

Reliability of the Gross Motor Function Classification System Expanded and Revised (GMFCS E & R) among students and health professionals in Brazil

Confiabilidade do Sistema de Classificação da Função Motora Grossa Ampliado e Revisado (GMFCS E & R) entre estudantes e profissionais de saúde no Brasil

Fiabilidad del Sistema de Clasificación de la Función Motora Gruesa Ampliada y Revisada (GMFCS E & R) entre estudiantes y profesionales de salud en Brasil

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ABSTRACT | The Gross Motor Function Classification System has been reliable to classify the gross motor function of children with cerebral palsy (CP); however, the reliability of the Portuguese version (Brazil) is not entirely established in the country, especially among different health professionals and undergraduate students. The aim of this study was to evaluate the reliability of the Portuguese version (Brazil) of the GMFCS E&R by students and health professionals (physical and occupational therapists), with different levels of experience. The gross motor function of 30 children with CP between 4 and 18 years was filmed, accompanied by the neurology service or rehabilitation of a hospital in São Paulo's countryside. The videos were sent to students of a public university and to physical (PT) and occupational therapy (OT) professionals that composed three groups (Group 1: 1 PT and 1 OT with more than 5 years of experience in neurology; Group 2: 1 PT and 1 OT with up to two years of experience; Group 3: an undergraduate student of PT and 1 of OT). The kappa coefficient was used to evaluate reliability among the groups. Almost perfect agreement was obtained in Group 1 [K=0.83; 95%CI (0.68-0.98)] and substantial was obtained in groups 2 and 3 [K=0.79; 95%CI (0.63-0.95) and K=0.67; 95%CI (0.48-0.86), respectively]. The GMFCS E&R proved reliable for use by health professionals of different areas and levels of experience, including undergraduate students, helping them to understand the heterogeneity of CP.

Keywords | Cerebral palsy; Reproducibility of Results.

RESUMO | O *Gross Motor Function*, traduzido para o português como Sistema de Classificação da Função Motora Grossa (GMFCS), tem se mostrado confiável para classificar a função motora grossa de crianças com paralisia cerebral (PC). Porém, a confiabilidade da versão brasileira ainda é pouco estabelecida no país, especialmente entre diferentes profissionais e estudantes de graduação na área de saúde. O objetivo deste estudo foi avaliar a confiabilidade da versão brasileira do GMFCS por estudantes e profissionais da área de saúde (fisioterapeutas e terapeutas ocupacionais), com diferentes níveis de experiência. Foram realizadas filmagens da função motora grossa de 30 crianças com PC entre 4 e 18 anos acompanhadas pelo serviço de neurologia ou reabilitação de um hospital no interior paulista. Os vídeos foram enviados a estudantes de uma universidade pública e profissionais da área de fisioterapia (FT) e terapia ocupacional (TO) que compuseram 3 grupos (grupo 1: 1 FT e 1 TO com mais de 5 anos de experiência em neurologia; grupo 2: 1 FT e 1 TO com até dois anos de experiência; grupo 3: um estudante de graduação em FT e 1 de TO). O coeficiente *kappa* foi utilizado para avaliar a confiabilidade entre os grupos. Concordância quase perfeita foi obtida no grupo 1 [K=0,83; IC 95% (0,68-0,98)] e substancial para os grupos 2 e 3 [K=0,79; IC 95% (0,63-0,95) e K=0,67; IC 95% (0,48-0,86) respectivamente]. O GMFCS E & R se

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mostrou confiável para ser utilizado por profissionais da saúde de diferentes áreas e níveis de experiência profissional, inclusive por estudantes de graduação, auxiliando-os na compreensão da heterogeneidade da PC.

Descritores | Paralisia cerebral; Reprodutibilidade de Resultados.

RESUMEN | En la clasificación de la función motora gruesa de niños con parálisis cerebral (PC), el Gross Motor Function viene siendo fiable, sin embargo la versión brasileña todavía sigue siendo poco aplicada, en especial por distintos profesionales y estudiantes de grado en el área de la salud. El propósito de este artículo es el de evaluar la fiabilidad de esta versión para estudiantes y profesionales del área de la salud (fisioterapeutas y terapeutas ocupacionales), con distintos niveles de experiencia. Se captaron video-imágenes de la función motora gruesa de treinta niños con PC entre 4 y 18 años de edad, acompañados por el servicio de neurología o por la rehabilitación de un hospital en

el interior de São Paulo, y se las enviaron a los estudiantes de una universidad pública y a los profesionales del área de fisioterapia (FT) y terapia ocupacional (TO), los cuales formaron tres grupos: Grupo 1 con 1 FT y 1 TO cuya experiencia en neurología era de más de cinco años; Grupo 2 con 1 FT y 1 TO y la experiencia hasta dos años; y Grupo 3 con 1 estudiante de grado en FT y 1 en TO. Se empleó el coeficiente kappa para evaluar la fiabilidad de los grupos. Los resultados mostraron concordancia casi positiva para el Grupo 1 [$K=0,83$; IC 95% (0,68-0,98)] y sustancial para los grupos 2 y 3 [$K=0,79$; IC 95% (0,63-0,95) y $K=0,67$; IC 95% (0,48-0,86), respectivamente]. Se concluye que el GMFCS E & R es fiable para emplearse por los profesionales en diferentes áreas de la salud, así como con distintos niveles de experiencia, incluso por estudiantes de grado, lo que les ayuda en el trabajo con el PC.

Palabras clave | Parálisis cerebral; Reproducibilidad de Resultados.

INTRODUCTION

Cerebral palsy comprises a group of permanent disorders of the development of movement and posture, causing activity limitation attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior, by epilepsy, and by secondary musculoskeletal problems¹. The severity of neuromuscular and musculoskeletal impairments associated with cerebral palsy is extremely variable and, consequently, motor function ranges from the ability to walk in the community and perform skills associated with play and recreation (e.g. run, jump) to complete dependence on caregiver assistance for self-care and mobility². The classifications of cerebral palsy are based on different approaches, such as the predominant motor abnormality (spastic, dyskinetic, ataxic), topographical distribution (unilateral and bilateral for spasticity), and functionality¹. Due to the heterogeneity of cerebral palsy, it is common to find children with spastic CP that exhibit dystonia characteristics, as well as those with unilateral involvement with some degree of motor involvement on the opposite side, and others with bilateral involvement and asymmetry in both sides¹. In addition, such traditional classification systems related to topography and motor abnormalities,

although useful for clinical and epidemiological proposals, provide limited information about mobility, not indicating the severity level and, therefore, are not very helpful to the prognosis³. Thus, the classification of cerebral palsy should be accompanied by functional classifications¹ such as the Gross Motor Function Classification System (GMFCS)⁴.

The GMFCS is a five-level classification system based on voluntary movements, with emphasis on sitting, transportation, and mobility. Level I includes children and young people who walk without limitations; in level II the child has limitations to walk long distances and at equilibrium; in level III, the child walks using a hand-held mobility device (walker, crutches, canes). Children and young people in level IV are usually transported in a manual or motorized wheelchair. In level V, there are severe head and trunk control limitations, requiring extensive use of assisted technology and physical assistance⁴. The GMFCS includes 4 age groups: 0 to 2 years, 2 to 4 years, 4 to 6 years, and 6 to 12 years⁴, and it was adapted transculturally to Brazilian Portuguese⁵.

The expanded and revised version of the GMFCS (GMFCS E&R) includes the age group from 12 to 18 years, which emphasizes that the performance of the gross motor function is influenced by physical, social, and attitudinal environment, and by personal factors such as preferences, interests, and motivation⁶. The GMFCS E&R translation into Brazilian Portuguese

made in accordance with the ones suggested by Center For Childhood Disability Research (CanChild) and made available on their website* was conducted in 2010 by a group of occupational therapists and one neurologist⁷.

The validity and reliability of the original version of the GMFCS have been extensively studied and well established among health professionals in different countries (physical therapists, pediatricians, orthopedists, physiatrists, and occupational therapists)^{6,8,9,10}, and parents^{8,11-15}, which is also beginning to occur with the extended and revised version (GMFCS E&R)¹⁶. The GMFCS can easily be incorporated into clinical practice, allowing comparisons of children accompanied by different clinicians with similar functional levels, and also can predict the gross motor function of children with cerebral palsy¹⁷. Moreover, it can be used by students, helping them to understand the heterogeneity of cerebral palsy, as it is a simple classification that does not require specific training¹⁸. Morris and Bartlett¹⁸ mention that the use of videos of GMFCS allows students to understand that cerebral palsy comprises more than one motor type or topographical distribution, and show that a child with quadriplegia (bilateral spastic CP) can be classified into different levels of GMFCS (II, III, IV or V)¹⁸.

Although the GMFCS and the GMFCS E&R consist in classifications of easy application, studies that assess their reliability in Brazil are scarce^{5,19} and did not verify their validity with other health professionals with different levels of experience in the area (strata)²⁰, including undergraduate students, who are involved in the treatment of children with cerebral palsy. The aim of this study was to evaluate the reliability of the Portuguese version (Brazil) of the GMFCS E&R for students and health professionals (physical and occupational therapists), with different levels of experience.

METHODOLOGY

This is a cross-sectional and quantitative study that aimed to compare the classification of the gross motor function of children with cerebral palsy by students and health professionals (physical and occupational therapists with different levels of experience). This study was approved by the Research Ethics Committee

of the Hospital das Clínicas of the Medical School of Ribeirão Preto. The parents signed an informed consent form (HCRP no. 12469/2008).

PARTICIPANTS

Thirty children with cerebral palsy who frequented the neurology or rehabilitation service of a university hospital in São Paulo's countryside participated in the research from February to October 2011, aged between 4 and 18 years. Inclusion criteria were: to have the diagnosis of cerebral palsy, regardless of type and motor impairment, to be between 4 and 18 years, and to understand simple commands. Exclusion criteria were low vision or blindness and epilepsy.

Students and both physical and occupational therapists also participated in the study and composed three groups: Group 1) one occupational and one physical therapist graduated for more than 5 years with experience in neurology and in using the GMFCS; Group 2) one occupational and one physical therapist graduated for less than 2 years, who worked with neurology and had brief experience in using the GMFCS; Group 3) one senior student of occupational therapy and one senior student of physiotherapy from a public university of São Paulo's countryside, given that only the occupational therapy student had contact with the GMFCS to classify a child's motor level, as part of an academic activity.

DATA COLLECTION PROCEDURE

The children were assessed regarding the control of head, trunk, postural changes (scrolling, dragging, crawling, lying to sitting, sitting to standing), gait, and the parents were asked about the methods of mobility often used in internal and external environments (school, community). These assessments were conducted by an undergraduate student of occupational therapy of Group 3 and filmed by a research assistant.

The videos of the 30 children were sent to the participants of the three groups for classification of the motor level using the GMFCS E & R, and the children were identified by code and age. Students and professionals also received the GMFCS E & R translated into Brazilian Portuguese, having 15 days to complete the classification. The classifications of

* Available from: www.canchild.ca.

the groups' members were compared with that of an occupational therapist with 9 years of experience in neurology, who had previous contact with the GMFCS.

STATISTICAL ANALYSIS

The GMFCS E & R is a five-level ordinal scale, whose data were analyzed using the statistical test of not-weighted kappa with 95% confidence interval to examine the agreement among the groups, with different levels of experience (students and health professionals).

The kappa coefficient values used to assess the agreement among the examiners were: values lower than zero (poor); between 0.00 and 0.20 (slight); 0.21 and 0.40 (fair); between 0.41 and 0.60 (moderate); 0.61 and 0.80 (substantial), between 0.81 and 1.00 (almost perfect)²¹.

RESULTS

The average age of the children was 7.58 years (7 years and 7 months), ranging from 4 to 17.91 years. Most children had bilateral spastic CP (n=23), five had unilateral spastic CP, and two had dyskinetic CP. Regarding sex, 43.3% of the sample was composed of girls and 56.7% of boys. Table 1 shows the distribution of the types of cerebral palsy, age, and sex as a function of the levels of the GMFCS E & R.

Table 1. Distribution of the types of CP, age, and sex as a function of motor levels

Types of CP	Level I	Level II	Level III	Level IV	Level V	Total
Bilateral Spastic CP	1	5	6	5	6	23
Unilateral Spastic CP	5	-	-	-	-	5
Dyskinetic CP	-	1	-	1	-	2
Age						
4 to 6	1	3	4	1	3	12
6 to 12	5	3	2	5	3	18
Sex						
Male	3	4	4	3	3	17
Female	3	2	2	3	3	13

Children with unilateral spastic cerebral palsy were classified by the occupational therapist with greater experience in the level I of the GMFCS E & R, while children with bilateral spastic CP were distributed in all motor levels.

Table 2 shows the disagreements among the groups of professionals and students about the levels of the GMFCS E&R and the index of agreement among them (K).

Table 2. Disagreement among the groups as a function of GMFCS' levels, kappa coefficient, and confidence intervals (CI).

Disagreements	I and II	II and III	III and IV	IV and V	Total	Kappa	C.I.
Group 1 (>5 years)	2	1	3	0	6	0.83	0.68-0.98
Group 2 (≤2 years)	4	1	2	2	9	0.79	0.63-0.95
Group 3 (students)	4	3	4	2	13	0.67	0.48-0.86
Total	10	5	9	4	28	-	-

We found a total of 28 disagreements among the 3 assessed groups, which predominated between levels I and II (n=10) and III and IV (n=9). The agreement was almost perfect in Group 1 which involved professionals with the highest level of experience in the field of neurology, and substantial in other groups with less experience.

DISCUSSION

The Gross Motor Function Classification System (GMFCS) has been widely used in research and clinical practice, being a valid and reliable instrument to assess the gross motor function of children with cerebral palsy^{4,22}. The results of this study indicated almost perfect agreement between physical and occupational therapists with more than 5 years of experience in neurology (Group 1), in which they classified the motor level of children using the Brazilian version of the GMFCS E & R. Results similar to this were obtained only in the Brazilian study developed by Silva et al.¹⁹ (K=0.90), in which direct observation was held and the parents were questioned about methods of mobility for the motor level classification, involving one undergraduate student of OT and one occupational therapist with nine years of experience.

In this study, we found substantial agreement among students (Group 3) or professionals of the same area, with up to two years of experience (Group 2), when they classified the motor level of children using the Brazilian version of the GMFCS E&R. In most studies, the agreement in the classification of the GMFCS has also been substantial, with kappa coefficient ranging between

0.64 and 0.80^{4,9,12}, involving different health professionals (physical therapists^{4,10,12,14,17}, doctors^{8,9,10,17}, occupational therapists^{4,5}, speech therapists¹⁰, and nurses¹⁰) and different methods of collecting information to classify the gross motor function using the GMFCS or GMFCS E & R (direct observation^{4,8,9,12,16}, questioning of parents^{12,16}, review of medical records^{7,8,23}).

Indexes of agreement quite similar to the students' group of this research (Group 3) were obtained in other studies, but with more experienced professionals^{8,10,12,23}. The study of Kondo et al.¹⁰ involved professionals from different areas (physical therapists, occupational therapists, speech therapists, doctors, and nurses) who made direct observation of the child, with kappa of 0.66. The study of McDowell et al.¹² involved two physical therapists and direct observation of the child was also held associated with the questioning of the parents, with kappa of 0.64.

Although in our research the professional experience is related to a higher rate of reliability, in the aforementioned studies^{10,12}, which involved health professionals, the agreement was similar to the students' group from our research, suggesting that professional experience is not the only determining factor for greater reliability in GMFCS classification. Besides the experience of the examiner, it is important to consider the method of gathering information, since research has shown that the index of agreement of GMFCS classification, using only the review of medical records, is lower, even when it involved health professionals from different areas^{8,23}, in contrast to the studies that have done direct observation of the child and gathered information from the parents. In the study of Morris et al.⁸, the children were classified with the GMFCS by orthopedic surgeons through the review of medical records, obtaining fair agreement rates ($k=0.38$), while physical therapists and pediatricians classified the same children through direct observation associated with the review of medical records, obtaining a substantial agreement ($k=0.65$). We can verify that GMFCS and GMFCS E&R have shown to be reliable when used by health professionals of different areas and levels of professional experience, being the method of collecting information mostly accomplished through direct observation^{4,8,9,12,16} and questioning of the parents^{12,16}.

In this research, most disagreements in the classification of GMFCS E&R occurred between the levels I and II, and levels III and IV. The studies of McDowell et al.¹², and Benedict et al.²³ also obtained

disagreements, for the most part, between the levels with lower motor severity for children aged 4 years or older. Other studies already indicate a predominance of disagreements between levels that indicate higher motor severity (IV and V) for children in this age group or older^{9,10}.

This research contributes to enlarge reliability studies of the GMFCS E&R in Brazil by professionals with different strata/levels of experience, reinforcing the idea that it can be used even by undergraduate students. Thus, the inclusion of this subject in undergraduate disciplines related to pediatric neurology can also assist students in understanding the heterogeneity of clinical types, levels of involvement and, mainly, the motor prognosis of children with cerebral palsy. This could be verified, for example, by looking at the description of the GMFCS E&R about the children in level V, who have severe limitations in maintaining antigravity head and trunk postures⁶, being necessary, therefore, the indication and use of assistive technology resources, such as wheelchairs and orthosis.

In addition, because the GMFCS is stable over time²⁴ it is possible to increase the communication between professionals and family members – helping them to understand the child's current skills –, discussing prognosis and planning future interventions, as well as improving public policies regarding this population²³.

CONCLUSION

The Brazilian version of the GMFCS E&R (Brazil) proved reliable for use by health professionals (physical and occupational therapists), with different levels of experience, including undergraduate students.

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