

Clinical Review of the Pediatric Evaluation of Disability Inventory

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Short Report

Introduction

The Pediatric Evaluation of Disability Inventory (PEDI) is a measure of functional impairment in children. It was developed at the New England Medical Centre Hospitals in Boston, USA, by Haley et al (1992), who have backgrounds including occupational therapy, physical therapy, psychology and computing. The PEDI is a standardised test designed to identify and describe functional impairment in children, monitor progress and be used as an outcome measure to evaluate different therapeutic programmes. This report summarises experiences using the PEDI and the findings following repeat administrations on 10 children with cerebral palsy attending the Bobath Centre for therapy.

The child's current functional performance is measured in the three domains of self-care, mobility and social function. The PEDI includes three measurement scales: 'functional skills', measuring capability to perform tasks; 'caregiver assistance', looking at how much assistance the child typically requires in the same areas; and 'modifications', identifying the equipment used by the child to carry out the tasks. The PEDI is administered by interview using the structured questionnaire provided. The interviewee may be the child's parent/caregiver or a therapist/teacher who knows the child well (Haley et al 1992).

Scores

In each of the functional skills domains, the child is scored as either *capable* of doing or *unable* to do each of the items, 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. The modifications scale records the number of pieces of equipment used to perform the different skills. This scale can assist in monitoring the effect of equipment on independence.

PEDI scores reveal two types of information: normative standard scores (NSS) and scaled scores. NSS can be obtained for children from 6 months to 7 years 6 months. These are based on what children would typically be doing at a particular chronological age, providing an indication of the child's ability in relation to age expectations. NSS have a mean score of 50 for each age-band and a standard deviation of 10. (The standard deviation is a measure of variation within a set of scores. Values are calculated for the amounts that a set of scores deviate from the mean. These are

averaged to give the standard deviation.) The range 30-70, representing two standard deviations above and below the mean, is the area within which 95% of the children in each age-band are expected to fall. Scores outside the 10-90 range provide little normative meaning. NSS can be translated into other formats such as percentiles if required (Haley et al 1992).

Secondly, scaled scores provide an indication of the child's performance along the continuum of relatively easy to relatively difficult items in a particular domain, such as self-care. These do not take into account the age of the child. The scale is from 0 to 100, with higher scores representing increasing levels of functional performance. These scores can be used for the child whose chronological age is above 7 years 6 months but whose capabilities fall below that of a seven-and-a-half-year-old.

A standard error of measurement is provided for all scores, based on the original normative population sample of 412 children. Two standard errors either side of a score provide a confidence interval of 95%. For example, a mobility scaled score of 60 has a standard error of 2.2. There is, therefore, a 95% likelihood that the child's score is in the range from $60.0 \pm (2 \times 2.2)$ or from 55.6 to 64.4. The interpretation of scores over time should take this into account because, unless change exceeds two standard errors, there is uncertainty as to whether it is due to a real alteration in performance (Haley et al 1992).

Method

A retrospective study was carried out on children with a diagnosis of cerebral palsy who attended the Bobath Centre. The PEDI was administered by an occupational therapist interviewing the parent/caregiver and readministration took place between 6 and 9 months later, depending on the date of the annual case review. The first 10 children to have their tests repeated were included in the study.

Results

The PEDI was administered on 30 children and readministered, after a period of 6-9 months, on 10 of these children, representing four different classifications (spastic quadriplegia, spastic diplegia, ataxia and athetoid quadriplegia). The average age was 10 years 2 months

(range 3 years 9 months to 18 years 8 months). Therapy at the Bobath Centre consisted of either one or two fortnight blocks of daily therapy over the year or regular therapy once or twice weekly. It included physiotherapy and/or occupational therapy or speech and language therapy. This was in addition to local provision where children received one or more types of therapy, ranging from once weekly to occasional monitoring.

Scaled scores were obtained for all subjects (Table 1). The group of children was heterogeneous, so no particular trends were anticipated. The scores are related to clinical observations to provide further understanding of the results.

Description of area of dysfunction

The PEDI provided a clear picture of each subject's functional status. This appeared accurate in the light of the therapist's previous observations, but served to enhance knowledge of the child's abilities, the burden on the carer and the areas of difficulty.

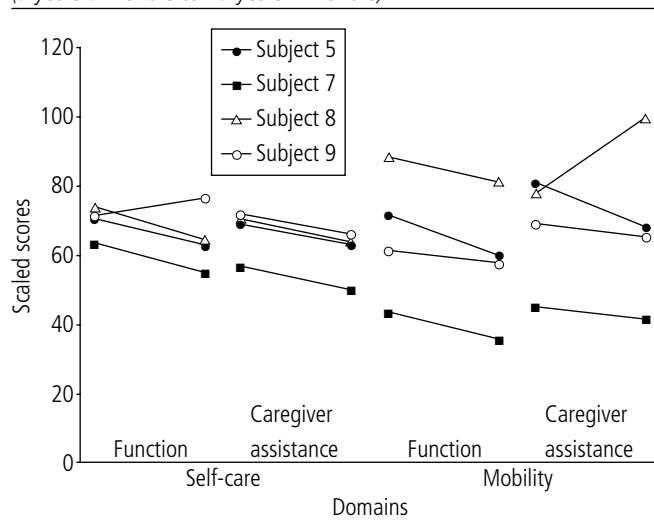
Progress over time

Most of the subjects showed score improvement in some domains and deterioration in others (see Table 1). It is important to remember that a higher score for function indicates an increasing level of functional performance and a higher score for caregiver assistance indicates that the child requires less assistance. Most of the improved scores could be related directly to the areas being addressed in therapy. Subject 4 was working on transfers and dressing and showed improvements in caregiver assistance within the domains of self-care and mobility and also in function within the mobility domain; subject 7 was working on communication skills and showed improvement in the level of caregiver assistance in the social function domain. Subject 1 showed improvement in nearly all the scaled scores, reflecting the acquisition of new skills in the areas being addressed during therapy, namely dressing, play and mobility. However, the normative standard scores (only appropriate for this subject) did not show improvement,

indicating that subject 1 was not maintaining pace with same-age peers (NSS not shown).

The older children with spasticity (subjects 5, 7, 8 and 9) all showed a decrease in function within the mobility domain, with the majority also requiring more assistance with mobility. The majority also showed decreases in the domain of self-care, both in function and in caregiver assistance (see Fig. 1). This reflects the influence of increasing muscle tightness with increasing height and weight. Subject 5, who had multi-level surgery pending for muscle tightness, showed a considerable decrease in functional mobility and also had the largest deterioration in the mobility caregiver assistance score.

Fig. 1. Self-care and mobility domains for older children with spasticity (9 years 3 months to 13 years 4 months)



The PEDI can reflect the impact of using equipment. Subject 2's powered wheelchair was being repaired at the time of the second administration, so adversely affecting her caregiver assistance mobility score. When using the PEDI with children approaching or within adolescence, scores for

Table 1. Scaled scores

Subject number	Age (at time of 2nd test)	Sex	Diagnosis	Function						Caregiver assistance					
				Self-care		Mobility		Social function		Self-care		Mobility		Social function	
				1	2	1	2	1	2	1	2	1	2	1	2
1	3y 9m	M	Sp Di	37	40	57	60	15	32	41	43	57	63	20	20
2	7y 7m	F	Sp Qu	68	58	42	42	82	82	66	62	49	36	90	100
3	7y 8m	M	Sp Di	71	72	65	60	77	77	61	67	60	57	90	77
4	7y 10m	M	Sp Di	68	64	54	57	82	73	63	68	55	67	90	90
5	9y 3m	M	Sp Di	70	63	70	62	82	73	68	65	83	69	100	90
6	10y 2m	M	Ath Qu	57	58	66	56	60	53	52	55	67	56	65	53
7	10y 10m	F	Sp Qu	63	54	44	35	65	63	56	49	47	43	51	83
8	13y 2m	F	Sp Di	74	65	89	83	82	71	71	67	78	100	100	90
9	13y 4m	F	Sp Di	71	75	62	59	100	96	73	68	69	65	100	100
10	18y 8m	F	Ataxic	44	46	45	39	54	51	35	41	43	49	49	51

Sp Di = spastic diplegia; Sp Qu = spastic quadriplegia; Ath Qu = athetoid quadriplegia; 1 = initial test; 2 = retest.

certain items can decrease; this reflects differing interests and priorities, such as increasing school work. For example, subject 9 had lower social function scores on retest because he was no longer carrying out household tasks consistently.

Subject 10 had decreased functional scores in the domains of mobility and social function. This may partly reflect a difficulty with the interviewee's language during assessment because English was not the first language. However, the subject had also increased in weight, making certain tasks more difficult. Some subjects also showed changes in scores which appeared unrelated to clinical observations (see below).

Discussion

The Bobath Centre has piloted the use of the PEDI for the designated uses of describing areas of delay and monitoring change. Familiarity with the manual is essential prior to use, with a need to pay particular attention to the social function performance and caregiver assistance sections because these were found to be the most difficult to score. The PEDI interview takes between 45 to 90 minutes to complete which, along with the interpretation of results and report writing, can make the process time consuming. However, this reduces with increasing familiarity with the test. Each scale is self-contained, therefore a less time-consuming option can be to use only one of the domains. The factors affecting interview time include the interviewee's language comprehension and expression, and emotional and physical wellbeing at interview.

The parents generally responded favourably to the interview and this alone could have many benefits. They were stimulated to think widely about their child's level of functioning and sometimes encouraged to try new activities. It highlighted areas in which the parent was providing assistance where a higher level of independence may have been possible and emphasised the purpose of specialised equipment in facilitating independence. Some interview questions were emotive, such as where the need for equipment had been established but a delay in receiving it was proving frustrating.

In this sample, the PEDI provided an overall picture of the child's abilities and areas of delay, which was supported by clinical observations. The PEDI was also shown to be sensitive to change, as demonstrated in other studies (Dudgeon et al 1994, Case-Smith 1996, Fragala et al 1998). Changes in scores could be linked with clinical observations, such as reflecting specific therapeutic input in an area; the importance of equipment in facilitating independence; the effects of increasing muscle tightness; changes in attitudes influenced by the onset of adolescence; and changes in parental perceptions leading to reducing assistance during tasks or giving opportunities to try new tasks.

Some subjects showed changes in scores which appeared unrelated to clinical observations. The parent interview relies on the perceptions of one person, which is a factor for consideration when attempting to interpret results. Parents

may wish to portray the child in the most positive way when using the PEDI for the first time; for example, subject 2's parent appeared anxious about any 'failed' items at first administration but was less so by second administration. Emphasis *may* be placed on the child's difficulties; for example, subject 3 had a pending legal assessment. It is therefore important to consider the child and family as a whole when seeking to interpret the meaning of the scores. In a study using the PEDI with pre-school children with motor delay, Case-Smith (1995, p650) also commented that 'validity may be affected by parents' interpretation of interview questions and overall impression of the child'. Introducing parents to the form a few days prior to the interview may increase the accuracy of responses and this strategy was supported in correspondence by therapists who have used the PEDI in research (Boschen and Wright 1994).

When reviewing the sample, it is apparent that many of the children showed some scores that deteriorated. Most can be explained by the above discussion and are not unexpected considering the ages of the majority of the sample. It is possible that actual therapy could have contributed to deterioration. However, therapeutic input varied from child to child and was not always focused on an area covered by the PEDI. The aims of therapy included prevention of deterioration and maintenance of existing skills, as well as acquisition of new skills. Therefore, no firm conclusions can be made regarding the effects of therapeutic input. If seeking to use the PEDI as a therapeutic outcome measure, it is vital to ensure that its remit covers the area in which therapy is focused.

Conclusion

This study shows that the PEDI is a useful tool for the therapist wishing to describe the area of functional delay in children with cerebral palsy. It also appeared sensitive to changes which were observed clinically, but more investigation is needed into the overall sensitivity of the test over various time scales and with children with differing disabilities. Relating the PEDI results to knowledge of the child's postural tone and patterns of movement (Mayston 1992) and other standardised assessments such as the Gross Motor Function Measure (Russell et al 1989) may contribute to a fuller understanding of the child as a whole and his or her functional ability.

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