Early Intervention Service Eligibility: Implications of Using the Peabody Developmental Motor Scales

Kimberly Van Den Wymelenberg, Jean Crosetto Deitz, Susan Wendel, Deborah Kartin

OBJECTIVE. Occupational therapists, as members of early intervention (EI) teams, are responsible for contributing to equitable decision making regarding service eligibility. Because the two editions of the Peabody Developmental Motor Scales (PDMS) are often used in this process, it is important to study these measures. Therefore, the purpose of this study was to examine the implications of using different editions of the PDMS (PDMS versus PDMS-2) and different types of scores (standard deviation versus percent delay) when determining children's eligibility for EI.

METHOD. With testing order counterbalanced, 30 candidates for EI evaluation, between 11 months and 34 months corrected age, were tested using both the PDMS and the PDMS-2.

RESULTS. Support for EI eligibility often differed depending on the edition of the PDMS used and the type of score used. When the PDMS was used, as opposed to the PDMS-2, disagreements occurred 23% to 43% of the time. For all disagreements, scores on the PDMS supported EI eligibility, whereas scores on the PDMS-2 did not. When support for service eligibility was compared using percent delay scores versus standard deviation scores, disagreements occurred more often for the PDMS (Gross Motor: 17%; Fine Motor: 23%) than for the PDMS-2 (Gross Motor: 7%; Fine Motor: 3%).

CONCLUSIONS. It is important that occupational therapists within a facility, and ideally within a state, identify a single test edition to use as part of the process for determining EI eligibility. Also, if standard scores and percent delay scores point to conflicting decisions (eligibility vs. noneligibility), further evaluation and greater reliance on clinical judgment are advised.
similar results, it is possible for service decision inequities to occur for children served in different states or in different settings within the same state (Shackelford, 2005).

As part of the process of determining eligibility for EI services, occupational therapists often evaluate motor development using standardized tests. In some cases, children have delays only in the motor domain and thus their performances on measures of motor development are key in determining eligibility for services. Since 1983, the Peabody Developmental Motor Scales (PDMS) has been one of the few standardized tests available to evaluate the motor development of young children (Folio & Fewell, 1983). Two studies provide support for the concurrent validity of the PDMS, with other assessments including the Bayley Scales of Infant Development (Palisano, 1986) and the Pediatric Evaluation of Disability Inventory (Nichols & Case-Smith, 1996). A third study, using a sample of 38 2-year-old Native American children, provided support for the concurrent validity of the PDMS and the Bayley Scales of Infant Development II Motor Scale for age-equivalent scores, but not for standard scores (Provost, Crowe, & McClain, 2000). In addition, there was poor agreement between the two tests for the classifications of significantly delayed, mildly delayed, and within normal limits (Provost et al., 2000). In 2000, a second edition of the PDMS, the PDMS-2 (Folio & Fewell), was made available. Research, using a sample of 30 children from 1 month to 11 months of age, supports high concurrent validity between the PDMS and the PDMS-2 with Pearson product-moment correlation coefficients of .84 for fine motor and .91 for gross motor (Folio & Fewell, 2000). However, with the Pearson product-moment correlation coefficient, it is possible for children to score consistently higher on one measure than the other and still have a high correlation between the two measures. Therefore, in order to understand how using one test as opposed to another influences score agreement and ultimately clinical decision making, a different type of study is needed.

Though many occupational therapists use the PDMS-2, others have anecdotally reported choosing the PDMS over the PDMS-2. They reported believing that, when the PDMS is used, children more often earn scores supporting qualification for EI services and that these results are more in line with their clinical judgments. Because occupational therapists are using both editions of the PDMS and some have expressed concerns, research involving the two test editions of the PDMS is needed to assist therapists in understanding what differences exist between the first and second editions and the possible implications these differences may have for practice.

In addition to possible inconsistencies resulting from use of different editions of a test, Shackelford (2005) noted that there are inconsistencies among states with regard to the methods used to determine eligibility for EI services. Some states allow for clinical judgment to serve as all or part of the EI eligibility criteria. However, the majority of states rely on standard deviation scores (derived from a standardized test) or percent delay scores (calculated from the age-equivalency score obtained from a standardized test) (Shackelford, 2005). When this is done with either version of the PDMS, there may be inconsistencies in findings related to EI eligibility. Therefore, in addition to research focusing on implications of using different versions of the PDMS, research is needed that focuses on the implications of using different types of scores when using these measures as part of the process of determining eligibility for EI services for children younger than 36 months of age.

Thus, the purpose of this study was to examine the implications, when determining eligibility for EI services, of using scores from two different editions of the PDMS and of using different types of scores from the same test edition. Specifically, each of the following questions was addressed two times, once for gross motor scores and once for fine motor scores.

1. To what extent do scores from the PDMS-2 agree with scores from the PDMS?
2. To what extent do PDMS-2 scores and PDMS scores agree on eligibility status for EI services?
3. To what extent do standard deviation scores and percent delay scores within one test edition agree on eligibility status for EI services? This was examined for each edition of the PDMS.

Method

Participants

After approval from the University of Washington Institutional Review Board Human Subjects Review Committee, care providers of children from two EI centers in Washington State were contacted regarding the study. To be eligible for the study, children needed to be at least 12 months of age but younger than 36 months chronological age. In addition, all children had to meet the following inclusion criteria: (a) the child’s parent or guardian agreed to have his or her child participate in the study; and (b) an evaluation was indicated to determine eligibility for initial enrollment in EI services, or alternatively, if the child was currently enrolled in EI services, a reevaluation was indicated as determined by the child’s therapist. Children were ineligible to participate in the study if (a) the child had severe disabilities, such that the child was obviously significantly delayed (i.e., 9 months to 14 months corrected age,
child did not have head control in supported sitting; 15 months to 22 months corrected age, child did not sit independently for at least 1 or 2 seconds; 23 months to 28 months corrected age, child did not stand when holding onto support or furniture; 29 months to 35 months corrected age, child did not independently stand for 2 to 3 seconds); (b) the child used adaptive equipment for mobility (e.g., wheelchair); (c) the child had an injury that would impede engagement in gross motor or fine motor tasks (e.g., recent hip surgery, so that function was restricted by a cast or splint); or (d) the child had a severe vision deficit so that imitating a person’s gesture or a block formation was compromised (e.g., blindness).

Procedures

Brief and scripted introductory information about the study was provided to the child’s parent or guardian by one of two persons: the staff person at the facility who received the child’s initial referral or the child’s occupational therapist who provided the child’s ongoing therapy services. If the parent or guardian agreed to have his or her child participate in the study, a screening and child demographic questionnaire was administered via phone.

If the child met the established inclusion criteria, two appointments were scheduled no more than 7 days apart at a day and time that was mutually agreeable. When determining which test (PDMS or PDMS-2) was administered to the child first, random assignment in blocks of 10 without replacement was used. This was done so that each test in the study was administered first an equal number of times, thus avoiding order bias.

In an attempt to control for developmental maturation, the interval between the test administrations was no more than 7 days. An effort was made to schedule the appointments at the same time of day to avoid performance variation based on time of day. The appointments took place at the child’s home or at an EI center, whichever was most comfortable and convenient for the parent or guardian. For consistency, the two appointments took place at the same location. Each appointment lasted between 45 and 90 min.

One occupational therapist, with post-professional training in the administration of pediatric standardized motor tests, conducted all of the test administrations for the study. A second occupational therapist, with more than 20 years of experience administering pediatric standardized tests, established interrater agreement with the first therapist. Interrater point-by-point percent agreement of at least 85% on both the PDMS and the PDMS-2 was attained before beginning the study. Interrater agreement was checked after approximately every 10th child and ranged from 85% to 100% (mean = 92%). In addition, a third occupational therapist rescored one third of the test protocols to ensure accurate scoring. In all but one instance, the scoring was identical. In the one instance in which there was an inconsistency, a correction was made.

For both the PDMS-2 and the PDMS, the Gross Motor Scale and Fine Motor Scale were administered to each child participating in the study. The Fine Motor Scale was administered first. As is done in standard practice, to maximize a child’s attention or to be responsive to a child’s behavioral needs, the examiner sometimes switched to the Gross Motor Scale before completing the Fine Motor Scale, and later returned to complete the Fine Motor Scale. The assessments were administered and scored according to the corresponding test manual instructions. If the child was born prematurely (less than or equal to 36 weeks of gestation), the child’s corrected age was used to determine the standard deviation and age equivalency scores on each test.

Test administration occurred, to the maximum extent possible, in an area free of distraction and with minimal noise. Breaks for the child (determined by the child, the child’s parent, or the examiner) were given as necessary. If the child cried, fussed, lay down, or refused tasks, a break was given.

Results

Participants

Of the 33 children approached to participate in the study, 2 did not participate because of scheduling conflicts and 1 child was lost to follow-up before the second test administration. Thus, data collection was completed for 30 children. These children ranged in age (corrected for prematurity) from 11 months to 34 months (mean = 23 months). Nine of the participants were born prematurely. Half (15) were male and half (15) were female. Relative to ethnicity, 17 were Caucasian, 6 were African American, 3 were Asian or Pacific Islander, 2 were Hispanic, 1 was Middle Eastern, and 1 was Haitian.

Results Relating to the Two Test Editions

The magnitudes of difference between standard deviation scores on the PDMS and the PDMS-2 are presented in Table 1. The data show that 43% of the time, for the Gross Motor Scale, the standard deviation scores from the two tests were within 0.5 standard deviations of one another. This result indicates that 57% of the time, standard deviation scores from the two tests differed by 0.5 standard deviations or more on the Gross Motor Scale. For the Fine Motor Scale, 23% of the time the standard deviation scores from the two tests were within 0.5 standard deviations of...
one another. This finding indicates that 77% of the time standard deviation scores from the two tests differed by 0.5 standard deviations or more on the Fine Motor Scale. For both the Gross Motor Scale and the Fine Motor Scale, children typically showed more delay on the PDMS than on the PDMS-2.

The magnitudes of difference between percent delay scores on the PDMS and the PDMS-2 are presented in Table 2. The data show that 23% of the gross motor percent delay scores from the two tests were 5 percentage points or less different from one another, whereas 77% of the gross motor percent delay scores from the two tests were greater than 5 percentage points from one another. For the Fine Motor Scale, 20% of the percent delay scores from the two tests were 5 percentage points or less different from one another, and 80% of the fine motor percent delay scores from the two tests were greater than 5 percentage points from one another. For both the Gross Motor and Fine Motor Scales, children typically showed more delay on the PDMS than on the PDMS-2.

**Test Edition Agreement on Eligibility Status**

Table 3 presents the test edition agreement of eligibility for EI services when using standard deviation scores and percent delay scores. The data show that when standard deviation scores were used, 43% of the time the test editions disagreed on fine motor eligibility status. For the Gross Motor Scale, when percent delay scores were used, 27% of the time the test editions disagreed on whether the child’s score was above or below the 25% criterion; for the Fine Motor Scale, the two test editions disagreed 23% of the time. Note that for all of the disagreements, the scores from the PDMS supported qualification for EI Services, whereas the scores from the PDMS-2 did not support qualification for services.

**Score Agreement on Eligibility Status**

Tables 4 and 5 present the agreement of standard deviation scores and percent delay scores when determining eligibility for EI services when using either the PDMS or the PDMS-2. The PDMS-2 standard deviation scores and percent delay scores were less likely to disagree on eligibility for EI services than PDMS standard deviation scores and percent delay scores.

**Discussion**

Findings of this study show differences in support for eligibility for EI services depending on which PDMS test edition is used (PDMS or PDMS-2) and which type of score is used (standard deviation score or percent delay score). Relative to test edition, both standard deviation scores and percent delay scores tended to show less delay on the

| Table 1. Magnitudes of Difference Between Standard Deviation Scores on the PDMS and PDMS-2 (N = 30) |
|---------------------------------------------------------------|---------------------------------------------------------------|
| PDMS-2 Scores Show More Delay                                   | PDMS Scores Show More Delay                                   |
| Scale | > 2.00 | 1.50–1.99 | 1.00–1.49 | 0.50–0.99 | 0.05–0.49 | None | 0.05–0.49 | 0.50–0.99 | 1.00–1.49 | 1.5–1.99 | > 2.00 |
| Gross Motor          | # of Children | 0 | 0 | 0 | 5 | 2 | 1 | 10 | 5 | 6 | 0 | 1 |
|                     | % of Children | 0 | 0 | 0 | 16.7 | 6.7 | 3.3 | 33.3 | 16.7 | 20.0 | 0.0 | 3.3 |
| Fine Motor           | # of Children | 0 | 0 | 0 | 3 | 0 | 1 | 6 | 6 | 8 | 5 | 1 |
|                     | % of Children | 0 | 0 | 0 | 10.0 | 0.0 | 3.3 | 20.0 | 20.0 | 26.7 | 16.7 | 3.3 |

**Note.** PDMS = Peabody Developmental Motor Scales (Folio & Fewell, 1983, 2000). In some cases children had lower standard deviation scores on the PDMS-2 than on the PDMS because the lowest possible standard deviation score on the PDMS is −2.33, whereas lower standard deviation scores can be reported for the PDMS-2. Thus, for example, one child received standard deviation scores on the PDMS and PDMS-2 of −2.33 and −3.00 respectively.

| Table 2. Magnitudes of Difference Between Percent Delay Scores on the PDMS and PDMS-2 (N = 30) |
|---------------------------------------------------------------|---------------------------------------------------------------|
| PDMS-2 Scores Show More Delay                                   | PDMS Scores Show More Delay                                   |
| Gross Motor          | # of Children | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 6 | 9 | 4 | 1 | 3 |
|                     | % of Children | 0 | 0 | 0 | 0 | 0 | 0 | 6.7 | 6.7 | 10.0 | 20.0 | 30.0 | 13.3 | 3.3 | 10.0 |
| Fine Motor           | # of Children | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 9 | 7 | 3 | 2 | 3 |
|                     | % of Children | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.7 | 13.3 | 30.0 | 23.3 | 10.0 | 6.7 | 10.0 |

PDMS-2 than on the PDMS, suggesting that it is less likely for an infant or toddler to qualify for services on the basis of PDMS-2 test scores than on the basis of PDMS test scores. This was substantiated by results relating to the second research question regarding the extent to which scores on the PDMS-2 and scores on the PDMS agree on eligibility status for EI services. These results indicated that both PDMS supported qualification for EI services and scores from the PDMS-2 did not support qualification. Relative to the third research question, findings indicated that standard deviation scores and percent delay scores within one test edition sometimes disagreed on support for eligibility status for EI services.

The fact that the disagreement rate was so high between the PDMS-2 and PDMS relative to support for EI services is a concern for pediatric occupational therapists, as well as for the children and families with whom they work. These findings corroborate occupational therapists’ anecdotal reports and mean that, for young children referred for evaluation, the scores of children tested with the PDMS are more likely to support qualification for services than the scores of children tested with the PDMS-2. This could result in inequities in decision making. Because it is possible for a child’s eligibility status to be partially dependent on the test edition that the therapist chooses to use, occupational therapists are cautioned to select and use only one edition of the PDMS in their settings. Further, occupational therapists are advised to understand the extent to which these two editions of the PDMS measure differently. The latter is particularly important in situations where a child is initially tested using the PDMS and follow-up testing is done using the PDMS-2. In such a case, it is conceivable that the child might receive a standard score that is more than 1.5 standard deviations below the mean on the PDMS (supporting service eligibility) and on follow-up testing with the PDMS-2 might receive a standard score that is less than 1.5 standard deviations below the mean (not supporting service eligibility). Also, caution is indicated in assuming improvement based on scores when the PDMS is used at initial evaluation and the PDMS-2 is used at follow-up. Instead, the change in scores may be a function of differences in how the two tests measure, part of which may be attributable to differences in their standardization samples (Folio & Fewell, 1983, 2000). There is no mention in the PDMS manual of the inclusion of children with disabilities in the normative sample; whereas, for the PDMS-2, 10% of the normative sample was identified as having speech–language disorders, mental retardation, physical disability, or “other handicap” (Folio & Fewell, 2000, p. 41). Therefore, because the sampling procedures used in the development of these two measures differed substantially, if the purpose of testing is to chart progress, use of the same edition of the PDMS from one time to the next is advised.

Findings of this study also show differences in eligibility status for EI service with regard to the type of score used (standard deviation or percent delay). For example, based on one administration of a single test version, a child’s scores could show a 27% delay (meeting the 25% delay criteria for
support for eligibility) and a standard deviation score of −1.3 (not meeting the −1.5 standard deviations below the mean criteria for support for eligibility). Although, for both the PDMS and the PDMS-2, standard deviation scores and percent delay scores differed from each other relative to support for EI eligibility, this difference was less marked for PDMS-2 scores. Thus, relative to the interchangeable use of standard deviation and percent delay scores, the PDMS-2 is the preferred measure. Even so, occupational therapists are advised to look at both types of scores when determining eligibility for EI services. If one type of score supports EI service eligibility and the other does not, as in the previous example, it is even more important for the occupational therapist to use additional data and his or her clinical judgment to determine whether EI services are warranted for that particular child.

**Strengths and Weaknesses**

This study had several strengths. First, the order in which the two tests editions were administered was randomized so that each edition was administered first an equal number of times, controlling for maturation and possible order effects of testing. Second, the time interval between testing sessions was minimal, reducing the likelihood that differences were because of maturation. Third, the therapist administering all of the tests was trained specifically in test administration and worked in an EI setting. Further, interrater agreement for scoring both tests was high throughout the study. The primary limitation of this study was the small sample, limited to one geographic location.

**Conclusion**

This research clearly demonstrated that occupational therapists often obtain different developmental motor assessment results depending on which edition of the PDMS is used and which type of score is used (standard deviation scores or percent delay scores). This discrepancy has the potential to influence parity in EI service eligibility decisions based on fine motor and gross motor scores. As a result, several recommendations are warranted if occupational therapists plan to use the PDMS or PDMS-2 with young children. First, all therapists in a setting, and ideally within a state, should select only one version of the PDMS and use it consistently when determining EI service eligibility. Second, if differences relative to support for EI service eligibility are noted when standard deviation scores as opposed to percent delay scores are used, then both types of scores should be considered in combination with clinical judgment. Further, this study points to the limitations in all measurement and serves as a caution, reminding occupational therapists that it is important to complement data from standardized tests with additional observations and clinical judgment. Because the PDMS and the PDMS-2 are both also used with preschool and kindergarten children, this study merits replication with these age groups.

**References**


