

# **The relationship between parent-reported PEDI-CAT mobility and gross motor function in children with cerebral palsy: Brief report**

## **In preparation for Developmental Neurorehabilitation**

Kim Scott PT, DPT  
Board Certified Pediatric Clinical Specialist  
Graduate Research Associate/PhD Student  
School of Health and Rehabilitation Sciences  
The Ohio State University  
[Kimberley.scott@osumc.edu](mailto:Kimberley.scott@osumc.edu)

Jessica Lewis, PT, DPT  
Board Certified Pediatric Clinical Specialist  
Department of Clinical Therapies  
Nationwide Children's Hospital  
Columbus, Ohio  
[Jessica.Lewis@nationwidechildrens.org](mailto:Jessica.Lewis@nationwidechildrens.org)

Jeff Pan PhD  
Assistant Professor  
Center for Biostatistics

Jill Heathcock MPT, PhD  
Associate Professor  
The Ohio State University  
School of Health and Rehabilitation Sciences  
Division of Physical Therapy  
[Jill.heathcock@osumc.edu](mailto:Jill.heathcock@osumc.edu) (corresponding author)

### **Abstract**

**Purpose:** The PEDI-CAT mobility domain (PEDI-mob) is a parent reported measure of mobility for children, with normative data for ages birth to 7.5 years. The purpose of this research is to investigate the relationship between the PEDI-mob and Gross Motor Function Measure (GMFM)-66 and -88 and GMFCS levels.

**Methods:** Fifty-seven children (2-8 years of age) participated. Parent report and motor assessment were collected at the same session. A Pearson product-moment correlation was calculated for PEDI-mob and GMFM-66 scores, and an ANOVA was used to analyze PEDI-mob across GMFCS levels.

**Results:** Large, statistically significant correlation between PEDI-mob and GMFM-66 scores, ages 2-8 years ( $r=0.894$ ,  $p\text{-value}=0.01$ ). Differences in PEDI-mob scores were found across GMFCS levels, with significant differences between all levels except between levels II and III ( $p\text{-value} < 0.001$ ).

**Conclusion:** These results support a strong relationship between parent-reported and clinically measured motor function

**Keywords:** cerebral palsy, PEDI-CAT, GMFM, GMFCS, parent-report

## **Introduction**

Cerebral palsy (CP) is the leading cause of motor impairment in childhood, occurring in 1 in 700 live births.<sup>1</sup> Children with CP have impairments of motor function and are at risk for secondary musculoskeletal impairments, including contractures, spasticity, pain, fatigue, and strength deficits. These impairments impact postural control and movement, restrict participation, and limit gross motor function.<sup>2</sup> Children with CP have lower levels of daily activity energy expenditure and physical activity compared to typically developing children.<sup>3</sup> This decreased activity level and impaired mobility can restrict their ability to participate in social activities, decrease acquisition of important self-care skills, and impact overall quality of life.<sup>4-7</sup> All of these things can impact these children negatively when they reach adulthood.<sup>5</sup>

The Gross Motor Function Classification System (GMFCS) is a five-level classification scale used to objectively describe and predict gross motor function of children with CP.<sup>8</sup> Children in level I walk independently and may only have noticeable impairments in higher-level sports. Children in level V are dependent for all care and rely on power mobility controlled by a caregiver. The GMFCS assists clinicians and parents with planning interventions and services, setting goals and translation of research into practice.<sup>8</sup> In children over four years of age, GMFCS levels are stable over time and can be used to anticipate needs of children as they develop.<sup>9</sup>

The GMFCS is not used in isolation. One of the common assessments physical therapists use to measure gross motor function in children with CP is the Gross Motor Function Measure (GMFM). The original version includes 88 items across five dimensions: (A) Lying and Rolling, (B) Sitting, (C) Crawling and Kneeling, (D) Standing, and (E) Walking, Running and Jumping. The GMFM-88 is a valid and reliable tool to determine both baseline gross motor function and

change in function over time.<sup>10,11</sup> Despite the value of the GMFM in assessing motor function among children with CP, there are barriers to its use in some circumstances. It can take 45-60 minutes to administer and test items have very specific administration guidelines to assure consistency and accurate test administration.<sup>12</sup> The GMFM can be used to help classify a child into a level and, together, the GMFM-66 and GMFCS levels can be used to plot a child's gross motor function using reference curves and percentiles.<sup>9</sup>

The Pediatric Evaluation of Disability Inventory (PEDI) is a norm-referenced measure of daily function in three domains: self-care, mobility, and social skills for children from birth to 7.5 years of age.<sup>13</sup> Similar to the GMFM, the PEDI requires 45-60 minutes to complete.<sup>13</sup> The computer-adapted version of the PEDI (PEDI-CAT) is a newer and updated version of the PEDI that is designed to be a parent-report measure of function for children up to 21 years of age. The PEDI's functional skills domains of self-care, mobility, and social function were revised and the caregiver assistance scale was replaced with a responsibility scale. The mobility domain of the PEDI (PEDI-mob) takes into account a child's use of walking aids and/or a wheelchair and effectively assesses the function mobility of children using these mobility devices.<sup>14</sup> Using item-response theory, parents complete only the most relevant items, allowing parents to complete all four domains in 12.6 minutes.<sup>15,16</sup> Validation studies included parents and caregivers from a representative range of education, economic, and racial identifications.<sup>15,17</sup> Each test is scored in a standard metric so that results can be compared across time points and across groups of children.<sup>16</sup>

The purpose of this study is to determine the relationships between the GMFM and GMFCS level and the PEDI-mob in order to determine if parent report on this tool may be used to develop an accurate estimate of gross motor function.

## Materials and Methods

### Participants

Fifty-seven participants (n=57) were included in this study. Participants' age range was 2 years, 1 month to 8 years, 10 months. A summary of the participants' age, sex, distribution of involvement, type of CP, and GMFCS level is presented in Table 1.

**Table 1.**  
Participant Characteristics

	GMFCS Level					Total (n=57)
	I (n=20)	II (n=6)	III (n=6)	IV (n=15)	V (n=10)	
<b>Age (years, mos)</b>						
Mean	5y, 0mos	3y, 1mo	5y, 10mos	4y, 11mos	5y, 1mo	4y, 11mos
(SD)	(1.81)	(1.36)	(2.06)	(1.60)	(2.20)	(1.88)
<b>Sex<sup>a</sup></b>						
Male	9 (45%)	4 (67%)	2 (33%)	13 (87%)	6 (60%)	34 (60%)
Female	11 (55%)	2 (33%)	4 (67%)	2 (13%)	4 (40%)	23 (40%)
<b>Distribution of Involvement<sup>a</sup></b>						
Monoplegic	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Hemiplegic	10 (50%)	1 (16.6%)	1 (16.6%)	1 (7%)	1 (10%)	14 (25%)
Diplegic	3 (15%)	3 (50%)	0 (0%)	0 (0%)	0 (0%)	6 (11%)
Triplegic	2 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (3%)
Quadriplegic	3 (15%)	1 (16.6%)	4 (67%)	11 (73%)	8 (80%)	27 (47%)
Unspecified	2 (10%)	1 (16.6%)	1 (16.6%)	3 (20%)	1 (10%)	8 (14%)
<b>Type of CP<sup>a</sup></b>						
Spastic	14 (70%)	3 (50%)	5 (83%)	10 (67%)	8 (80%)	40 (70%)
Hypotonic	3 (15%)	1 (17%)	1 (17%)	4 (26%)	1 (10%)	10 (18%)
Ataxic	0 (0%)	2 (33%)	0 (0%)	1 (7%)	0 (0%)	3 (5%)
Unspecified	3 (15%)	0 (0%)	0 (0%)	0 (0%)	1 (10%)	4 (7%)

Abbreviation: GMFCS, Gross Motor Function Classification System.

<sup>a</sup>Frequency (proportion).

### Procedures

Data were collected in conjunction with a randomized controlled clinical trial comparing a different doses of rehabilitation emphasizing principles of motor (ClinicalTrials.gov Identifier: NCT02897024). The current study includes measurements taken before any treatment. This study was approved by The Ohio State University and Nationwide Children's Hospital's

Institutional Review Board (#2016N0031). Parents or legal guardians provided verbal and written informed consent.

A parent or caregiver completed the PEDI-CAT. Study therapists administered the GMFM-88 for each participant. These therapists received training in the GMFM-88 and achieved intra- and inter-rater reliability  $>0.95$  and reliability was retested every 6 months among study therapists. Therapists scored GMFCS levels for participants. GMFCS level was confirmed with electronic medical record.

### *GMFM-88*

The gold standard for evaluation of motor function in children with CP is the Gross Motor Function Measure (GMFM).<sup>18</sup> The GMFM includes 88-items across five domains of functional skills.<sup>10</sup> The GMFM-88 is a valid and reliable tool to determine both baseline gross motor function and change in function over time for children with CP.<sup>10,11</sup>

### *GMFM-66*

Rasch analysis was applied to the GMFM-88 to develop a 66-item version, the GMFM-66.<sup>19</sup> The GMFM-66 is reliable, valid and sensitive to change among children with CP.<sup>20</sup> For this study, GMFM-66 scores were generated from GMFM-88 results using GMAE-2 software.<sup>19</sup>

### *PEDI-mob*

The PEDI-mob has been validated with the PEDI mobility subscale and the GMFM.<sup>17</sup> The PEDI-mob can be completed by a parent or caregiver in 10-30 questions in as few as 4 minutes.<sup>16</sup>

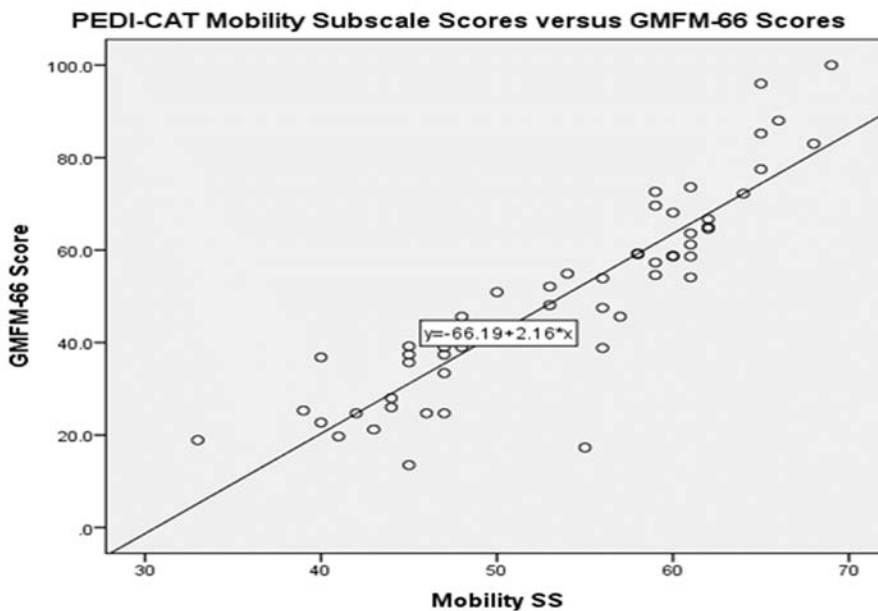
## **Results**

Data analysis was completed using SPSS, version 24.<sup>21</sup> Significance value was set at 0.05. Data were checked for normality using skewness and kurtosis. The accepted range was -

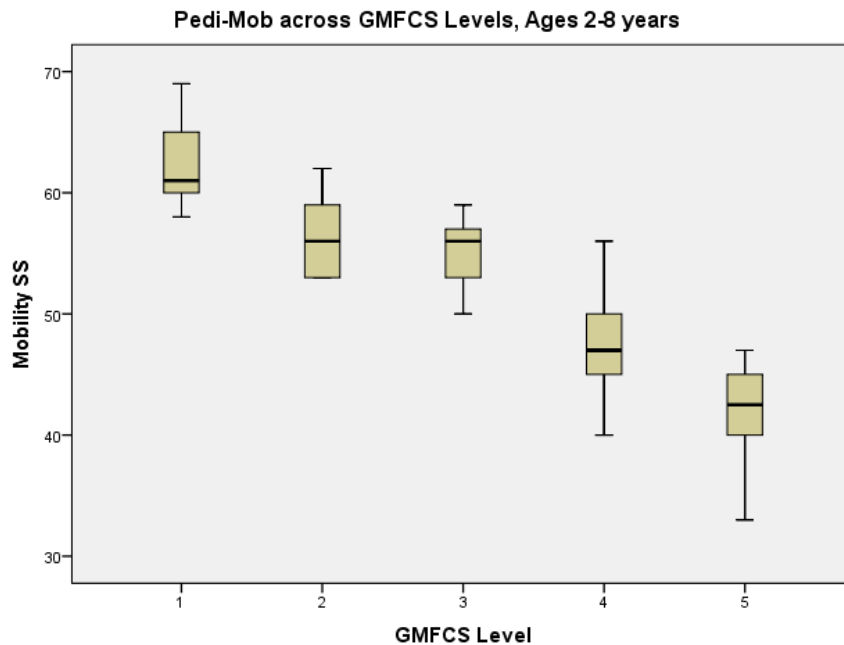
1.96 to 1.96 for both skewness and kurtosis divided by standard error. Using this standard, normal distribution was confirmed for GMFM-66 and PEDI-mob scores. Therefore, parametric testing was used.

Descriptive statistics summarized demographic data. A Pearson product-moment correlation coefficient was calculated for PEDI-mob and GMFM-66 scores. A large, positive, statistically significant correlation was found ( $r= 0.894$ ,  $p= <0.001$ ). See Figure 1. An ANOVA was performed to analyze PEDI-mob scores across GMFCS levels. Significant differences were found between level I vs II, III, IV, V; level II vs IV, V; level III vs IV, V; level IV vs V ( $p$ -value  $<0.001$ ). See Figure 2.

**Figure 1.**



**Figure 2.**



**Discussion:**

The GMFM is a primary measure for gross motor function for children with CP in research and clinical practice.<sup>18</sup> This assessment can take a very long time to administer and must be done in person. Fatigue, medical complexity or fragility, and decreased cognition can limit participation and use of this tool for some children. Very young children and children with more severe motor impairments may exhibit these limiting factors.<sup>22</sup> Importantly, clinicians completing standardized assessments frequently use of modifications during testing, decreasing the standardization validity of the assessment.<sup>23</sup> For all these reasons, it may be useful to have a complementary measure that is shorter assessment and also a reliable and valid measure for assessing the motor abilities of children with CP. A parent or caregiver questionnaire could be a solution and would not be impacted by fatigue, medical fragility, or cognitive abilities of the child on a single assessment day.

Parents of children with CP and other motor disabilities are likely accurate in their

assessment of their child's motor, cognitive, and communication abilities.<sup>24,25</sup> For example, parents of infants rated a motor milestones checklist with almost perfect agreement with the AIMS as scored by a therapist.<sup>26</sup> Specifically for children with CP, parents are reliable in estimating their child's GMFCS level using simple questionnaires.<sup>24</sup> The PEDI-mob is a standardized questionnaire that parents can complete to help therapists evaluate the mobility skills of children with CP. Requiring only a few minutes to complete, this assessment is strongly representative of the Activities and Participation component of the ICF model because it focuses on how well a child executes a mobility task and how much difficulty a child has to be able to successfully participate and be involved in that task..<sup>27</sup> There are currently limited assessments that evaluated the functional mobility of children with CP. The assessments that are currently used have limitations that include limited age ranges and increased assessment time.<sup>28</sup> Successful activity and participation for children with CP largely relate to the child's ability to move and interact with their environment.<sup>29</sup> Interventions targeting the activity and participation component of the ICF model will ultimately help improve mobility and function.

Our results indicate that there is a strong relationship among the PEDI-mob, GMFM-66, and GMFCS levels. These results indicate that parents accurately report of their child's mobility and functional skills using the PEDI-mob. The PEDI-mob could be used as an adjunct to the GMFM to estimate gross motor function and GMFCS levels of children with CP. In addition, the ease of use of the PEDI-mob could make assessments of motor skills for children with CP easier in settings where space, time, and equipment may limit a physical therapist's ability to complete the full GMFM. This assessment could be easily administered remotely via telephone or telemedicine if the child lives in a remote or rural area as long as a parent or caregiver is accessible. The PEDI-mob might also be an alternative option to assess a child that fatigues



easily or is medically fragile.

This study had some limitations. The sample population had an age range from 2-years-old to 8-years-old, thus, we are unable to comment on children with cerebral palsy outside of this age range. Ages of less than four years were included in this sample and this is a time period when the GMFCS level of a child is less stable. Cognitive levels varied with our sample population, therefore, the child's ability to follow standardized instruction may have influenced their scores on the GMFM. In addition, this study is testing only the relationship between assessment tools and does not take into account the child's participation in physical therapy intervention prior to this study.

### **Conclusion**

The mobility domain of the PEDI-CAT is an excellent tool parents and physical therapists can use to evaluate the gross motor function of a child with CP. Using this information, future studies could create predictability tables to estimate a child's GMFM-66 score based on parent report on the PEDI-mob. The GMFM-66 estimates could then be used to help physical therapists and parents understand the child's overall gross motor function, thus, allowing a plan of care to be created using a short parent questionnaire rather than a longer, physically demanding, assessment tool.

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## **Declaration of Interest Statement**

The authors have no conflicts of interest to declare.

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