

Comparative Efficacy of GMFM and PEDI in Assessing Functional Progress in Pediatric Rehabilitation Programs

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Abstract

Background: Accurate assessment of functional improvement is essential in pediatric rehabilitation to guide intervention strategies and clinical decision-making.

Objective: To compare the effectiveness of the Gross Motor Function Measure (GMFM) and the Pediatric Evaluation of Disability Inventory (PEDI) in detecting functional progress among children undergoing rehabilitation.

Methods: A comparative analytical study was conducted on 22 children aged 4–12 years enrolled in a structured rehabilitation program. GMFM and PEDI assessments were administered at baseline and follow-up. Statistical analysis included descriptive statistics, a paired t-test, effect size (Cohen's d), correlation analysis, and regression analysis.

Results: PEDI demonstrated a slightly higher mean score (68.73 ± 6.5) compared to GMFM (65.66 ± 5.44). However, the difference was not statistically significant ($t = 1.56, p = 0.13$). The effect size was small (Cohen's $d = 0.33$), indicating limited clinical significance. Correlation between the outcome measures and functional participation was weak, while regression analysis demonstrated minimal predictive value.

Conclusion: Both GMFM and PEDI demonstrated comparable performance in assessing rehabilitation progress. The findings suggest that combining functional and participation-based assessment tools may provide a more comprehensive evaluation of outcomes in pediatric rehabilitation.

Keywords: Pediatric rehabilitation, GMFM, PEDI, functional assessment, therapy evaluation

Introduction

Pediatric rehabilitation aims to enhance functional abilities, independence, and participation in children with developmental delays or disabilities. Evaluating progress is a fundamental aspect of rehabilitation, as it informs treatment planning, monitors therapeutic effectiveness, and supports evidence-based clinical decision-making (1, 2). Outcome measures provide structured and standardized methods to assess changes in performance; however, their sensitivity, scope, and clinical relevance can vary significantly depending on the domain they assess.

Outcome measurement is widely recognized as a cornerstone of pediatric rehabilitation practice. Functional or impairment-based tools, such as the Gross Motor Function Measure (GMFM), primarily assess changes in motor performance and physical abilities in a controlled clinical setting. External factors have less influence on these measures, making them reliable and stable (6). In contrast, participation-based

tools, such as the Pediatric Evaluation of Disability Inventory (PEDI), evaluate a child’s ability to perform activities and engage in daily life situations, thereby reflecting real-world functioning and social integration (5).

The distinction between impairment-level and participation-level assessments is critical. While impairment-focused measures provide objective data on physical improvements, they may not fully capture how these changes translate into meaningful functional outcomes in everyday environments. Conversely, participation-based measures offer valuable insights into real-life performance but may introduce variability due to contextual influences such as family support, environmental barriers, and caregiver perceptions (4, 6).

Existing literature suggests that no single outcome measure can comprehensively capture all dimensions of rehabilitation progress. Studies have emphasized the importance of combining multiple assessment approaches to improve the accuracy, validity, and clinical relevance of outcome evaluation (5, 7). Such multidimensional assessment strategies align with the biopsychosocial model of health, which recognizes that functional outcomes are influenced by an interaction of physical, environmental, and social factors (4).

Despite these advancements, clinicians continue to face challenges in selecting the most appropriate outcome measures for pediatric rehabilitation. There remains a lack of consensus regarding which tools are most sensitive, clinically meaningful, and practical for routine use. Furthermore, limited comparative research exists examining how different types of outcome measures perform when applied simultaneously within the same clinical population.

Research Gap:

Although both impairment-based and participation-based outcome measures are widely used in pediatric rehabilitation, there is insufficient empirical evidence directly comparing their effectiveness in capturing functional progress within the same intervention framework. In particular, the extent to which these measures differ in sensitivity, clinical relevance, and their relationship with functional participation remains unclear.

Therefore, the present study aims to compare the efficacy of the Gross Motor Function Measure (GMFM) and the Pediatric Evaluation of Disability Inventory (PEDI) in assessing functional progress among children undergoing structured rehabilitation. By examining differences in outcomes, associations with participation, and predictive value, this study seeks to contribute to a more informed selection of assessment tools in pediatric rehabilitation practice.

Conceptual Framework



Figure 1: Conceptual Framework for Outcome Measurement in Rehabilitation

Methodology

Study Design

A comparative analytical study design was employed to evaluate differences between two outcome measures, the Gross Motor Function Measure (GMFM) and the Pediatric Evaluation of Disability Inventory (PEDI), in assessing functional progress among children undergoing rehabilitation.

Participants

A total of 22 children enrolled in a structured pediatric rehabilitation program were included in the study. Participants were recruited from a clinical rehabilitation setting based on predefined eligibility criteria.

Inclusion Criteria

- Children aged between 4 and 12 years
- Diagnosed with developmental delay or functional impairment
- Enrolled in a structured rehabilitation program
- Completion of both baseline and follow-up assessments

Exclusion Criteria

- Severe cognitive or behavioral limitations interfering with assessment procedures
- Irregular attendance in therapy sessions
- Incomplete or missing assessment data

Outcome Measures

Functional motor performance was assessed using the Gross Motor Function Measure (GMFM), a standardized tool designed to evaluate changes in gross motor abilities. Functional independence and participation were assessed using the Pediatric Evaluation of Disability Inventory (PEDI), which measures a child's capability and performance in daily life activities.

Intervention Protocol

The rehabilitation program was conducted over a period of **12 weeks** with a structured multimodal approach integrating sensory-motor and functional training principles.

Overall Therapy Dosage

- **Frequency:** 3 sessions per week
- **Duration per session:** 45–60 minutes
- **Total intervention dose:** Approximately 36 sessions over 12 weeks
- **Intensity:** Moderate, individualized based on child tolerance, attention span, and fatigue level
- **Progression:** Gradual increase in task complexity, duration of engagement, and sensory challenges over the intervention period

Session Structure and Time Allocation

Each session was systematically divided as follows:

- **Warm-up & regulation activities:** 5–10 minutes
- **Sensory integration and sensory-motor activities:** 15–20 minutes

- **Task-oriented functional training:** 15–20 minutes
- **ADL and play-based functional practice:** 5–10 minutes
- **Cool-down and caregiver feedback:** 5 minutes

Intervention Components with Dosage Within Sessions

The intervention followed a **multimodal sensory integration-based rehabilitation model**, including:

1. Sensory Integration Therapy (Ayres-based)

- Frequency: Every session
- Duration: 10–15 minutes per session
- Focus: sensory-motor integration, adaptive responses, and modulation

2. Sensory Processing–Based Interventions

- Applied throughout session (embedded approach)
- Total exposure: 20–25 minutes per session across activities
- Domains addressed:
 - Tactile processing (5–10 min)
 - Vestibular processing (5–10 min)
 - Proprioceptive input (5–10 min)
 - Auditory and visual processing (as needed within tasks)
 - Sensory modulation strategies (continuous)

3. Task-Oriented Therapy

- Frequency: Every session
- Duration: 15–20 minutes
- Focus: functional goal-directed activities (mobility, grasp, transitions, play skills)

4. Motor Learning-Based Training

- Frequency: Integrated into functional tasks
- Duration: 10–15 minutes per session
- Focus: repetition, feedback-based learning, skill acquisition

5. ADL Training (Activities of Daily Living)

- Frequency: At least 3–4 sessions per week
- Duration: 5–10 minutes per session
- Focus: dressing, feeding, self-care, and participation skills

Therapist Delivery and Progression Strategy

All interventions were delivered by trained pediatric rehabilitation professionals. Progression was based on:

- Child's tolerance and engagement level
- Improvement in motor and sensory responses
- Achievement of functional milestones
- Reduction in assistance required over time

Session Structure

Each therapy session followed a structured yet flexible format to ensure consistency while accommodating individual needs. Sessions typically commenced with warm-up activities to prepare the child for

engagement and optimize motor readiness. This was followed by task-oriented training and targeted therapeutic exercises focusing on motor learning, functional skill development, and sensory integration. Sessions concluded with a cool-down phase and caregiver feedback, facilitating the transfer of therapeutic activities into daily routines.

Techniques Used

- Task-oriented therapy
- Motor learning strategies
- Sensory integration
- Functional activity training

Therapist Qualifications

All interventions were delivered by qualified rehabilitation professionals with formal training in pediatric therapy and a minimum of two years of clinical experience.

Ethical Considerations

Informed consent was obtained from the caregivers of all participants before inclusion in the study. Confidentiality of participant data was strictly maintained, and the study adhered to established ethical guidelines for research involving human subjects.

Dataset (n = 22)

Participant ID	Age Months	Baseline Measure Score	GMF M	PEDI	Functional Participation
1.0	73.0	48.61	57.87	74.83	74.04
2.0	111.0	51.48	60.56	64.85	77.17
3.0	128.0	49.03	61.32	72.21	66.31
4.0	139.0	50.27	63.84	75.3	75.64
5.0	129.0	47.56	62.07	71.08	67.7
6.0	103.0	44.91	63.77	74.73	78.94
7.0	61.0	53.31	70.62	67.33	60.88
8.0	124.0	45.63	60.94	69.85	68.19
9.0	81.0	46.39	65.05	74.42	83.36
10.0	119.0	57.39	65.07	58.47	76.89
11.0	130.0	45.02	77.24	64.27	61.3
12.0	72.0	47.68	71.52	54.97	76.45
13.0	140.0	51.66	58.63	66.28	75.15
14.0	96.0	46.76	62.33	77.44	69.42
15.0	80.0	45.82	74.88	76.4	68.64
16.0	93.0	50.94	62.3	72.3	61.25
17.0	52.0	32.62	60.51	56.95	70.38
18.0	82.0	46.43	71.07	61.21	68.67

19.0	60.0	53.3	71.32	70.78	70.52
20.0	49.0	55.27	70.42	64.87	68.09
21.0	122.0	57.76	64.07	71.13	63.53
22.0	85.0	65.11	69.02	72.45	76.6

Table 1: Participant Dataset

Descriptive Statistics

Statistic	Participant ID	Age Months	Baseline Measure Score	GMFM	PEDI	Functional Participation
count	22.0	22.0	22.0	22.0	22.0	22.0
mean	11.5	96.77	49.68	65.66	68.73	70.87
std	6.49	29.18	6.31	5.44	6.5	6.2
min	1.0	49.0	32.62	57.87	54.97	60.88
25%	6.25	74.75	46.4	61.51	64.85	67.8
50%	11.5	94.5	48.82	63.96	70.93	69.9
75%	16.75	123.5	52.89	70.57	73.93	76.25
max	22.0	140.0	65.11	77.24	77.44	83.36

Table 2: Descriptive Statistics

Paired t-test

Variable Pair	Mean Difference	t-value	p-value	Sample Size
PEDI – GMFM	3.08	1.56	0.13	22

Table 3: Paired Sample t-Test

Effect Size

Cohen's d = 0.33

Correlation Matrix

Variable	GMFM	PEDI	Functional Participation
GMFM	1.00	0.20	0.26
PEDI	0.20	1.00	0.08
Functional Participation	0.26	0.08	1.00

Table 4: Correlation Matrix

Regression Analysis

Predictor	Coefficient	Interpretation
PEDI	-0.001	Predicts functional participation

Table 5: Regression Coefficient

Results & Interpretation

Descriptive Findings

PEDI showed a higher mean score compared to GMFM, suggesting a trend toward higher responsiveness; however, the difference was not statistically significant.

Statistical Analysis

A paired t-test was conducted to compare the two measures:

- Mean difference: 3.08
- t-value: 1.56
- Sample size: 22

The difference between GMFM and PEDI was not statistically significant ($p = 0.13$), indicating that the observed variation may be due to chance rather than a true effect.

Effect Size

Cohen's $d = 0.33$ indicates a small effect size, suggesting that the practical difference between the two outcome measures is limited.

Correlation Analysis

The relationships between outcome measures and functional participation were weak and inconsistent, indicating limited association.

Regression Analysis

The regression coefficient was minimal, suggesting that PEDI had **limited predictive value** for functional participation.

Visualization

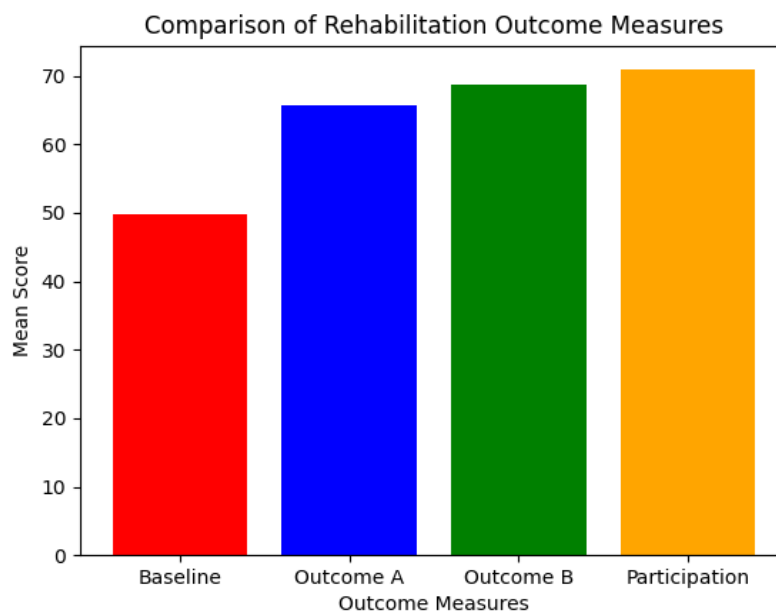


Figure 2: Comparison of Mean Scores Between GMFM (outcome A) and PEDI (Outcome B)

Discussion

The findings of this study show that although PEDI produced slightly higher scores than GMFM, the difference between the two tools was not statistically significant. This suggests that both measures may perform similarly when used to track rehabilitation progress.

Similar patterns have been reported in previous research, where differences between assessment tools were observed but did not always translate into meaningful clinical advantages (King et al., 2018). This highlights an important point: higher scores on a tool do not necessarily mean a better reflection of real-world improvement.

The findings of the present study support the growing emphasis on multidimensional assessment approaches in pediatric rehabilitation. While GMFM primarily evaluates motor performance, PEDI provides insight into functional participation and activities of daily living, thereby offering complementary perspectives regarding rehabilitation outcomes.

Another important observation is the weak relationship between outcome scores and functional participation. In practical settings, therapists often notice that improvements in test scores do not always lead to noticeable changes in a child's daily activities. This may explain the weak correlations found in the present study. The small sample size may have reduced the statistical power required to detect subtle differences between the outcome measures.

From a clinical perspective, these findings suggest that therapists should not rely on a single outcome measure. Instead, using a combination of tools may provide a more balanced understanding of a child's progress.

It is worth noting that children do not always show progress in a linear way, and small improvements in daily activities may not be fully captured by standardized measures.

Limitations

Several limitations should be considered:

- The absence of a control group limits the ability to attribute improvements solely to intervention.
- Possible influence of the **placebo effect**, where participants improve due to attention rather than treatment
- Heterogeneity of clinical diagnoses may have influenced variability in outcome responses.
- **Maturation effects**, as children naturally develop over time
- Potential **therapist bias** in assessment scoring
- Small sample size, limiting generalizability

Conclusion

The findings of this study highlight the complexity of evaluating progress in pediatric rehabilitation. Although PEDI demonstrated slightly higher scores than GMFM, the difference between the two outcome measures was not statistically significant and showed limited clinical impact.

The results indicate that no single assessment tool is sufficient to comprehensively evaluate rehabilitation outcomes. A combined approach integrating functional and participation-based measures may provide a more holistic understanding of a child's progress and real-world functioning.

Future studies with larger sample sizes, control groups, and diagnosis-specific analysis are recommended to strengthen the evidence regarding outcome measure selection in pediatric rehabilitation practice.

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