Measuring Physical Disablement: The Contextual Challenge
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Measuring Physical Disablement: The Contextual Challenge

Context is a fundamental consideration in physical therapy assessment and in the interpretation of physical disablement. Specification of context may include physical requirements of a task such as the demands for speed or a specific degree of accuracy, or the social context in which an activity is performed such as dressing for work versus dressing for leisure activities. Context also encompasses individual factors such as the importance of particular activities within the person's culture or value system, or the specific types of roles requiring physical functioning that a person resumes upon discharge from physical therapy. Data are presented to illustrate the differences in performance across related physical tasks and between self-care and mobility tasks in home and school settings in children with severe functional delays. These data highlight the potential impact of context on performance. Implications for future development of functional assessments are discussed, particularly in light of the importance of incorporating contextual information in the clinical interpretation of disablement outcomes for patient groups and individual patients. [Haley SM, Coster WJ, Binda-Sundberg K. Measuring physical disablement: the contextual challenge. Phys Ther. 1994;74:443-451.]

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Disability models have been proposed as an organizing structure for physical therapy diagnoses1 and as a framework for a comprehensive physical therapy assessment across multiple outcome domains.2,3 A major purpose of the disablement models is to help identify the various within-person and external factors that play a role in the manifestations of disability. Inherent within the progression of the levels of disablement (from within-person factors at the organ and impairment levels to external factors influencing functional limitations and disability) is the essential relationship between the person and the person's environment. This emphasis on the interaction of the person and the context in which a person fulfills his or her daily roles is a major tenet of the disablement framework, yet context generally has not been incorporated into routine clinical assessment or outcomes research in physical therapy. The purpose of this article is to highlight the relevance of context in physical therapy clinical assessment and in the interpretation of disablement outcomes, both for patient groups and for individual patients.

Context and the Measurement of Physical Disablement

When the physical therapist asks a parent of a child with physical disabilities about the child's typical performance in the task of ambulating 15.2 m (50 ft), he or she is likely to receive an answer such as "it depends." As the parent so aptly reports, the child's performance frequently depends on the particular surface for walking (eg, recently waxed linoleum; thick, plush carpet; or uneven sur-
faces outdoors), the setting (eg, home, school, or community), and the social context in which the child has chosen to move 15.2 m (eg, to greet dad when he comes home from work, to participate in play activities with friends, or when going to bed). Similarly, it is intriguing how often a physical therapist will assess a patient as “independent” in ambulation while in the hospital setting, yet the patient upon returning home may be unsafe in ambulating in a crowded home environment where there are considerable obstacles and alterations in floor surfaces. These examples emphasize the importance of the specification of context and the need to understand the person-environment interaction when setting treatment goals and interpreting outcomes in physical therapy.

Person-environment interaction is a recurrent theme in disablment models. In the original model of disablement developed by Nagi, disability was defined as a limitation in performing social roles within particular sociocultural and physical environments. The World Health Organization (WHO), through its model of disablement defined in the International Classification of Impairments, Disabilities, and Handicaps (ICIDH), encourages the interrelated specification of the environment and the capabilities of the individual. For example, in the ICIDH model, a person with the same level of physical impairment may or may not have a disability in using a toilet, depending on whether the toilet is accessible to the person on the same floor or only on adjacent floors. In the WHO model, the relevance of social context is particularly emphasized for the handicap level of disablement, which involves restriction in performance of roles required or expected within the person’s culture. The disablement model proposed by the Institute of Medicine defines disability as “the expression of a physical or mental limitation in a social context—the gap between a person’s capabilities and the demands of the environment.”

In our own work in the conceptualization and development of functional assessments for young children, we have identified context, especially as it interacts with developmental factors, as a primary consideration in the measurement of childhood disability. Thus, in all of these disablement schemes, the presence of disability is characterized as a function of both individual characteristics and the contextual demands and supports in the relevant environments.

It is important to emphasize that context is an important issue in the clinical measurement of disablement at multiple levels. Although context may have the most profound impact at the level of handicap (as defined in the WHO classification), context is nevertheless a basic consideration by the physical therapist in the assessment of almost all facets of functional limitations and disability. For example, the performance of a transfer from a sitting to a standing position may be influenced by the height of the chair, the ability to walk outdoors may be affected by the consistency of the terrain. Although the level of “handicap” is often portrayed as measurement at the “social” level and disability at the “person” level, no physical activity or task is strictly devoid of environmental factors or social context. In many situations that a physical therapist may encounter, a person’s unique level of physical ability and the person’s particular physical and social environments interact to define “genuine” levels of functional limitations and disability for that person in his or her relevant contexts.

The importance of context as a component of the clinical assessment of physical disability is not a new concept. In the early 1980s, a progressive model of assessment was proposed by Brown et al. Their integrated system, entitled “Rehabilitation Indicators,” explicitly recognized the prominence of the person’s environment as the important setting for assessing rehabilitation outcomes. Rather than viewing functional performance as an abstract set of skills, unrelated to the environment in which the person lived, worked, or attended school, they identified measures of behavioral functioning within different environments. Status Indicators (identification of the person’s place in the sociocultural environment) and Activity Pattern Indicators (typical patterns of activities) were developed. These two tools document the person’s daily activities in areas of mobility, activity level, community involvement, and social/recreational participation. More recently in the rehabilitation literature, authors have recognized the need for the measurement of functional behaviors in a variety of relevant environments. Support for this ecological view of rehabilitation outcomes and the potential differences in “actual” functioning across settings has been demonstrated in adult patients with hemiplegia and rheumatoid arthritis, for whom declines in functional performance between rehabilitation clinic and home setting have been a consistent finding. Similarly, studies with children have reported difficulties in the generalization of competencies acquired in a specialized setting to a more typical environment.

Interestingly, the field of psychology has also seen a resurgence of interest in the influence of context on task performance during the past decade. Drawing on the work of Gibson, Vygotsky, and others, a number of developmental psychologists have argued forcefully that the social and physical contexts are always active influences on a child’s activity. Thus, the child’s competencies cannot be treated as abstract entities that reside within the child and function in the same way regardless of the kind of problem the child encounters. Fetter has discussed the relevance of these concepts to physical therapy, particularly Gibson’s concept of affordance. This concept emphasizes that the human organism is designed to meet the challenges and tasks posed by the typical human environment. Thus, movement is best thought of as a response organized to meet a desired goal in a manner attuned to the particular physical and social characteristics of the context.
Rogoff and other developmental psychologists have expanded the discussion of context by focusing on the extent to which social and cultural aspects of the context also may be involved in functional task performance, particularly when new tasks are being mastered. Among other themes, this work has highlighted the extent to which performance of required or necessary tasks is always embedded in a social context that stipulates the physical demands and materials for the task, the form and amount of guidance provided, and the cultural value and meaning of the task. Although the overt efforts by parents to structure the tasks and environment of young children are the most obvious examples of this contextual support, Dunn and Law have emphasized that adults (both nondisabled and disabled) are also engaged in continuous efforts to create physical and social environments that will support the accomplishment of their chosen activities.

In related work, Gentile has proposed a taxonomy of motor skill acquisition that emphasizes the consequence of physical task demands on motor learning and performance. This taxonomy identifies relevant task and environmental characteristics that influence the performance of motor skills. For example, contextual characteristics such as a variable support surface (walking on uneven surfaces on which every step is different) impose different demands on the motor system than consistent support surfaces (walking on a level, predictable surface). Because of the varying physical and social demands of different contexts, it is argued that it may not be valid to assume that the physical assessment of the child or adult in one context is indicative of how he or she will perform in other contexts. Rather than focusing primarily at the level of handicap, Gentile's work particularly emphasizes the impact of context on physical tasks and activities (physical disablenment: levels of functional limitations and disability).

The importance of context and the assessment of function within the patient's relevant environments are identified as major themes in a recent special series on functional assessment in the occupational therapy literature. In this series, Dunn emphasizes the importance of context in the assessment of functional performance. She argues, “We must realign our thinking to ensure that our routine actions in practice and research demonstrate our strong commitment to contextually relevant performance.” Dunn also expresses concern that therapists often create simple, contrived tasks as part of a functional assessment battery, when the assessment of the real-life tasks would be more relevant and informative. Further, she calls for the development of contextually based evaluation tools, including patient-report measures and observational scales of functional performance in context.

**Context and the Purpose of Assessment**

Contextual specification is meaningful both in assessments focused on group analyses and for individual clinical assessment. The incorporation of contextual elements is perhaps most significant in clinical assessment situations that are focused on an individual's pattern of functional performance. Additional detail specifying context supports the goal of identifying how a patient performs across related tasks and settings, defines points of intervention in relevant contexts and environments, and may demonstrate progress in reducing disability across environments and different social situations. A high degree of contextual detail, however, may be viewed as irrelevant and unnecessary if the purposes of assessment are to aggregate information across very large groups of patients or to measure only gross approximations of functional capability. For example, many physical functioning outcome measures in rehabilitation medicine and in health status research have been designed to assess groups of patients, and may regard the specification of context as an unessential element of assessment.

To illustrate, the criterion for independence on the locomotion item of the Functional Independence Measure (FIM) is the ability to walk a minimum of 45.7 m (150 ft) without an assistive device. For very large studies of global functional status, this lack of contextual specification may be inappropriate, because group measures are not designed to assess individual-specific differences. For an individual patient, however, the distinctive contexts in which ambulation takes place are not specified. If a person performs differently in indoor versus outdoor ambulation, or is able to ambulate in unobstructed environments but not in crowded hallways or on uneven surfaces, then information about the variability of the individual's functional performance in different contexts is not obtained. Detailed contextual information becomes imperative for clinical assessment at the individual level, especially for persons with severe physical disabilities, persons who have difficulty performing consistently across varying contexts, or persons who use alternative means to achieve functional mobility (such as with the use of a wheelchair). If the physical therapist has reason to believe that different environments or varying task requirements will have a strong influence on individual performance, and detailed information for identifying status or change in an individual within and between settings is important, then he or she needs an assessment that includes a strong contextual framework. We believe that an individual assessment of disability needs to include all relevant environments and examine functional performance in the multiple tasks and activities that encompass the person's essential life roles. According to Christiansen,

It is possible that clinicians must be prepared to accept assessment approaches with greater costs in exchange for information of greater value that will lead to increased efficiencies in intervention.
**Context in Pediatric Functional Assessment**

To illustrate the importance of building context into functional assessment, we present some preliminary data from our work with the Pediatric Evaluation of Disability Inventory (PEDI).27 The PEDI is a comprehensive clinical assessment that samples key functional behaviors in children from the ages of 6 months to 7.5 years. Although primarily designed for the functional evaluation of young children, the PEDI can be used for the evaluation of older children if their functional abilities fall below that expected of typically developing children up through the age of 7.5 years. The PEDI can be administered by the physical therapist who is familiar with the child, or by structured interview and parent report. The intent of the PEDI is to gather information regarding the child’s typical performance in his or her relevant environments. The PEDI consists of two major dimensions—functional skills scales and caregiver assistance scales—in the content domains of self-care, mobility, and social function. The performance of functional tasks and activities is measured by the functional skills scales, which sample a set of behaviors that are believed to be important for daily functioning. The amount of help required to accomplish daily tasks is measured by the caregiver assistance scales. In this article, for illustrative purposes, we will present data from the functional skills mobility scale to demonstrate the importance of context in task demands and from the caregiver assistance self-care and mobility scales to demonstrate the influence of context across home and educational settings.

Normative data from 412 typically developing children between the ages of 6 months and 7.5 years are presented. Details of the specific sampling strategy and the representativeness of the standardization sample to a regional and national population are provided in the PEDI manual.27 Clinical data are reported from 24 children (ages 3-10 years) with severe disabilities who attend a day-school program housed within a pediatric rehabilitation center. The PEDI data were obtained from the rehabilitation team (consisting of a physical therapist, an occupational therapist, a speech therapist, and an educator) within the day school. Concurrent PEDI data were also obtained independently via structured interview from parents. Using a Rasch Item-Response Theory (IRT) analysis,28 we developed a hierarchical scale of item difficulty based on the responses of each sample (see Appendix for further details about the Rasch IRT analysis). Based on a 0-to-100 scale, items that were relatively easy were given a low score, whereas more difficult items were given a relatively high score.

Table 1 depicts the differences in task difficulty for the nondisabled and disabled groups for a sample of transfer tasks on the PEDI functional skills mobility scale. Note the roughly similar hierarchical pattern of item difficulties between the two groups and the considerable differences in difficulty across the transfer tasks. In both groups, there is a large difference in task difficulty between the items “gets in and out of adult chair” and “gets in and off of adult toilet.” This difference strongly suggests that important task information for an individual child would be lost if contextual information regarding transfer tasks is not specified.

Table 2 presents pairs of locomotion tasks for children with and without disabilities. In the first pair, differences in difficulty between the items “moves within a room” and “moves between rooms” are noted for both samples. A somewhat larger difference is noted in children with disabilities, which may reflect the increased difficulty for the children in wheelchairs to manage thresholds and get through doorways. Indoor locomotion, as expected, was an easier task for both groups than locomotion outdoors. A difference in the consistency of the outdoor surface (level versus rough) also made a noticeable difference in task difficulty in both groups of children.

Collectively, these preliminary data suggest that the task requirements of various transfer and locomotion skills do make a difference in the performance of typically developing young children.

| **Table 1.** Context in Transfers: Items on the Pediatric Evaluation of Disability Inventory Functional Skills Mobility Scale |
|-------------------|---------------|---------------|
| **Item**          | **Non-disabled Children** | **Children With Disabilities** |
| Gets on and off low chair | 44*           | 36            |
| Gets in and out of own bed | 54            | 38            |
| Gets in and out of adult chair | 56           | 48            |
| Gets on and off adult toilet | 71           | 62            |
| Gets in and out of car | 88            | 83            |

*Scale values are in logit units transformed to 0-100 scale; as the scale values increase, the item is more difficult.

| **Table 2.** Context in Locomotion: Items on the Pediatric Evaluation of Disability Inventory Functional Skills Mobility Scale |
|-------------------|---------------|---------------|
| **Item**          | **Non-disabled Children** | **Children With Disabilities** |
| Moves within a room | 28*           | 31            |
| Moves between rooms |               |               |
| Walks without support (indoors) | 46           | 48            |
| Walks without support (outdoors) | 49           | 58            |
| Walks on level surfaces | 38           | 43            |
| Walks on rough surfaces | 48           | 52            |

*Scale values are in logit units transformed to 0-100 scale; as the scale values increase, the item is more difficult.
children and children with disabilities. These data indicate it is not advisable to combine all transfer or all locomotion tasks into aggregate items, particularly when focusing on the individual child and his or her performance in a variety of related mobility tasks. Of course, even more contextual information than was given in these examples could be provided to improve the precision of an assessment. There is a point, however, at which gathering an excessive amount of detail would be counterproductive and would impose an unreasonable time burden on the child and the physical therapist. The amount of contextual information provided in an assessment will be influenced by the purpose of the assessment, the goals of intervention, and the time demands placed on the therapist within a particular clinical environment.

In order to examine the effect of the broader context (setting) on the functional performance of children with disabilities, we compared information on the PEDI obtained separately from the rehabilitation team at the school program and from the parents. We asked that the rehabilitation team report on each child's functional performance in the educational setting and that the parents report on the child’s functional performance in home and community settings. Items that were not applicable across settings were dropped from these analyses, including the self-care item “dressing lower body” and the mobility items “bed mobility/transfers” and “tub transfers.” Using the Rasch IRT analytic procedures, we developed plots of centered item calibration estimates for responses from the rehabilitation team and the parents on the child’s need for assistance in seven self-care and five mobility activities. Confidence bands (95% confidence levels) were also drawn in to estimate whether item calibrations were stable between the two settings. Items that deviated less than \pm 2 standard errors (within the 95% confidence bands) were judged to remain reasonably stable between contexts; items outside the confidence bands were judged to be unstable between contexts. Item calibrations were obtained using BIGSTEPS, a Rasch computer program, and recorded using SYSTAT software. Control lines were then calculated by a supplementary macro program. Because the sample size was relatively small for a stable solution (N=24), the item standard errors were relatively large, which served to enlarge the region of the confidence bands.

In Figures 1 and 2, the item calibrations from the parent responses are graphed along the y-axis, and the responses from the rehabilitation team are graphed along the x-axis. As item calibration values approximate 100, items require less amounts of assistance; as items approach 0, more assistance is required. Thus, item-points above the centered line indicate that the parents felt the children needed less assistance at home in that item than the rehabilitation team felt was necessary at school; item-points below the centered line indicate that the rehabilitation team felt the children (as a group) needed less assistance in school in that item than the parents gave the children at home.

Only one of the seven self-care items was outside of the 95% confidence bands; another item was on the confidence line. Both items pertain to

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**Figure 1.** Effect of setting on self-care items.
bowel and bladder function. These item-points' position below the centered line indicate that (as a group) more assistance was given to the children in managing bowel and bladder control at home than in school. One possible interpretation of these differences is that the more regulated structure in school created less need for assistance with bowel and bladder management as compared with at home. The average item calibrations for items “eating” (a meal), “grooming” (including combing hair and caring for nose), “bathing” (including washing and drying hands and face), and “toileting” (including toilet management and hygiene) were relatively stable across home and school settings.

Two of the five mobility items were outside of the 95% confidence bands. The item “stairs,” which addresses the amount of assistance needed to climb and descend a full flight of stairs, was below the centered line, indicating that, as a group, more assistance was given to the children in managing stairs at home than in school. The item “indoor locomotion” was above the centered line, indicating that more assistance was given at school for indoor locomotion of 15.2 m than at home. The item “car transfers” was on the 95% confidence line. The position of this item below the centered line suggests that car transfers tend to require more assistance at home than at school. Interpretation of these differences requires additional information about the specific environments at home and school. Among possible factors influencing the level of assistance provided in the two settings may be liability issues around safety at school, greater time pressure for mobility at school, presence of obstacles impeding free movement at school, and potential differences in the vehicles used for transportation to school and at home.

In general, these preliminary results indicate that the amount of assistance needed for certain functional activities in this group of children with severe disabilities is relatively stable across settings. Although the group analyses indicated similar patterns of assistance given to most of the activities across school and home settings, inspection of the raw data indicates that a number of children did function differently across settings. These differences were most apparent in the toileting, car transfer, and stair items. The group differences were most likely due to a combination of differing physical task requirements between settings (eg, transfers to a school van or bus versus the family car) and different social expectations (eg, bowel and bladder function). For the physical therapist, these contextual differences are important considerations in group analyses (such as for program evaluation or outcome studies) and for treatment planning and assessing progress in functional skill development over time in individual children. The results support the contention that context is an important consideration at the group level, particularly for certain types of functional activities. Furthermore, function for many individual patients may best be described in a contextual framework rather than as a general abstraction of capability that can be generalized across many tasks and settings.

**Building Context into Functional Assessment**

Much of the discussion to date on disablement outcomes has been directed toward the analysis and comparison of outcomes across the different levels of the model (impairment, functional limitations, disability, and
so on). Much less emphasis has been placed on the assessment of disability across settings or on how the environment affects physical and role function. Based on the data presented and other analyses of the PEDI database, we have recognized the need to develop functional assessments for specific contexts. For example, Table 3 illustrates how the content emphasis of functional items may differ across home and school settings. We have recently received funding from the National Institute on Disability and Rehabilitation Research to develop a new assessment for use in an educational setting that will incorporate the most important contextual elements of functional performance in a school environment.

Another, very sophisticated approach to embedding context into functional assessment is exemplified by the work of Fisher. In the Assessment of Motor and Process Skills (AMPS), Fisher uses a many-faceted Rasch method to create a common scale for over 50 instrumental activity of daily living tasks. Based on standardization data, each task has been calibrated along the scale according to its motor skill and motor process challenge. Persons who are evaluated on the AMPS select three items from different levels of difficulty to perform. This choice allows each person to select an activity relevant in his or her environment, and avoids testing that places the person in a contrived situation or requires the person to perform a task that has no relevance to his or her chosen setting or roles. Fisher’s innovative work is a direct application of tailored or adaptive testing, in which items can be adapted to the individual’s context and ability level. This type of assessment approach has great promise in physical therapy, because it may serve to make assessments more relevant to the person, and perhaps to other interested audiences such as payors. While still providing precise estimates of functional performance, tailored tests of physical functioning could be streamlined because irrelevant tasks and items not related to the person’s ability or context are simply not administered.

A prototype of a clinical outcomes system for inpatient and outpatient rehabilitation is currently being pilot tested at New England Rehabilitation Hospital, Woburn, Mass. The intent of the system is to facilitate the collection of relevant contextual information in the routine assessment of individual patients, while still maintaining the ability to aggregate important group data. To illustrate, we have provided an example (Tab. 4) of the locomotion item that integrates information on context (specific setting and task requirements), level (type of locomotion), distance, devices, and assistance. This information is gathered along with the standard FIM score. In the example in Table 4, the patient is ambulating 45.7 m (unobstructed, level surface indoors in a straight line) using a walker and requiring only supervision (FIM score of 5). In the patient’s hospital room (task requirements of moving around obstacles), however, the patient uses a straight cane (the walker is too bulky for safe use) and is currently ambulating about 3 m (10 ft) with moderate physical assistance.

In our example, context is a very important factor in the actual performance, and in this case, it also has an impact on the type of assistive device used. At the individual level, changes in locomotion function may be identified by performance changes in context, level of locomotion, distance, devices, caregiver assistance, or combinations of all these variables. In our experience, we have found the context element to be an important consideration in defining meaningful progress and in determining whether patients are able to use developing locomotor skill to solve problems they encounter in contexts that provide additional challenges. Because of the possibility that lengths of physical therapy episodes of care will continue to decrease, the contextual emphasis has helped the physical therapy staff to focus intervention on the most relevant functional competencies in order for the patient to return to his or her environment and maintain as much independence in mobility (across all relevant contexts) as possible.

**Conclusion**

The disablement models portray context and person-environment interaction as essential elements in the actualization of disability for patient groups and for individuals. Although consideration of context helps to more clearly delineate functional outcomes, it may also serve to complicate outcome analyses and individ-
To incorporate major physical and social context into clinical data collection procedures that measure all relevant contextual elements, (2) tests that measure function in specific settings, (3) flexible tests in which only context-relevant content is measured, and (4) clinical data collection procedures that measure all relevant contextual elements. Further research is needed to help define the relevance of specific elements of context at multiple levels of the disablement spectrum for group analyses and for individual clinical assessment in physical therapy practice.

References

Appendix. Rasch Item-Response Theory Analysis Methodology

The determinants of varying levels of difficulty among mobility tasks (influence of context) from the Pediatric Evaluation of Disability Inventory (PEDI) and the stability of item calibrations between settings (home versus school) are based on Rasch Item-Response Theory (IRT) methodology.

The Rasch IRT methodology builds hierarchical scales by placing items along a continuum based on the probabilities of persons at various levels of ability indicating capability on a particular item. Using a maximum-likelihood mathematical procedure, the matching of item and person locations is performed by an estimation technique utilized by a Rasch model computer program. Estimates of item locations (calibrations) along a common measurement continuum define the hierarchical order of the items. Item calibrations are expressed in log-odd units (logits) that are positioned along the hierarchical scale. A logit is defined mathematically as the natural log of an odds ratio. An odds ratio for an item is the level of performance of the item in relation to the performance of the total set of items. The transformation of item counts to odds ratios usually yields logits ranging from −4 to +4. In these analyses, logits were converted to a 0 to 100 metric, with scaled values of greater magnitude representing increasing item difficulty. The hierarchical order and spacing between items can be inspected as to their theoretical and clinical usefulness for describing the construct (physical mobility) of interest. In the data reported in the article, larger scale values reflect the increasing level of difficulty of the item, representing the effect of different contexts on performance.

The stability of item calibrations across settings was examined by plotting the paired calibrations (home reports versus school reports) with associated confidence intervals based on ±2 standard errors of the item calibrations. As in this analysis, original logits were transformed to standardized scale values in a 0 to 100 metric, with scaled values of greater magnitude representing increasing item difficulty. Items within the 95% confidence lines represent calibrations that are stable across settings. For these items, the average level of assistance for an item reported to be given by parents and school personnel is not statistically different between settings. Items outside the 95% confidence lines represent differences in average item calibrations that are not likely due to chance variation. For these latter items, setting context appears to have an influence in the amount of assistance provided to the child to accomplish the item.