

<b>Outcome Measure</b>	<b>Paediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI – CAT)</b>
<b>Recommended Tier*</b>	Acute Hospitalised – Supplemental Moderate/Severe TBI – Supplemental Outcome – Supplemental
<b>Sensitivity to Change</b>	Yes
<b>Population</b>	Children and Youth (From birth through 20 years of age)
<b>Domain</b>	Social Cognition
<b>Type of Measure</b>	Objective assessment
<b>ICF-Code/s</b>	D3, d4, d5, d7
<b>Description</b>	<p>The Paediatric Evaluation of Disability Inventory (PEDI), originally published in 1992, has been revised as a computer adaptive test (CAT). The Paediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT) is a clinical assessment for children and youth that can be used across all diagnoses, conditions and settings. The <b>PEDI-CAT</b> is comprised of a comprehensive item bank of 276 functional activities acquired throughout infancy, childhood and young adulthood. It can be used across all clinical diagnoses and community settings. As with the original paper-pencil PEDI, the PEDI-CAT can be administered by professional judgement of clinicians or educators who are familiar with the child or by parent report. The PEDI-CAT is recommended for use with children approaching 1 year of age and up to 21 years of age.</p> <p>This computerized adaptive version of the PEDI is intended to provide an accurate and precise assessment while increasing efficiency and reducing respondent burden. The PEDI-CAT software utilizes Item Response Theory (IRT) statistical models to estimate a child’s abilities from a minimal number of the most relevant items or from a set number of items within each domain. All respondents begin with the same item in each domain in the middle of the range of difficulty or responsibility and the response to that item then dictates which item will appear next (a harder or easier item), thus tailoring the items to the child and avoiding irrelevant items. The CAT program then displays the results instantly.</p> <p>The PEDI-CAT measures function in four domains: (1) <u>Daily Activities</u>; (2) <u>Mobility</u>; (3) <u>Social / Cognitive</u>, and (4) <u>Responsibility</u>. The PEDI-CAT items were selected based on their relevance for children’s engagement in daily life tasks. This feature of the PEDI-CAT will enable clinicians to construct a description of a child’s current functional status or progress in acquiring functional skills that are part of everyday life. The PEDI-CAT combines elements of adaptive behavior measures used in early intervention, developmental disabilities and special education programs with functional assessments used in paediatric rehabilitation.</p>

## **Domains**

*The PEDI-CAT addresses four domains of function:*

1. **Daily Activities** - 68 items in four content areas including *Getting Dressed, Keeping Clean, Home Tasks, and Eating & Mealtime*.
2. **Mobility** - 75 items in five content areas including *Basic Movement & Transfers, Standing & Walking, Steps & Inclines, and Running & Playing*. There are an additional 22 items specifically for children who use mobility devices such as walking aids (canes, crutches, walkers) and / or wheelchairs.
3. **Social/Cognitive** - 60 items in four content areas of *interaction, Communication, Everyday Cognition, and Self Management*.
4. **Responsibility** - 51 items that assess the extent to which a young person is managing life tasks that enable independent living in four content areas of *Organisation & Planning, Taking Care of Daily Needs, Health Management, and Staying Safe*. The items in the Responsibility Scale require children to use several functional skills in combination to carry out life tasks. For this reason, this is a more difficult domain and is estimated to assess children and youth beginning at the age of 3 years and extending up to the age of 21 years.

## **Response Scales**

For the three Functional Skill domains (1) Daily Activities, (2) Mobility and (3) Social / Cognitive, children's ability is rated on a 4-point Difficulty Scale with responses ranging from 'Unable' to 'Easy'.

The (4) Responsibility domain has its own 5-point Responsibility Scale with responses ranging from "Adult / caregiver has FULL responsibility; the child does not take any responsibility" TO "Child takes FULL responsibility without any direction, supervision or guidance from an adult / caregiver".

## **Versions of the PEDI-CAT**

1) **Speedy ("Precision") CAT**: This is the most efficient CAT as it is the quickest way to get a score estimate that is precise while administering 10-15 items per domain. The score report for the Speedy CAT includes a percentile score, a scaled score, and a list of the responses to all PEDI-CAT items.

2) **Content-Balanced ("Comprehensive") CAT**: Approximately 30 items per domain are administered which include a balance of items from each of the content areas within each domain. The score report for the Content-Balanced CAT includes a percentile score, a scaled score, and an item map showing the location of the responses for that domain. The Content-Balanced is more likely used when the CAT is needed for program evaluation and research.

## **Properties**

## **Intended Population**

The PEDI-CAT is designed for use with children and youth (birth through 20 years of age) with a variety of physical and / or behavioural conditions.

### **Applications**

- Identification of functional delay;
- Examination of improvement for an individual child after intervention;
- Evaluation and monitoring of group progress in program evaluation and research.

### **Administration of the PEDI-CAT**

The PEDI-CAT does not require any special environment, materials or activities for administration. The PEDI-CAT can be completed directly by the child's caregiver(s) or by the child's therapist / clinician. The assessment focuses on typical performance at the present time. The PEDI-CAT can be used on multiple occasions for the same child (E.g., initial, interim, discharge and follow-up) and there is no minimum time that must pass between assessments.

A review of the PEDI-CAT Manual is needed prior to administration for professionals to familiarise themselves with the administration procedures, instrument content, item intent, response scales and score interpretation.

The PEDI-CAT can be used on a local computer.

### **PEDI-CAT Scoring**

#### **Score Reports**

After completion of the PEDI-CAT, score reports are available for each assessment date and for each domain administered. Score reports may be viewed immediately after completion of the PEDI-CAT or by opening the PEDI-CAT program and entering the appropriate child/youth identification number. Score reports can be printed or exported to the user's computer.

A Summary Report is available that provides: child / youth's identification number; child / youth's date of birth; child's gender; date of assessment; domains administered; scaled score(s) with standard error; normative score(s) (given as a T-score and age percentile range); fit score(s); number of items per domain; type of PEDI-CAT administered.

A Detailed Assessment Report is also available that provides: child / youth's identification number; child / youth's date of birth; child's gender; date of assessment; domains administered; scaled score(s) (with standard error); normative score(s) (given as a T-score and age percentile range); fit score(s); number of items per domain; proxy (respondent); use and type of walking aid and / or wheelchair (if applicable); type of PEDI-CAT administered; list of all items and responses for each domain administered.

If a Content-Balanced PEDI-CAT was completed the option for an item map can be selected prior to viewing the report(s).

### **Interpretation of PEDI-CAT Scores**

Similar to the original PEDI (1992) the PEDI-CAT provides two types of transformed summary scores for each of the four domains: normative scores and scaled scores. Separate summary scores are calculated for each of the four domains and for a small set of manual wheelchair items, if applicable. There is no total score that sums across all four domains. A Fit score is also generated by the program.

- (1) *Normative scores* (provided as age percentiles and T scores) - based on a child's chronological age and intended for use by clinicians so that they may interpret a particular child's functioning relative to others of the same age.
- (2) *Scaled scores* provide a way to look at a child's current functional skills and progress in these skills over time. Scaled scores are especially helpful in documenting improvements in functional skills for children not expected to exhibit or regain normative levels of functioning.

*Item Maps* (generated with a Content-Balanced PEDI-CAT) - represent a reasonable, sequential pattern of functional skills consistent with children's development and recovery of function and transfer of responsibility from adult to child throughout childhood and young adulthood.

### **[Linking Original PEDI Scores to PEDI-CAT Scores](#)**

Equations have been developed and are available in the PEDI-CAT manual to link previous Functional Skills Self-care, Mobility and Social Function scores from the original PEDI to the PEDI-CAT so that clinicians may continue to track a child's changes over time. Of note, there is no conversion for the Caregiver Assistance Scale as it has been replaced with the Responsibility Domain.

### **Standardisation, Validity and Reliability**

#### **(1) Normative Standardisation Sample**

The PEDI-CAT's normative standardisation sample was recruited through an online panel and resulted in a nationally representative sample of 2,205 parents of children less than 21 years of age in the contiguous United States. The clinical validation sample of 703 children with disabilities (behavioural, intellectual and physical) was also recruited through the online panel as well as through two clinical sites in the Northwest Central and Northeastern United States.

#### **(2) Reliability and Validity**

Discriminant validity was evaluated using simulated versions based on the initial normative and disability samples as well as in a prospective study of 102 children. Test-retest reliability was examined during a prospective study of PEDI-CAT in which parent respondents completed the PEDI-CAT twice within one month.

### (3) Efficiency Assessment

Efficiency was evaluated by examining the time it took parent respondents to complete the 60 items (15 items in each of the four domains). The mean time to complete the full PEDI-CAT for the full sample (n=102) was 12.66 minutes (SD=4.47). The least amount of time needed to complete the full PEDI-CAT was 3.96 minutes and the longest time was 26.68 minutes. The mean time for the re-test sample to complete the PEDI-CAT a second time dropped slightly to 12.26 minutes (SD=4.65).

Closer examination of the data for each case indicated that the parent respondents with times greater than the average were those parents who completed the PEDI-CAT in a clinic setting. In addition, it was noted that some parents needed assistance in using a laptop computer, others needed assistance reading or interpreting the items, and others chose to engage in conversation with the study personnel while completing the assessment, which prolonged the completion time.

### (4) Feasibility

After they completed the PEDI-CAT, the study coordinator asked the participants four questions as part of a User Evaluation Survey. Parent respondent feedback regarding item-relevance, provision of meaningful information about their own child, willingness to complete a CAT versus a full-length paper-pencil assessment, and interest in completing a CAT online was collected and summarised using percentages.

The majority of parent respondents indicated that they would be willing to answer questions about their child using a CAT versus a paper-pencil assessment. Almost all parents indicated that they felt they provided meaningful information about their child. However some individual items were reported as irrelevant, which we believe was due to the forced use of 15 items selected by a computer algorithm in this version of the PEDI-CAT that did not have an age filter (a modification added to the final PEDI-CAT). Parents were highly enthusiastic about the Responsibility domain reporting that the subtle distinctions in this area were particularly useful for older children and teens.

In summary, the PEDI-CAT demonstrated strong evidence of known-group discriminant validity, was stable in its score estimates over a month's separation in re-testing, and was favourably reviewed by parents who not only completed the computer interface quickly but also reported they would prefer its use over a traditional fixed format paper-pencil assessment.

### Advantages

- 1) Normative standard scores, provided as age percentiles and T scores, are available for 21 age groups (intervals of one year);
- 2) Scaled scores are based on data from the normative and disability samples;
- 3) Each PEDI-CAT domain is self-contained and can be used separately

	<p>or along with the other domains;</p> <ol style="list-style-type: none"> <li>4) Age, gender and mobility device filters prevent irrelevant items from being presented;</li> <li>5) Items are worded using everyday language and clear examples;</li> <li>6) Illustrations of Daily Activities and Mobility items are included to facilitate understanding of the item intent;</li> <li>7) The PEDI-CAT is available for iPads and PCs. Each download includes English and Spanish languages.</li> </ol>
<b>Disadvantages</b>	<ol style="list-style-type: none"> <li>1) Lengthy administration time (60min);</li> <li>2) Skills are at the lower end of the continuum;</li> <li>3) Items focused primarily on home-based activities, which creates difficulties for therapists to answer questions without parent input;</li> <li>4) Original standardisation sample had some sampling error due to a lack of geographical representation and small numbers in each age group, which can affect the validity of interpretations made using norm-referenced scores</li> </ol>
<b>Additional Information</b>	<p>Computer adaptive testing methodology uses a computer interface to administer an assessment individualised to each child. CAT uses a computer algorithm to pre-select the items that will be administered to a specific person based on responses to previous items. Thus, the basic notion of an adaptive test is to mimic what an experienced clinician would do. A clinician learns most when assessment items are directed at the child's approximate level of functional ability. In practice, this approach minimises the number of items that are administered for a child to obtain an estimate of functioning in any particular content area. Items that are not relevant for a particular child are filtered out. For example, children who use wheelchairs exclusively would not receive ambulation items, and young children would not receive advanced grooming items such as shaving that are not applicable for their age.</p> <p>CAT-based instruments have the advantages of reducing test burden while increasing test precision because test items are selected to match the person's functional ability level, minimise the number of irrelevant test items administered and thus, increase efficiency. In the future CATs may link with electronic transmission of clinical data and allow easy use with current documentation systems. CATs can provide efficient and reliable data entry, analysis and management as assessments are stored in a database on a local computer or server.</p>
<b>Reviewers</b>	<p>Vicki Anderson Cathy Catroppa</p>

## References

Beaton DE, Bombardier C, Katz JN, Wright JG, Wells G, Boers M, Strand V, Shea B. Looking for important change/differences in studies of responsiveness. *Journal of Rheumatology*. 2001; 28:400-405.

Coster WJ, Haley SM, Ni P, Dumas HM, Fragala-Pinkham MA. (2008). Assessing self-care and social function using a computer adaptive testing version of the Pediatric Evaluation of Disability Inventory. *Arch Phys Med Rehabil*. 2008;89:622-629.

Dumas HM, Fragala-Pinkham MA, Feng T, Haley SM. A Preliminary Evaluation of the PEDI-CAT Mobility Item Bank for Children Using Walking Aids and Wheelchairs. *Journal of Pediatric Rehabilitation Medicine*. 2012; 5:29-35.

Dumas HM, Fragala-Pinkham MA. Concurrent Validity and Reliability of the Pediatric Evaluation of Disability Inventory-Computer Adaptive Test Mobility Domain. *Pediatric Physical Therapy*. 2012; 24:171-176.

Dumas HM, Fragala-Pinkham MA, Haley SM, Ni P, Coster W, Kramer JM, Kao YC, Moed R, Ludlow LH. Computer adaptive test performance in children with and without disabilities: prospective field study of the PEDI-CAT. *Disability & Rehabilitation*. 2012;34(5):393-401.

Dumas HM, Fragala-Pinkham MA, Haley SM, Coster WJ, Ying-Chia Kao, Kramer JK, Moed R. Item bank development for a revised Pediatric Evaluation of Disability Inventory (PEDI). *Physical & Occupational Therapy in Pediatrics*. 2010;33(4):332-338.

Haley SM, Raczek AE, Coster WJ, Dumas HM, Fragala-Pinkham MA. (2005). Assessing mobility in children using a computer adaptive testing version of the Pediatric Evaluation of Disability Inventory. *Arch Phys Med Rehabil*. 2005;86:932-939.

Haley, SM, Ni P, Jette AM, Tao W, Moed R, Meyers D, Ludlow LH. Replenishing a computerized adaptive test of patient-reported daily activity functioning. *Qual Life Res*. 2009;18:461-471.

Haley SM, Coster WJ, Dumas H, Fragala-Pinkham MA, Kramer JM, Ni P, Tian F, Kao Y-C, Moed R, Ludlow LH. (2011), Accuracy and precision of the Pediatric Evaluation of Disability Inventory Computer Adaptive Tests (PEDI-CAT). *Dev Med Child Neurol*. 2011;53:1100-1106.

Haley SM, Coster WI, Kao Y-C, Dumas HM, Fragala-Pinkham MA, Kramer JM, Ludlow LH & Moed R. Lessons from use of the Pediatric Evaluation of Disability Inventory: Where do we go from here? *Pediatr Phys Ther*. 2010;22(1):69-75.

Haley SM, Ni P, Ludlow LH, Fragala-Pinkham MA. Measurement precision and efficiency of multidimensional computer adaptive testing of physical functioning using the Pediatric Evaluation of Disability Inventory. *Arch Phys Med Rehabil*, 2006;87:1223-1229.

Haley, SM, Fragala-Pinkham MA, Dumas HM, Ni P, Gorton GE, Watson K, Montpetit K, Bilodeau N, Hambleton RK, Tucker CA. Evaluation of an item bank for a computerized adaptive test of activity in children with cerebral palsy. *Phys Ther*. 2009;89(6):589-600.

Kao, Y-C, Kramer, J.M., Liljenquist, K., Tian, F., & Coster, W.J. Comparing the functional performance of children and youth with autism, developmental disabilities, and without disabilities using the revised Pediatric Evaluation of Disability Inventory (PEDI) item banks. *American Journal of Occupational Therapy*. 2012;66:607–616.

Kramer, J.M., Coster, W.J., Kao, Y-C, Snow, A., Orsmond, G., & Moed, R. A new approach to the measurement of adaptive behavior: Development of the PEDI-CAT for children and youth with autism spectrum disorders. *Physical & Occupational Therapy in Pediatrics*. 2012;32(1);34-47.

Tucker CA, Gorton GE, Watson K, Fragala-Pinkham MA, Dumas HM, Montpetit K, Bilodeau NA, Ni P, Hambleton RN, Haley SM. Development of a parent-report computer-adaptive test to assess physical functioning in children with cerebral palsy I: Lower-extremity and mobility skills. *Dev Med Child Neurol*. 2009;51:717-724.