape, without crossing over the shape's border.
  Administration: Test can be administered to individuals or to a group of children, as young as 2 years old. Each subsection takes approximately 5 minutes to complete.
  Results are reported as a standard score, percentile or other equivalents. | Sample of 1,737 individuals age 2 to 18 years (2010) and 1,021 adults ages 19-100 (2006), and has proven reliability and validity. To date, has not had formal validation in the paediatric stroke population.
  Children who perform well on VMI testing may still have visual perception or motor coordination deficits. Visual conceptualization and motor coordination should be evaluated separately to confirm the results. | Abilities/Beery-Buktenica Developmental Test of Visual-Motor IntegrationSixthEdition/BeeryBuktenicaDevelopmentalTestofVisualMotorIntegrationSixthEdition(BeeryVMI).aspx |
| The BOT-2 is an assessment measure of gross and fine motor skills. | The BOT-2 evaluates motor impairment and motor function through observation of play activities, and includes 8 subtests. Items included are:
  1. Bilateral coordination – assesses control with tasks requiring movement of both sides of the body.
  3. Running speed and agility: evaluated maximum running speed, running and changing direction, as well as stationary and dynamic hopping and jumping skills
  4. Upper-Limb coordination – evaluates ability to coordinate arm and hand movement and visual tracking of tasks such as catching, throwing and dribbling
  5. Strength: evaluated | The test is intended to be administered by a professional (physical therapist, occupational therapist, special education teacher, etc)
  BOT-2 has both age and sex-specific normative data, allowing comparison to peers.
  The BOT-2 has been validated for higher-functioning individuals diagnosed with autism, Asperger's, Developmental Coordination Disorder, and mild/moderate intellectual disabilities. To date, it has not had formal validation in the paediatric stroke population.
  The following weakness of the tool should be noted: 1. Limited test-retest reliability in some sub-tests and composite scores.
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<td><strong>Focus on the Outcome of Communication Under Six (FOCUS©)</strong> Thomas-Stonell et al., 2010. Eadie et al., 2006.</td>
<td>FOCUS is an assessment measure that evaluates change in communicative participation.</td>
<td>FOCUS consists of 50 items and takes approximately 10 minutes to complete. The two versions of the outcome measure – one for parents and one for speech-language pathologists – consist of the same items. Parents describe real-word changes in their child’s communication skills, including improved socialization, increased independence, talking more, talking better and being better understood. Sample FOCUS items for Activities: “My child uses new words.” “My child can string words together.” “My child uses words to ask for things.” “My child talks a lot.” Sample FOCUS questions for Participation: “My child is included in play activities by other children.” “My child gets along with other children.” “My child can use language to express needs.”</td>
<td>FOCUS can be can be used for any child between the ages of 18 months to 5 years and 11 months; FOCUS can be used with children who have a variety of communication disorders. FOCUS is aligned with the World Health Organization’s (WHO) International Classification of Functioning, Disability and Health - Children and Youth (ICF-CY) FOCUS has been shown to have good internal consistency, test-retest reliability for parents and speech-language pathologist, inter-rater reliability, and strong construct validity for detecting change.</td>
<td><a href="http://research.hollandbloorview.ca/Outcomemeasures/FOCUS">http://research.hollandbloorview.ca/Outcomemeasures/FOCUS</a></td>
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<td>child is included in games by other children. “My child can communicate effectively with other children.” The clinician version has an additional “observed” column. Scoring: FOCUS has a total of 50 items, broken into 2 parts. Each item is scored from 1 to 7. Part 1 has 34 items and has the following headings: (Score 1) Not at all like my child (Score 2) A little like my child (Score 3) Somewhat like my child (Score 4) A fair bit like my child (Score 5) Quite a bit like my child (Score 6) Very much like my child (Score 7) Exactly like my child Part 2 has 16 items. These items are designed to measure how much help the child needs to complete tasks. The items are also scored from 1 – 7. (Score 1) Cannot do at all (Score 2) Can do with a great deal of help (Score 3) Can do with a lot of help (Score 4) Can do with a bit of help (Score 5) Sometimes does without help (Score 6) Often does without help (Score 7) Can always do without help Treatment change is measured using the FOCUS Total Score. The numbers from the columns on each page are calculated and then the totals from Part 1 and Part 2 are added together to compute the FOCUS Total Score. Interpretation of FOCUS Total Change Scores: When interpreting the FOCUS change score (i.e., the difference between the two FOCUS administration To date, it has not been validated in the paediatric stroke population.</td>
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<td><strong>Pediatric Quality of Life Inventory (Peds QL) 4.0</strong></td>
<td>The PedsQL 4.0 is an assessment measure evaluating health-related quality of life</td>
<td>The PedsQL 4.0 consists of 23 items derived from 4 Generic Core Scales, which are multidimensional child self-report and parent proxy-report and integrated with the PedsQL Disease-Specific Modules. The Generic Core Scales include the following dimensions: Physical (8 items); emotional (5 items); social (5 items); and school (5 items).</td>
<td>The PedsQL distinguishes between healthy children and pediatric patients with acute or chronic health conditions. The following disease-specific modules are available: asthma, rheumatology, diabetes, cancer, cardiac conditions. To date, there are no disease-specific modules for paediatric stroke. One study has found that the PedsQL 4.0 Generic Inventory Scales to be a promising assessment tool for health related quality of life for children following stroke.</td>
<td><a href="http://www.pedsql.org/">http://www.pedsql.org/</a></td>
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<td><strong>Pediatric Functional Independence Measure (WeeFIM)</strong></td>
<td>The WeeFIM is an assessment measure of functional performance in infants, children and adolescents</td>
<td>The WeeFIM consists of 18 items that measure functional performance in three domains: 1. Self-care: eating; grooming; bathing; dressing – upper body; dressing – lower body; toileting; bladder management; bowel management 2. Mobility: transfer – chair, wheelchair; transfer – toilet; transfer – tub, shower; walk, wheelchair, crawl; stairs. 3. Cognition: comprehension; expression; social interaction; problem solving; memory. The 0-3 Module of the WeeFIM is a questionnaire that measures precursors to function in children 0-3 years old who have a variety of disabilities. The 0-3 module can be administered to parents by interview or self-report and is useful across many settings, including early</td>
<td>The WeeFIM was originally intended to assess children between the ages of 6 months and 7 years with acquired or congenital disease. The measurement may be used with children above the age of 7 years as long as their functional abilities, as measured by the WeeFIM instrument, are below those expected of children aged 7 who do not have disabilities. To use the FIM and WeeFIM assessors need to attend training and pass an online exam to become credentialed. Once an assessor has passed the exam, credentialing remains valid for two years, after which time the exam must be sat again.</td>
<td><a href="http://www.udsmr.org">www.udsmr.org</a></td>
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<td>capable of doing or unable to do each of the items in each of the functional skills domains, which are listed in order of mastery. Capability indicates what the child can do without help, even if the child does not regularly perform these skills. Caregiver assistance is measured on a 6-point rating scale from total assistance to complete independence.</td>
<td>The Family Needs Questionnaire – Pediatric Version is currently in Phase I testing at the Centre for Leadership in Acquired Brain Injury. <a href="http://hollandbloorview.ca/Assets/Centres%20for%20Leadership/FINAL%204C%20Webpage%20-%20C%20GAN%20Project%20Summary%20Family%20Needs%20Questionnaire.pdf">http://hollandbloorview.ca/Assets/Centres%20for%20Leadership/FINAL%204C%20Webpage%20-%20C%20GAN%20Project%20Summary%20Family%20Needs%20Questionnaire.pdf</a></td>
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<td>Family Needs Questionnaire – Pediatric Version</td>
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