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Limitations of Standardized Developmental Assessment in Pediatric Rehabilitation: Severe Floor Effects and the Need for Extended Measurement

HoGyung Gwak[1,2] , Eunyoung Cho, Ph.D[1,2], MinYoung Kim, MD, Ph.D[1,2,3†]

[1]Department of Rehabilitation Medicine, CHA Bundang Medical Center, CHA University School of Medicine, Seongnam 13496, Republic of Korea
[2]Digital Therapeutics Research Team, Department of Research, CHA Bundang Medical Center, Seongnam 13520, Republic of Korea
[3]Graduate School, CHA University, Pocheon-si, Gyeonggi-do 11160, Republic of Korea

Background

- Children with cerebral palsy, global developmental delay, and autism spectrum disorder are often challenging to measure accurately using structured standardized assessments because of their specific pathological characteristics and variable symptoms.
- Conventional standardized developmental assessments have shown limited measurement sensitivity in children with severe developmental disabilities, particularly due to floor effects.

Objective

- This study longitudinally examined floor effects and measurement limitations of a conventional standardized developmental assessment (K-BSID-II) in pediatric rehabilitation populations and explored developmental age–based ratio indices as a complementary metric.

Methods

- Following Institutional Review Board (IRB) approval, a total of 380 children (aged 24–36 months) were initially recruited between April 2008 and February 2020.
- To ensure the reliability of longitudinal trajectories, the final analysis was restricted to 163 participants who completed a minimum of three consecutive K-BSID-II sessions; those who did not meet this threshold were excluded from the dataset.
- This three-session requirement was established to provide a sufficient baseline and follow-up for evaluating the persistence of measurement limitations.
- While MDI and PDI were calculated via the standard system, significant floor effects were observed due to severe impairments. To address this, ratio scale indices based on developmental age (DA) were derived to evaluate the limitations of standardized scoring in this clinical population.

Assessment Session	Mental Outlier n (%)	Motor Outlier n (%)
1st Session	380 (32.3%)	316 (43.9%)
2nd Session	247 (33.4%)	189 (44.6%)
3rd Session	171 (32.7%)	134 (48.7%)

* Note: Outliers are defined as subjects with developmental indices of 50 or below, representing the "floor effect" where standard scoring cannot further differentiate functional levels.

Table 1. Proportion of Developmental Outliers in BSID-II (Index Score ≤ 50)

Results

- Data from the three longitudinal sessions revealed a consistent and severe floor effect, as detailed in Table 1. The analysis of developmental outliers showed that 32.3–33.4% in the mental domain and 43.9–48.7% in the motor domain fell below the measurable range across all sessions.
- The demographic and clinical characteristics that contribute to these measurement limitations are presented in Table 2. Frequency analysis revealed that cerebral palsy was the most prevalent diagnosis, and 59% of the children exhibited dual impairments, significantly impacting their standardized assessment performance.

Category	Characteristics	n (%)
Diagnosis*	Cerebral palsy	113 (69%)
	Delayed milestone	43 (26%)
	Respiratory distress syndrome of newborn	13 (8%)
	Language problem	8 (5%)
	Etc. (Torticollis, Hydrocephalus, Genetic syndrome)	26 (16%)
Impairment Type	Dual (Motor & Mental)	96 (59%)
	Motor only (including CP)	38 (23%)
	Mental only (Language & Cognitive)	14 (9%)
	None	15 (9%)

*Note: Only participants who completed all three longitudinal sessions were included. Multiple diagnoses were permitted; percentages may not sum to 100%.

Table 2. Demographic and Clinical Characteristics

Conclusion

- This study demonstrates the inherent limitations and floor effects of conventional standardized developmental assessments when applied to pediatric rehabilitation settings. A substantial proportion of the clinical population consists of children with cerebral palsy, whose physical symptoms significantly impact their performance on traditional tasks. The findings emphasize that current indices often overlook the substantial inter- and intra-individual variations inherent in this population, failing to clarify their true maximal performance levels.

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