The PEDI has better psychometric properties than the WeeFIM, and is therefore the instrument of choice for measuring individual self care outcomes in children with acquired brain injury aged between 6 months and 7.5 years

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Clinical scenario:

There is increasing emphasis on evaluation of therapy outcomes by occupational therapists working with children recovering from acquired brain injuries (ABI). Preliminary searching revealed two paediatric assessments designed to assess **functiona**l outcomes: The Pediatric Evaluation of Disability Inventory (PEDI) and the Functional Independence Measure for Children (WeeFIM). Both assessments assess similar areas of function, but we wanted to know if one was more reliable, valid and responsive than the other for use with children recovering from ABI.

Focussed clinical question:

Which measure, the PEDI or the WeeFIM, is more reliable, valid and responsive for assessing self-care outcomes in children recovering from acquired brain injuries?

Summary of search, 'best' evidence' appraised, and key findings:

- Five citations were located and critiqued. Three studies have been appraised.
- No single paper directly answered the clinical question.
- Ziviani and colleagues, (2001) prospectively compared the concurrent validity of the WeeFIM with the PEDI. This study demonstrated that the WeeFIM assesses similar constructs to the more comprehensive PEDI. This study had some methodological flaws.
- Ottenbacher and colleagues (1999) also prospectively compared the concurrent validity of the WeeFIM with two standardised developmental skills assessments, the Vineland Adaptive Behaviour Scales and Batelle Developmental Disability Inventory Screening Test. They found the WeeFIM provided similar basic information to the other assessments.
- Kothari and colleagues (2003) retrospectively demonstrated that the generic PEDI scales were responsive to changes in children receiving inpatient rehabilitation for acquired brain injuries (ABI), using a cohort design. The unpublished ABI specific scales of the PEDI developed by the authors were also shown to be responsive, but not significantly more responsive, than the generic scales of the PEDI.

Clinical bottom line:

The PEDI has better psychometric properties and is the assessment of choice for individual assessment of self-care outcomes in children who have sustained an ABI. The WeeFIM shows potential for individual assessment, and service evaluation, for children with ABI but needs to be more rigorously studied in populations of children who have sustained acquired injuries.

Limitation of this CAT:

- This critical appraisal has not undergone a process of external peer review.
- Very few studies have investigated functional assessment tools specifically in paediatric populations with acquired brain injuries.

Search strategy:

- Preliminary searching revealed only one study exclusively using subjects with ABI. Therefore, we broadened the population search terms to include developmental, acquired neurological and neurodevelopmental disorders and disabilities.
- Broadening the population search terms lead to the need for refining the clinical question to 'self-care functional outcomes'.
- As the PEDI and the WeeFIM were the most commonly used and researched functional assessment tools in paediatric clinical practice, we used 'PEDI' and 'WeeFIM' as key search terms.
- No published study directly answered the refined clinical question; however five papers contributed to specific aspects of the question in relation to one or both of the tools.

Table 1. Search terms

	Search Terms
Population	pediatric, paediatric, children, child, young person, young people, infant, acquired brain injury, brain injury, acquired neurological disorder, neurodevelopmental disability, developmental disorder
Exposure	occupational therapy, physiotherapy, outcome measures, clinical assessment tools, disability evaluation, assessment, functional assessment, functional assessment tool, pediatric evaluation of disability inventory, PEDI, functional independence measure for children, WeeFIM, BDIST, VABS
Comparison	PEDI, WeeFIM
Outcome	self-care, functional outcomes, treatment outcome, independence, activities of daily living, ADL, care giver assistance

Databases/ sites searched: Embase, CINAHL, Medline, OT seeker, Cochrane Library, PsychINFO

Inclusion and exclusion criteria:

Inclusion Criteria:

- Studies that investigated the PEDI and/ or the WeeFIM to examine their reliability, validity or responsiveness

Exclusion Criteria:

- Papers published pre-1999
- Studies addressing the reliability and validity of the individual tools with specific cultural groups
- Studies that did not investigate self-care outcomes either specifically or concurrently with other functional domains
- Studies that utilised the PEDI and/ or the WeeFIM as part of an intervention based study, but did not specifically look at the reliability, validity or responsiveness of the assessment tools

Results of search:
Five papers were located and categorised which met the inclusion/exclusion criteria (Table 2.)

Table 2. Summary of Articles retrieved using the Oxford Centre for Evidence-based Medicine Levels of Evidence (Phillips, Ball, Sackett, et al., 2001)

Levels of Evidence	Number Located	Source of Evidence
1a. Systematic Review of Level 1 Studies		
1b. Validating Cohort Study		
2a. Systematic Review of Level > 2 Studies		
2b. Exploratory Cohort Study (Prospective, Retrospective)	5	Medline – *Ziviani et al., (2001)* Embase, CINAHL, AHMED – *Dumas et al., (2001).* AHMED, Embase, CINAHL, Medline – *Ottenbacher et al., (2000).* Medline – *Ottenbacher et al., (1999).* Embase, CINAHL, AHMED – *Kothari et al., (2003)*
3a. Systematic Review of level 3b and better studies		
3b. Non-consecutive Study		
4. Case-control Study		
5. Expert opinion		

Best evidence: The following articles were identified as providing the best evidence and selected for critical appraisal:

Kothari, D.H., Haley, S.M., Gill-Body, K.M., and Dumas, H.M. (2003). Measuring functional change in children with acquired brain injury: Comparison of generic and ABI-specific scales using the PEDI. *Physical Therapy, 83*, 776-785.

Ottenbacher, K.J., Msall, M.E., Yon, N., Duffy, L.C., Granger, C.V. and Braun, S. (1999). Measuring developmental and functional status in children with disabilities. *Developmental Medicine and Child Neurology, 41*, 186-194.

Ziviani, J., Ottenbacher, K.J., Shepard, K., Foreman, S., Astbury, W. and Ireland, P. (2001). Concurrent validity of the Functional Independence Measure for Children (WeeFIM) and the Pediatric Evaluation of Disability Inventory for children with developmental disabilities and acquired brain injury. *Physical and Occupational Therapy in Pediatrics, 21,* 91-101.

The reasons for selecting these three papers were:

- No one paper directly answered the clinical question.
- These three papers provided the highest level of evidence for answering the clinical question, and utilised designs that were most appropriate to determine reliability, validity and responsiveness.
- The study by Kothari and colleagues (2003) was the only study to exclusively use children with acquired brain injury in their sample. This study contributed to answering the clinical question.
- The study by Ottenbacher and colleagues (1999) compared the WeeFIM with the Vineland Adaptive Behavior Scales (VABS) and Battelle Developmental Inventory Screening Test (BDIST) developmental assessments.

Critical Appraisal Checklists Used: Fritz, J.M., & Wainner, R.B. (2001). Examining diagnostic tests: an evidence based perspective. *Physical Therapy* 81(9), 1546-64.

Summary of evidence:

Table 3. Description and appraisal of study by Ziviani and colleagues (2001).

Objective of study:
To examine the concurrent validity of the Functional Independence Measure for Children (WeeFIM) with the Pediatric Evaluation of Disability Inventory (PEDI).

Sample:
The specific type of sampling method utilised was not reported, however the authors appear to have used a convenience consecutive sampling method. A sample population of 41 children with acquired brain injuries and developmental disabilities receiving inpatient and outpatient services at a Brisbane paediatric rehabilitation unit were recruited. The sample consisted of 21 boys and 20 girls with an age range of 1.6 years to 9.5 years (mean = 6.4 years). The common medical diagnosis of the sample were reported to be acquired brain injury (n= 16), spina bifida (n = 19) and other chromosomal and genetic abnormalities (n = 6). Information about demographics and severity of disability within the sample were not reported.

Assessment tool(s) investigated:
The PEDI is a comprehensive standardised functional assessment of self-care, mobility and social function. The PEDI was used as the gold standard in this study as it was considered to be comprehensive, was developed specifically for children, and had sound psychometric properties. The PEDI has documented inter-rater reliability, and concurrent validity with the BDIST, in children with severe disabilities (Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992).

The WeeFIM (Version 5) is a minimal data set functional performance measure with 18 items assessing the domains of self-care, motor and cognition. The WeeFIM Clinical Guide (1998) reports test-retest and inter-rater reliability for the test. Additionally content validity has been established with the VABS, BDIST and Amount of Assistance Questionnaire (Ottenbacher, Msall, Lyon, Duffy, Ziviani, Granger & Braun, 2000). Both the PEDI and the WeeFIM can be administered by direct observation, interview or a combination of both.

Method:
Two trained raters, an occupational therapist with five years paediatric clinical experience and a physiotherapist with four years experience in adult and paediatric rehabilitation scored the first 20 children to establish inter-rater reliability. Training involved review of the administration manuals and rating protocols for both assessments. This was followed by viewing a training tape and rating two case studies for the WeeFIM. Training in PEDI administration involved practice followed by a peer review of trial assessments. To establish inter-rater reliability one rater provided the instructions whilst both raters scored each of the 20 children. After inter-rater reliability was established, the occupational therapist administered the assessments to the remaining 21 children. Only the scores of the occupational therapist who scored the assessments for all 41 children were included in the final statistical analysis. Both assessments were administered through direct observation in an alternate order on the same day. From the information provided It is unclear if the raters were the children's primary treating therapists or if they had conducted prior assessments with any of the children.

Results:
A high correlation was found between the PEDI self-care subscales and the WeeFIM self-care and sphincter control items (Spearmans rho ≥ .88). The WeeFIM transportation, locomotion and the PEDI mobility subscales were highly correlated (rho≥ .94) and the WeeFIM communication and social cognition items were highly correlated with PEDI social function (rho ≥ .94). The findings demonstrated that the WeeFIM (Version 5) categories, although global in nature and broadly scored, are highly correlated with similar PEDI domains, thus the assessments measure similar constructs. It is unclear whether a ceiling effect occurred for any of the children assessed with the PEDI, as it is not noted how many children in the sample were older than the standardised age range of 6 months to 7.5 years. Version 5 of the WeeFIM used in this study has a standardised age range of 6 months to 18 years.

Authors conclusions:
Most healthcare organisations require an efficient and cost-effective tool for monitoring therapy outcomes and evaluating programs. Due to ease of administration, the WeeFIM may be a more time effective and cost efficient tool for measuring functional ability, than the PEDI.

Reviewer appraisal comments:

- Information regarding sample size and power calculations were not provided. The small convenience sample used in this study may therefore have reduced the clinical significance of the high correlations that were reported.
- The small sample and lack of information provided about the severity of disability limited the generalisability of study findings.
- Two therapists scored the first 20 children to establish inter-rater reliability however only one therapist then completed assessments with the remaining 21 children. Only the results of the therapist who completed all assessments were used in calculating correlations to establish the strength of association between the PEDI domains and WeeFIM items. It is unclear why the second therapist's results were not included.
- Assessments were administered in an alternate order on the same day, with the therapist not blinded to initial assessment data upon administering the second assessment. This may have introduced measurement bias.
- Results were not reported in terms of statistical significance and interpretations of correlation coefficients were not reported which limited use of the results. Analysis of the strength of correlation would have enabled the reader to establish the significance of the results independently.
- The opinions of the therapists included in the study were discussed regarding their tool of preference; this information deviated from the study purpose.

Table 4. Description and appraisal of study by Ottenbacher and colleagues (1999)

Objective of study
Investigated the concurrent validity of the WeeFIM (Version 4) minimal data set functional assessment with two commonly used standardised developmental skills assessments, the VABS and BDIST

Sample:
The sample was recruited from three early childhood educational programs and developmental disabilities rehabilitation centres in Western New York (area not specified). The sample was obtained via third party recruitment whereby parents of children with disabilities were invited to participate through invitations, announcements and notices. The sample population was n = 205 children (133 male and 72 female) with developmental disabilities. Sample mean age was 45.77 months (range = 11 – 87 months, SD = 19.70). The final sample consisted of 71 children from 11 to 31 months, 81 children from 37 to 60 months, and 53 children from 61 to 87 months. Adequate sample demographics were provided, 70% of the sample was white, 31% were African-American, 6% Hispanic, and 3% were other.

A proportional sampling method was used to ensure that children were evenly distributed between the groups assessed with the VABS and BDIST. The proportional sampling plan was based on type and severity of disability, and age. Severity of disability was based on a child's score using standardised developmental assessments administered on admission to the service. Developmental impairments were reported to include cerebral palsy, prematurity, down syndrome, spina bifida, epilepsy and genetic impairments. 33% of the children were described as having mild disability, 51% moderate disability and 16% extreme disability. Information on socioeconomic status was also reported to have been collected but was not reported. No drop outs were reported.

Assessment tool(s) investigated:
The VABS and the BDIST are both widely used paediatric developmental assessments that have been standardised using children with and without disabilities and norm referenced for chronological age (Raggio, Massingale, & Bass, 1994; Glascoe & Byme, 1993).

Method:
All 205 children were assessed using the WeeFIM and were additionally (following proportional sampling method) randomly assigned (via a coin flip) to be assessed by either the VABS or the BDIST. Half of the sample was assessed with the WeeFIM first whilst the other half were administered the developmental assessment tool they were assigned to first. The second assessment was completed within a period of 3 weeks, with effort made to administer the assessment on the same day of the week and at approximately the same time of day. The primary rater collected all the BDIST and VABS data and the majority of the WeeFIM data (number conducted by primary rater not reported). The primary rater was a paediatric nurse with more than twenty years experience working with children with developmental disabilities in rehabilitation. The other raters administering the WeeFIM had a minimum three years experience working with paediatric disabilities. Raters were blinded to each child's health status and scores achieved on previous developmental assessments prior to the initial assessment. The same person (mostly caregivers, in some cases teachers) was interviewed for the second assessment as in the first assessment. Rater training involved review of the WeeFIM administration and rating protocol, viewing of a training tape and completion of rating two case studies (minimum 90% agreement required). It was not reported who read the test scores and analysed the data. Spearman's correlation coefficients for ordinal data were used to determine the strength of the association between scores on the WeeFIM with those on the VABS and BDIST. All total and subscale scores on the WeeFIM were compared with total and subscale scores on the VABS using data from 104 participants and on the BDIST using data from 101 participants.

Results:
The VABS daily living domain was highly correlated with the WeeFIM self-care domain (r= .88), communication domain (r= .81) and total WeeFIM scores (r= .91). The WeeFIM self-care domain was significantly correlated with BDIST adaptive domain (r= .92) and personal domain (r= .82). Total WeeFIM scores were also highly correlated with the BDIST adaptive domain (r= .94) and personal domain (r= .85). Total score correlations between the WeeFIM and both developmental assessments were statistically significant (p< .05). Correlations for total ratings between the WeeFIM and BDIST were r= .92 and for the WeeFIM and VABS r= .89.

Authors conclusions:
The authors concluded that the WeeFIM, BDIST and VABS are measuring similar skill areas. The WeeFIM provides similar basic information to the other more time-consuming developmental assessments. Thus, the WeeFIM may be preferred by non-clinical intervention program stakeholders and individuals involved in a child's care. As correlations for total WeeFIM and all VABS and BDIST subscales were >.70, it is unclear whether specific developmental skills are subsets of task performance in the related WeeFIM constructs. Further research is required to establish the construct validity and responsiveness of the WeeFIM using developmental assessments.

Reviewer appraisal comments:
- Assessment administrators were not blinded to the scores of the first assessment upon administration of the second assessment, which may have introduced measurement bias.
- Although correlations between the total scores of the WeeFIM, VABS and BDIST were significantly correlated, there are inherent difficulties in examining the concurrent validity of a minimal data set functional assessment, with comprehensive developmental skills assessments (Portney & Watkins, 2000). Although the correlations were reported to be statistically significant they should be interpreted cautiously due to conceptual differences between the WeeFIM functional assessment and the VBAS and BDIST developmental assessments.
- As stated by the authors, a comprehensive factor analysis and evaluation of conceptual differences between two types of assessments would be required to properly investigate construct validity of the WeeFIM. Therefore the correlations should be interpreted cautiously as they do not provide information on the magnitude of differences between sets of data, but measure the linear relationships (Portney & Watkins, 2000).

Table 5. Description and appraisal of study by Kothari and colleagues (2003).

Objectives of study:
(1).To determine the congruence of the functional items of a new, unpublished ABI-specific subscale of the PEDI developed by the authors of the study, with the subscales of the generic (published) PEDI.
(2) To determine whether the generic PEDI subscales were responsive to change when used with an ABI inpatient rehabilitation population,
(3) To determine if the new ABI-specific subscales developed by the authors would be more responsive to change than the generic PEDI subscales.

Sample:
A convenience sample of 87 children and adolescents (55 male and 32 female) recovering from brain injury between October 1994 and July 1997 were included in the sample (7 participants were excluded from the initial 94 due to having incomplete PEDI admission and discharge file data). Mean age of the 87 children and adolescents was 9.2 years, SD -= 5.2, range = 1-20years). The sample was obtained via retrospective chart review at Franciscan Children's Hospital and Rehabilitation Centre inpatient service (Boston, Massachusetts). Diagnostic classifications included in the sample included traumatic brain injury (58.6%), seizures (4.6%), brain tumours (13.8%), haemorrhage (9.2%), anoxia (3.4%), and cerebral infarct (2.3%). Basic demographic information was provided. Information about severity of disability within the sample was not included.

Assessment Tool(s) Investigated:
The PEDI was used to assess mobility and self-care domains functional skills and caregiver assistance scales. Previous studies have shown the PEDI to be a reliable measure (Nichols & Case-Smith, 1996; Wright & Boschen, 1992), however the validity of the PEDI for use with an ABI specific population is unknown.

Methods:
The PEDI was administered on admission and within three days of discharge. The PEDI was administered on both occasions by therapists from the child's treating team. The length of time between testing varied. Data was collected retrospectively and analysed by the researchers. Initial PEDI data was used to develop the ABI specific subscale.

Results:
Statistically significant correlations were found between item locations using ABI specific and generic subscales in the functional skills categories, $p < .05$. The functional skills self-care subscale correlation was, r = .87 ($p < .01$).
The relative precision of 1.2 indicated the ABI-specific caregiver assistance self-care subscale was 20% more responsive than the generic subscale for detecting change in functional independence over time. Relative precision was determined by comparing the mean difference between admission and discharge standard scores. This was also demonstrated by an effect size of 0.691 for the ABI specific scale as opposed to 0.584 for the generic subscale.
Paired t-tests indicated that both ABI and generic scales were sensitive to functional change.

Authors conclusions:
The unpublished ABI specific subscale of the PEDI showed only minimal improvement in sensitivity, in comparison to the generic PEDI subscales. Therefore, the PEDI generic subscales can be used to assess functional change in children with ABI.
The differences in item location evident between the generic and ABI-specific self-care and mobility subscales, demonstrated the inherent differences in skill attainment of children with ABI in comparison to children without disabilities. Hence, the ABI-specific subscales may be useful from a clinical perspective for setting treatment goals and predicting functional outcomes in children with ABI.

Reviewer Appraisal Comments

- The PEDI has only been standardised for children up to 7.5 years, however children up to 20 years of age were included in the sample.
- No statistics were provided to indicate sample size required to create a valid ABI measurement scale.
- Inclusion of children from such a wide age range was questionable, as a 15 to 20 year old who sustained an ABI would generally be expected to make greater gains in recovery of self-care skills over a shorter time frame than a three or four year old without this memory of learnt skills. This may have artificially inflated the responsiveness of the PEDI scores.
- It was unclear whether caregiver interview, observation or both were used to conduct the assessments.
- No information was provided regarding whether therapists were blinded or not to the study aims and purpose.
- Primary therapists administering the PEDI were not blind to admission scores when reassessing prior to discharge, nor was it reported how many primary therapists that conducted the initial assessments then reassessed the same child prior to discharge, which may have introduced measurement bias.
- Further analysis needed to be conducted to allow for interpretation of the correlations and provide clinically meaningful information. This further analysis may have included examining the strength of the correlations using a test for statistical significance and a regression analysis to ensure equality of variance (Portney & Watkins, 2000).
- A small sample size may have reduced the statistical significance of the correlations, and caused larger standard error of item estimates.
- The small sample size, single setting limited the generalisability of the study findings.

Implications for practice:

The PEDI has been described as the 'gold standard' of paediatric functional assessment tools as it is considered to be comprehensive and was specifically designed for use with children (Ziviani et al., 2001). The PEDI costs $350AUD and takes approximately 30 minutes to administer. Specialised training is not required to administer the PEDI.

In contrast, the WeeFIM was originally developed from the Functional Independence Measure for adults (FIM) as a means of providing a quick and easy tool for evaluating service outcomes in paediatric populations (WeeFIM clinical guide, 1998). One limitation of the WeeFIM for an Australian population is that there is no formal WeeFIM accreditation process available within Australia. This process is available and required of therapists who use the WeeFIM in the US. According to the website, training takes approximately two hours, and participants are required to complete a short test to become registered.

As the demand for service accountability and evaluation increases, there is need for a single outcome measure that is quick and easy to administer, and which measures individual and service outcomes. The WeeFIM is promising as a tool for evaluating service outcomes, but its psychometric properties need to be more rigorously investigated to ensure its reliability, validity and responsiveness. The PEDI has been more rigorously studied with paediatric populations, including children with ABI, than the WeeFIM. Therefore, the PEDI is currently the assessment of choice for assessing individual outcomes as it is comprehensive and has good psychometric properties demonstrated during its development and by independent researchers. (Ziviani et al., 2001; Kothari et al., 2003).

Preliminary evidence suggests that the WeeFIM measures similar constructs to the PEDI, at an individual client level, but has the advantage of also being suitable as a service evaluation tool because it is quick and easy to administer. However, the preliminary evidence that is currently available should be interpreted cautiously as reduced methodological rigour limits the

generalisability of the evidence. Further research is needed across multiple settings, with more rigorous prospective designs comparing the concurrent validity and responsiveness of both assessments. For example, future studies need to administer and compare outcome data over time with samples, not just at one point in time.

References

Articles critically appraised (Best contributed to answering clinical question and highest level of evidence available)

Level 2b Evidence

1. Kothari, D.H., Haley, S.M., Gill-Body, K.M., & Dumas, H.M. (2003). Measuring functional change in children with acquired brain injury: Comparison of generic and ABI-specific scales using the PEDI. *Physical Therapy*, *83*, 776-785.

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3. Ziviani, J., Ottenbacher, K.J., Shepard, K., Foreman, S., Astbury, W. & Ireland, P. (2001). Concurrent validity of the functional independence measure for children (WeeFIM) and the pediatric evaluation of disability inventory for children with developmental disabilities and acquired brain injury. *Physical and Occupational Therapy in Pediatrics, 21,* 91-101.

Related articles (met inclusion/ exclusion criteria, not critically appraised)

Level 2b Evidence

4. Dumas, H.M., Haley, S.M., Fragala, M.A. & Steva, B.J. (2001). Self-care recovery of children with brain injury: Descriptive analysis using the pediatric evaluation of disability inventory (PEDI) functional classification levels. *Physical and Occupational Therapy in Pediatrics, 21,* 17-27.

5. Ottenbacher, K.J., Msall, M.D., Lyon, R.N., Duffy, L.C., Ziviani, J., Granger, C.V., Braun, S.B., Feidler, R.C. (2000). The WeeFIM instrument: It's utility in detecting change in children with developmental disabilities. *Archives of Physical and Medical Rehabilitation, 81,* 1317-1326.

Relevant articles related to WeeFIM and/ or PEDI

6. Discala, C., Grant C.C., Brooke, M.M., & Gans, B. (1992). Functional outcome in children with traumatic brain injury: Agreement between clinical judgment and the functional independence measure. *American Journal of Physical and Medical Rehabilitation, 71,* 145-148.

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