Cross-cultural adaptation of the Gross Motor Function Classification System into Brazilian-Portuguese (GMFCS)

Adaptação transcultural para o Brasil do sistema de classificação da função motora grossa (GMFCS)

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Abstract

Background: Due to the complexity of clinical symptoms of cerebral palsy and the difficulties in classifying it based upon the motor types and the topography of the body distribution only, Canadian researchers have proposed the Gross Motor Function Classification System (GMFCS). Although this classification system has been largely used in Brazil, it has not been cross culturally adapted yet. **Objectives:** To perform the cross adaptation of the Gross Motor Function Classification System for the Cerebral Palsy (GMFCS) into Brazilian-Portuguese and to verify the reliability among observers of the adapted instrument in Brazilian children. **Methods:** This study was performed in two stages; the first stage was related to the process of cross-cultural adaptation and the second stage tested the instrument. Translation, back-translation, semantic and content analysis, back-translation of the final version and the approval of the authors were used for the cross-cultural adaptation. The test of the instrument was performed in 40 children with cerebral palsy, who were evaluated by two raters to verify the reliability among the observers. **Results:** The results showed that the stages of translation and back-translation did not present any difficulties and the semantic and conceptual equivalence was achieved. The reliability among the observers showed that the evaluations do not differ and that there is an excellent correlation and internal consistency of the construct with an ICC of 0.945 (95% CI 0.861 to 0.979) and a Cronbach α of 0.972. **Conclusions:** The final version of the GMFCS showed good potential of applicability for undergraduate students and professionals of the neuropediatric area.

Keywords: translation; cerebral palsy; classification.

Resumo

Contextualização: Em função da complexidade das manifestações clínicas da paralisia cerebral (PC) e das dificuldades na sua classificação baseada apenas nos tipos motores e topografia de distribuição corporal, estudiosos canadenses propuseram o Gross Motor Function Classification System (GMFCS). Apesar de esse sistema de classificação estar sendo bastante utilizado no Brasil, ele ainda não havia sido adaptado transculturalmente para tal. **Objetivos:** Realizar a adaptação transcultural para o Brasil do Sistema de Classificação da Função Motora Grossa (GMFCS) para a PC e verificar a confiabilidade entre observadores do instrumento adaptado com crianças brasileiras. **Métodos:** Este estudo consistiu em duas etapas, sendo a primeira relacionada com o processo de adaptação transcultural, e a segunda referente à testagem do instrumento. A adaptação transcultural do instrumento foi feita por meio da tradução, retrotradução, análise semântica, análise de conteúdo, retrotradução da versão final e aprovação dos autores do instrumento. A testagem do instrumento ocorreu junto a 40 crianças com PC, as quais foram avaliadas por dois examinadores para verificar a confiabilidade entre observadores. **Resultados:** Os resultados demonstram que as etapas de tradução e retrotradução não apresentaram dificuldades, e a equivalência semântica e a conceitual foram obtidas. A confiabilidade entre examinadores demonstrou que as avaliações quase não diferiam e que havia excelente correlação e consistência interna do constructo, com coeficiente de correlação intraclasse (ICC) de 0,945 (com intervalo de 0,861 a 0,979) e α de Cronbach de 0,972. **Conclusões:** A versão final do GMFCS mostrou bom potencial de aplicabilidade por graduandos e profissionais da área de neuropediatria.

Palavras-chave: tradução (produto); paralisia cerebral; classificação.

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Introduction ∷∶.

Cerebral palsy (CP) is described as a series of motor and postural development disorders that cause functional limitations attributed by non-progressive disorders occurring in the Central Nervous System (CNS) during fetal development or during the first two years of life[1-3]. The prevalence of CP ranges from 1.5 to 2.5 per 1,000 live births, with little or no difference among Western nations, despite the lack of data referent to Latin-American countries[4]. In Brazil, there are no specific data in relation to the number of CP cases, however, the 2000 census registered 24.5 million people with some sort of impairment (14.5% of the Brazilian population), among which 23% had motor impairments, including CP patients[5].

The CP has traditionally been described based on the type of clinical manifestation (motor type) as well as on the body location (topography). With regards to the motor type, it can be classified as spastic, athetoid, ataxic, hypotonic and mixed and; as for the topography, it can be classified as hemiplegic, diplegic and quadriplegic[1,6,7]. Because it is distributed in a wide spectrum, there are many differences related to the motor impairment and functional limitations, which cannot be discriminated within these two classifications. Therefore, the clinical and scientific community often used inconsistent terminologies to describe the disability of children with CP such as "mild", "moderate" or "severe"[8,9].

Due to the complexity of the clinical manifestations of the CP and the difficulties in its classification, researchers linked to the *Canchild Centre for Childhood Disability Research* developed the Gross Motor Function Classification System (GMFCS)[10] as an attempt to standardize the evaluations with regards to the degree of motor impairment of individuals with CP from infant to 12-year old. The GMFCS has been widely accepted and used in research and in clinical practice, since it provides a simple, valid, and reliable way of classifying a complex phenomenon, besides being an instrument which has been validated for the English language and having an excellent levels of reliability[11].

The goal of the GMFCS is to classify the child's gross motor function emphasizing in the "sitting" and "walking" movements through five motor levels presented in each of the four age groups (0-2, 2-4, 4-6, and 6-12 years old), characterizing child's motor performance by taking into account different contexts such as home, school, and community spaces[11].

The GMFCS is an extremely important instrument for professionals who work with children with CP, since it allows the establishment of appropriate therapeutic goals according to the patient's age and motor level, and thus ensure an appropriate care for each subject[7].

The GMFCS is able to predict the prognosis of the gross motor function of children with CP, since there is a tendency for children with lower motor development potential to reach their limits more quickly than children with higher potentials[12]. The classification of the child in relation to the motor GMFCS levels remains stable over time, certifying that, not only ensure a greater uniformity in the classification of the gross motor function but also this instrument predict the prognosis for children with CP[12,13].

In the last years, GMFCS has been widely used both in clinical practice as well as in research in Brazil[7,14-17]. Until very recently, the adaptation of instruments developed in another culture and often in another language, were only simply translated into the language of the country where it will going to be used or, at most, a literal comparison of it with the back-translation[18]. Nowadays several authors suggest that the process of cross-cultural adaptation of an instrument must follow more stringent steps, including semantic evaluation, and also considering aspects of the cultural background and lifestyle of the target population[19-22]. Thus, it is important that the GMFCS undergoes a process of cross-cultural adaptation, which will bring benefits for the target population, in this case, undergraduate students, health professionals and researchers involved in the healthcare of children with CP.

Therefore, the objectives of this study were to perform a cross-cultural adaptation of the GMFCS for the Brazilian population and to assess the reliability of the observers of the translated version.

Methods ∷∶.

This study was divided into two phases, the first related to the cross-cultural adaptation procedure, and the second phase concerning the testing of the instrument.

Cross-cultural adaptation

The objective of this phase was to translate and adapt the instrument for the Brazilian population, with the following steps: translation, semantic analysis of the items, content analysis or judging and back-translation of the instrument.

Participants

Translation phase of the instrument: three participants, an occupational therapist, with good English skills and experience in pediatric neurology field (P1); a university professor

with fluency in English (P2); and an university professor with experience in pediatric neurology field (P3).

Back-translation phase of the version 1 of the instrument: one participant (P4), a linguist with a undergraduate degree in Languages, with fluency in English and translation experience in the field of pediatric neurology, although not familiar with the original version of the GMFCS in English.

The stage of semantic analysis of the items: sixteen participants divided into two groups of potential users of the instrument, one group composed by less skilled participants (lower stratum) represented here by seven 3rd and 4th-year undergraduate students of Occupational Therapy and Physical Therapy courses, and another group formed by higher skilled participants (highest stratum), represented here by five university professors (with a doctoral or masters degree), working in the pediatric neurology field and four pediatric neurology professionals (physical therapists and occupational therapists), who have been working for more than two years and with clinical experience in this area.

The phase of content analysis or judging: nine participants, the same ones that composed the highest stratum group in the semantic analysis.

Back translation of the final version of the instrument: two participants, a linguist (who also participated in the back translation phase of the version 1 of the instrument –P4), and an occupational therapist (who also participated in the initial phase of the translation – P1).

Procedures

The procedures used in the process of cross-cultural adaptation of the GMFCS followed the proposals for translation and adaptation of instruments developed in other linguistic and sociocultural contexts, based on studies carried out by Beaton et al.[19] and Herdman, Fox-Rushby and Badia[20]. The procedures used to perform the semantic analysis and content analysis, with also comprise the steps of cross-cultural adaptation, were based on the studies by Pasquali[22-24], in a way that the whole process of cross-cultural adaptation of the GMFCS followed six phases, which are described below:

Phase 1 – Authorization from the instrument's authors

A request to authorize the translation of the instrument was submitted to the authors of the GMFCS[10] for CP, and the translation procedures were only initiated after this permission was granted.

Phase 2 – Initial translation

Firstly, the translation from the original English version into Portuguese was performed by P1. This translation was checked and discussed with P2, who received the original English version, read it aloud, and translated it from English to Portuguese. During this reading, P1 followed the already translated version into Portuguese, writing down the differences found between both versions.

Then, P3 conducted a review of the two translations, giving suggestions to the preliminary version (version 1) to be back-translated. The version 1 of the instrument was produced after this phase.

Phase 3 – Back-translation of the version 1

After finishing the translation of the version 1, P4 carried out the back-translation of this version into the mother tongue of the instrument (English), according to the procedures described by Beaton et al.[19] and Herdman, Fox-Rushby and Badia[20]. Then, a comparison between the back-translated version 1 and the original version of the instrument was performed by P1 and P4, resulting after this analysis the version number 2.

Phase 4 – Semantic analysis of the items

Version 2 was subjected to a semantic analysis, which consists in verifying whether the terms used in the items and paragraphs of the instrument were clear. According to Pasquali[22], this phase must be carried out by two different groups: the lower stratum group, represented by people with less skills who will use the instrument, and the highest stratum group, represented by higher skilled people in this area in question.

Participants in this phase received a semantic analysis form, as well as the version 2 of the GMFCS, followed by instructions on how to filling in the items contained in the form. After completed, it was then handed over to one of the researchers.

Phase 5 – Content analysis or judging analysis

The version 3 of the instrument was elaborated after the semantic analysis performed by the two stratum groups, and also after comparing the highest stratum participants' suggestions to the literature of pediatric neurology field. This version was handed back to the participants of the highest stratum group (called here the judges) in order for them to analyze the content of the instrument and to indicate whether they *agreed* or *disagreed* with the item/paragraph being evaluated. A qualitative empirical analysis was conducted as proposed by Pasquali[22] in which verifies the agreement index. The proposed formula for

this analysis is $\frac{C}{C+D} \, X \, 100$, being C the total agreement number and D the total disagreement number.

Phase 6 – Back-translation of the final version and submission to the authors

After the content analysis, a new version of the translation was elaborated, called as the final version, which was back-translated again into English by P1 and P4, being this back-translated version sent to the authors of the instrument for verification and approval.

Instruments used in the semantic analysis of the items and content analysis (or judging analysis) phases

Semantic analysis form: it was developed by the researchers based on the study carried out by Pasquali[22-24] with the objective to verify whether the terms used in the paragraphs and the items of the version 2 of the GMFCS were clear to be used by the target population (undergraduate students and professionals in the pediatric neurology field). Being an analysis that verifies the clarity of the words, the technical terminology and the understanding of the phrases, the participants were given two response alternatives: *understandable* and *non-understandable.* By checking the *non-understandable* option, the participants were requested to justify their choice and make suggestions for improvement.

Content analysis form: it was developed by the researchers based on the study carried out by Pasquali[22], in order to verify whether the paragraphs and items of the version 3 of the GMFCS referred to the attribute in question, in this instrument, is actually gross motor function of children with CP. By analyzing the contents of the instrument, the participants of this phase had the options to respond agree or disagree. By checking the disagree option, the participant should justify their reasons.

Application of the instrument and inter-rater reliability test

After the approval of the final version by the authors, the instrument was used in order to verify its applicability among the Brazilian population. Moreover, the inter-rater reliability test was carried out in order to demonstrate the reproducibility of the assessment.

Participants

The participants were 40 children diagnosed with CP, with age varying from 8 months old to 11 years and four months old, who were receiving outpatient care in a tertiary university hospital. There were 10 children in each age group, according to the GMFCS distribution (children under 2 years of age, 2 to 4 years old, 4 to 6 years old and 6 to 12 years old). These children were evaluated by a professor with doctoral degree and with an occupational therapy background, with more than 20 years of experience (both clinically and educational) in the pediatric neurology field.

In order to perform a comparison between the raters, 45% sample were randomly selected, in such a way that at least 30% of each age group were contemplated, resulting in a total of 18 pairs of observations to be compared. These 18 children were classified using the final version of the GMFCS by another rater (an occupational therapist with more than 5 years of experience in the pediatric neurology field) in order to verify the reliability inter-observers of the instrument. The statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) program, version 17.0. To verify the level of correlation between two measurements, the intraclass correlation coefficient (ICC)[25] was used, with a 95% confidence interval, and in order to evaluate the internal consistency of the construct, Cronbach's α[26] was used.

Ethic procedures

Since it is a research involved human subjects, the present study was submitted to and approved by the Human Ethics Committee of the Universidade Federal de São Carlos (UFSCar), São Carlos, SP, Brazil, under the protocol nº CAAE: 149/2006, following the terms of decree 196/96, and all participants or guardians were informed about the objectives of the study, and after confirming their interest in participating in the experiment, they signed a informed consent form.

Results

After authorization by the authors of the original version of the GMFCS, the process of cross-cultural adaptation was initiated. The differences identified in the translations of the original instrument into Portuguese, performed by the participants P1, P2 and P3 were related to the terminology or to contents that were specific to the pediatric neurology field; which we decided to keep the terms that appeared in at least two of the translations. These results are shown in Table 1.

During the semantic analysis, was identifed only 11 terminology that were questioned by at least one of the groups of participants (the lowest stratum and the highest stratum groups), and these terms were analyzed considering the suggestions provided by the participants in the highest stratum

group. The terms that were considered more suitable for most of them were adopted, confirmed by a bibliographic review in the pediatric neurology field. Table 2 shows the terms that were questioned by the participants of the phase 4 of this study, as well as the number of disagreements in each stratum and the suggestions given by the components of the highest stratum group.

After this phase, a new version (version 3) was given to the participants of the highest stratum group, which they indicated whether they agreed or not with each paragraph or item of this version Then, the number of agreements and disagreements for each item and paragraph was calculated and to considered them relevant, the calculation method for percentage of agreement as proposed by Pasquali[22] was applied, where an item should be considered relevant if it present of percentage of agreement of at least 80% among the judges.

The results of this phase showed that, from the six paragraphs and 24 items analyzed, only two paragraphs and five items had minor questioning from some of the participants. However, as the percentage of agreement was 88.8%, which does not characterize a significant number of disagreements and remaining below the percentage of agreement used as a criterion, no content changes were performed to version 3.

Therefore, the back-translation that was sent to the authors of the original version of the instrument was performed from the version 3, called final version, which was approved by the authors without any change requested.

The final version was tested in a random sample of children with CP who were receiving outpatient care in a tertiary university hospital. A previous selection was performed aiming to obtain 10 children in each age group.

The results of this phase showed that the instrument was able to classify the children's motor levels. All levels were identified during the evaluation, in all groups, with the largest number of children being classified into level V (n=16), followed by level I (n=9), and then level IV (n=7), as shown in Table 3.

The inter-rater reliability showed that there were virtually no differences between the examiners and there was a strong and significant correlation, with an ICC of 0.945, with a 95% confidence interval ranging from 0.861 to 0.979. With regards to internal consistency of the instrument, the Cronbach α value obtained was 0.972.

Discussion ⁞⁞⁞.

The World Health Organization (WHO) recommends the translation and cultural adaptation of the existing assessment tools, since it facilitates the communication between different researchers and the comparison of data obtained on an international level[27]. However, in order to be used in a new country or culture (even within the same country) the adaptation of an instrument requires a method that guarantees the equivalence between the original and adapted versions of the instrument.

Table 1. Differences among the three translators and suggestions presented for Version 1.

Term	P1	P2	P3	Versão 1
1	Parte inferior do tronco	Base da coluna	Parte inferior do tronco	Parte inferior do tronco
2	Limitações físicas	Dificuldades físicas	Prejuízos físicos	Prejuízos físicos
3	Engatinham com reciprocação	Engatinham em padrão recíproco	Engatinham em padrão alternado	Engatinham em padrão alternado
4	Carregadas	Transportadas	Carregadas	Carregadas
5	Membros superiores	Braços	Membros superiores	Membros superiores
6	Impulsionam a cadeira de rodas	Manejam a cadeira de rodas	Manejam a cadeira de rodas	Manejam a cadeira de rodas
7	Lactentes	Bebês	Bebês	Bebês

Table 2. Terms that were questioned, the number of disagreements by two levels of participants and the selected term.

Questioned Terms	Number of disagreements from High Level Participants	Number of Disagreements of Low Level Participants	Selected Terms
Entrar e sair da posição (sentada, em pé)	4	2	Sentar-se e levantar-se
Tracionar-se	3	1	Puxar-se
Aparelhos assistivos de locomoção	2	0	Aparelhos auxiliares de locomoção
Rastejar em prono	1	0	Arrastar-se
Prejuízos físicos	4	0	Deficiências físicas
Mobilidade	3	1	Locomoção
Habilidades emergentes	2	2	Inicia habilidades
Habilidades motoras grossas	1	0	Habilidades motoras globais
Extensas adaptações	2	1	Muitas adaptações
Cruzar	1	0	Andar de lado

Not only a well-performed linguistic translation of its items is needed, but also a cultural adaptation is necessary, with the goal of maintaining the content validity of the instrument[19,28].

The GMFCS was submitted to a procedure of cross-cultural adaptation following a strict criteria proposed by Beaton et al.[19], Herdman, Fox-Rushby and Badia[20] and Pasquali[22]. The participation of different professionals during the phase of translation into Portuguese endorsed that the version 1 of the GMFCS presented a language suitable not only with regards to the structure of the Portuguese language, but also relevant to the area of knowledge of pediatric neurology. The process of back-translation into the original language is quite important, as it aims to ensure that the contents of the original version are preserved in the translated version[19]. The results showed that the translation and back-translation phases presented no difficulties, and the semantic and conceptual equivalence being obtained.

The semantic analysis phase tried to adjust the language, in order to make the instrument easy to understand. The

Table 3. Participants Children Characteristics from Step 7 – applicability and inter-rater reliability.

Groups	Participant	Sex	Age	Level	Reliability
Before 2nd Birthday	P1	M	16 months	II	II
	P2	M	9 months	V	-
	P3	M	15 months	IV	-
	P4	F	11 months	V	IV*
	P5	M	12 months	II	II
	P6	F	10 months	V	-
	P7	M	22 months	V	-
	P8	M	10 months	V	-
	P9	M	14 months	I	I
	P10	F	8 months	III	-
Between 2nd and 4th Birthday	P1	F	3y and 8m	V	V
	P2	M	3years old	I	I
	P3	F	3y and 5m	V	-
	P4	F	2y and 5m	V	V
	P5	F	2y and 3m	II	-
	P6	F	3y and 5m	III	-
	P7	M	3y and 6m	III	-
	P8	M	2y and 4m	V	-
	P9	M	4years old	V	-
	P10	M	3y and 4m	IV	IV
Between 4th and 6th Birthday	P1	M	5years old	I	I
	P2	F	5y and 10m	I	-
	P3	M	5y and 3m	V	V
	P4	F	5y and 6m	II	II
	P5	F	4y and 2m	I	II
	P6	F	4y and 9m	IV	V*
	P7	F	5years old	I	I
	P8	F	5years old	IV	III*
	P9	M	5years old	V	-
	P10	M	4y a 4m	I	-
Between 6th and 12th Birthday	P1	M	9years old	IV	III*
	P2	M	9years old	IV	IV
	P3	M	6y and 2m	V	V
	P4	M	7y and 9m	V	-
	P5	M	10 and 9m	I	-
	P6	F	7y and 1m	V	-
	P7	M	9y and 10m	IV	-
	P8	F	6y and 5m	I	-
	P9	M	6y and10m	III	-
	P10	F	11y and 4m	V	-

* Disagreement between observers.

participation of two different groups in this phase ensured the appropriateness of the language and the applicability of the GMFCS for a target-public with varied degrees of knowledge and skills in the area. That is what Pasquali[22,23] called knowledge stratum, being the lower stratum represented in this study by undergraduate students of physical therapy and occupational therapy, and the highest stratum represented by professors and professionals with vast experience in the pediatric neurology field.

According to Pasquali[22], the participation of individuals from the lower stratum aims to determine whether the items and the paragraphs contained in the instrument are understandable to the target population with lower academic skills (i.e. people who will use the instrument in their clinical practice); while the participation of highest stratus aims to not only at the better understanding and clarity of the items and paragraphs, but also to avoid to awkwardness of the language used in the translated version of the instrument.

The content analysis aims to determine whether the items and paragraphs of the instrument refer, in fact, to the latent attribute, i.e. if they referred to the gross motor function of the children with CP[22,23]. From the suggestions about the changes presented by the participants in the highest stratum group (called expert judges), it was possible to adjust the terminologies used in the translated version of the GMFCS, producing the final version*.

The Portuguese version contributes to comparative studies with other countries, since GMFCS versions are available in at least 10 languages and it has been highly cited in the literature, which reinforces such a classification in the scientific community[8].

The application of the final version of the GMFCS in children with CP showed a distribution that spread across all levels of classification, despite finding a majority of cases classified as level V, which may be justified by the fact that the participants of this phase were undergoing a therapeutic process in a tertiary level care service. According to the study conducted by Pfeifer et al.[7], 100 children in that service, there is a predominance of quadriplegic CP cases, which are usually classified as level V.

Although the sample of the present study is smaller than the study conducted by Pfeifer et al.[7], the distribution of the motor levels was similar to their study, since in three age groups proposed by the instrument (under 2 years of age, from 2 to 4 years old, and from 6 to 12 years old) there was a predominance of level V, and in the 4-6 age group there was a predominance of level I.

In relation to the agreement between the two raters, it was found through statistical tests that the evaluations did not differ and that there is a strong correlation between the scores. The closer the coefficient is to 1, the stronger the correlation, being the agreement between the raters classified as poor (<0.4), moderate (0.4 to 0.75) or excellent (>0.75)[29]. According to this criterion, it was verified that the result of the application of this instrument in children with CP showed that there was an excellent correlation between the examiners, which ensures the adequacy of the final translated version of the GMFCS.

It is considered that an instrument has a good internal consistency when the alpha values are greater than 0.70[30] and, according to this criterion, the final translated version of the GMFCS respects the original version of the instrument.

Some of the limitations found cannot be ignored, because, being a preliminary study, the final version of the GMFCS, translated and adapted for the Brazilian population, was applied to a small sample of children with CP and within the same healthcare service, and the reliability was carried out by two professionals belonging to the group that had a higher level of expertise in the area. Therefore, further studies are needed.

Ackowledgements :::.

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* This version is available on the Can Child website in the following address: http://canchild-mgm.icreate3.esolutionsgroup.ca/en/GMFCS/resources/GMFCS_portuguese.pdf

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