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ORIGINAL RESEARCH

Comparison between speedy and content-balanced versions of the Pediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI-CAT) in children with cerebral palsy

Comparação entre as versões rápida e conteúdo-balanceada do Inventário de Avaliação Pediátrica de Incapacidade – Testagem Computadorizada Adaptativa (PEDI-CAT) em crianças com paralisia cerebral

Comparación entre las versiones rápida y de contenido equilibrado del Pediatric Disability Assessment Inventory-Computerized Adaptive Test (PEDI-CAT) en niños con parálisis cerebral

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ABSTRACT | This study aimed to compare the speedy and content-balanced versions of the Pediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI-CAT) in its four domains. A cross-sectional observational study was conducted with children with cerebral palsy (CP). The two versions of PEDI-CAT were administered to each child with a 7-days interval, remotely, in interview format with caregivers. Pearson's correlation was used to evaluate the association among scaled scores in the two versions of PEDI-CAT. In total, 11 children with CP, aged 2 to 12 years, participated in the study. A strong significant association between mean values of the scaled score of the speedy and content-balanced versions in all domains ($p<0.0001$) was observed. Two children (18.2%) were classified differently regarding normative standard score in the Social/Cognitive domain. Both versions of PEDI-CAT showed concordant results in relation to the scaled score when applied to children with CP. However, one must cautiously interpret the normative standard score depending on the version used in the Social/Cognitive domain.

Keywords | Cerebral Palsy; Child; International Classification of Functioning; Disability and Health.

RESUMO | O objetivo deste estudo foi comparar as versões rápida e conteúdo-balanceada do Inventário de Avaliação Pediátrica de Incapacidade – Testagem Computadorizada Adaptativa (PEDI-CAT) em seus quatro domínios. Para tanto, foi realizado um estudo observacional transversal com crianças com paralisia cerebral (PC). As duas versões do PEDI-CAT foram aplicadas em cada criança com um intervalo de sete dias, no formato remoto, por meio de entrevistas com

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os responsáveis. Foi utilizada a correlação de Pearson para verificar a associação entre os escores contínuos das duas versões do PEDI-CAT. Participaram do estudo 11 crianças com PC, entre 2 e 12 anos de idade. Foi verificada forte associação significativa entre valores médios do escore contínuo da versão rápida e conteúdo-balanceada em todos os domínios (p<0,0001). Duas crianças (18,2%) foram classificadas de forma diferente em relação ao escore normativo no domínio social-cognitivo. As versões do PEDI-CAT mostraram resultados concordantes em relação ao escore contínuo quando aplicadas em crianças com PC. No entanto, é necessário ter cautela na interpretação do escore normativo dependendo da versão utilizada no domínio social-cognitivo.

Descritores | Paralisia Cerebral; Criança; Classificação Internacional de Funcionalidade, Incapacidade e Saúde.

RESUMEN | El objetivo de este estudio fue comparar las versiones rápida (*speedy-cat*) y de contenido equilibrado (*content-balanced*) del *Pediatric Disability Assessment Inventory-Computerized Adaptive Test* (PEDI-CAT) en sus cuatro dominios. Para eso, se realizó un estudio observacional transversal con niños con parálisis cerebral (PC). Las dos versiones del PEDI-CAT se aplicaron a cada niño por medio de entrevistas con los cuidadores, con un intervalo de siete días y en formato remoto. Se utilizó la correlación de Pearson para verificar la asociación entre las puntuaciones continuas de las dos versiones del PEDI-CAT. Once niños con PC, con edades comprendidas entre 2 y 12 años, participaron en el estudio. Hubo una fuerte asociación significativa entre los valores medios de la puntuación continua de la versión rápida y el contenido equilibrado en todos los dominios (p<0,0001). Dos niños (18,2%) fueron clasificados de manera diferente con relación al puntaje normativo en el dominio sociocognitivo. Las versiones del PEDI-CAT mostraron resultados concordantes en cuanto a la puntuación continua cuando se aplica a niños con PC. Sin embargo, se necesita precaución al interpretar el puntaje normativo basado en la versión utilizada en el dominio sociocognitivo.

Palabras clave | Parálisis Cerebral; Niño; Clasificación Internacional del Funcionamiento, de la Discapacidad y de la Salud.

INTRODUCTION

Cerebral palsy (CP) refers to a group of permanent disorders of movement and posture development, attributed to a non-progressive lesion in the developing brain[1]. Children with CP may present limitations in mobility, communication, and personal care activities[2-4], besides restrictions on engaging in the school, family, sport, leisure, recreation, and community environments[5]. The Pediatric Evaluation of Disability Inventory (PEDI) has been used in research and clinical practice to measure performance in activities and participation of children with CP[6,7].

A new version of PEDI, with adaptive computer testing (Computer Adaptive Test – PEDI-CAT)[8], was developed and used by therapists, physicians, researchers, and educators[8-12]. This version requires a software to evaluate four domains: Daily Activities; Mobility; Social/Cognitive; and Responsibility[8-10,12]. The software allows for an evaluation based on the Item Response Theory (IRT), i.e., the degree of difficulty of subsequent questions is adjusted based on the previous answer. Moreover, it optimizes the items presented, prioritizing those most likely to produce relevant information on the child's functionality[13]. The test has validity and reliability established in the literature[14,15] and was translated into and culturally adapted for Brazilian Portuguese[10].

PEDI-CAT has two versions: Speedy CAT, with 5–15 items per domain; and Content-Balanced CAT, with about 30 items per domain. Both can be applied face-to-face or remotely, and the interview with caregivers is more common[8]. Although it requires more time due to the greater number of items compared to the speedy version, the content-balanced version allows for the evaluator to better understand which skills are important for each child in their age group, allowing for the planning of individual programs based on the results obtained[8]. Both versions are valid for measuring performance, differentiating children who walk and do not walk and who have or do not have independent manual function[8]. The speedy version has been the most used in research, mainly because it

provides accurate information and has fewer items per domain to answer[11,12,16,17], and only one study that used the content-balanced version to plan an intervention program was found[18].

The rehabilitation team must evaluate the activity and participation of children with CP in order to monitor the development and effectiveness of interventions. Despite this need, clinicians still face barriers in the use of standardized tests. In many contexts, the time available for application, data release, and interpretation of evaluations is not enough[19]. Thus, faster-to-apply tests and easier interpretation have been more valued[20].

The COVID-19 pandemic allowed a new scenario in rehabilitation, with the option of bringing the entire therapeutic process of assessment, intervention, and reassessment to the remote environment[21]. According to Ignatowicz et al.[22], telerehabilitation for pediatric patients with many health conditions is acceptable and effective in therapeutic care. Moreover, telecare consumes less time and requires less effort from parents, besides reducing the risk of virus spread[23]. Thus, the demand for standardized instruments that can be applied remotely increased, especially when they can be answered by parents and/or caregivers[18].

Considering that the time of application of an instrument can hinder its use and that instruments with remote application have become essential to enable quality assessments during the COVID-19 pandemic, the speedy version of PEDI-CAT is a relevant instrument to be used with children and adolescents with CP. However, it is necessary to compare the two versions to properly recommend their use. Therefore, this study aimed to compare the speedy and content-balanced versions of PEDI-CAT in its four domains; also we verified the association between the scaled scores of both versions.

METHODOLOGY

Study design

This is a cross-sectional observational study, which is part of a larger study called PartiCipa Brasil.

Eligibility criteria

Children aged 2 to 12 years diagnosed with CP, whose caregivers signed an informed consent form, were included. Caregivers should have access to the internet to make the video call, enabling the application of PEDI-CAT.

Children with other neurological clinical conditions—such as Down syndrome, myelomeningocele, among others—were excluded.

Measuring instruments

The two versions (speedy and content-balanced) of PEDI-CAT were applied to each child, with a 7-day interval between them. According to Haley et al.[8], this instrument allows evaluating the performance in activities and the participation of individuals aged 0 to 21 years. It has four domains: Daily Activity, Mobility, Social/Cognitive, and Responsibility. The first three are related to performance in activities and the last, to participation. The score varies according to the domain, so that the first three are scored 1–4 (1=unable; 2=hard; 3=a little hard; 4=easy). Besides these, the questionnaire also has the option "I don't know." The responsibility domain varies from 1 to 5, 1 means the adult has full responsibility and 5 that the child takes full responsibility. PEDI-CAT generates a normative standard score according to the child's chronological age, comparing it with same age peers, classifying the child with delayed performance (<30), normal performance (30-70), or advanced for their age (>70). Moreover, the instrument provides the scaled score, allowing to compare the child's performance over time, being also used in a map that organizes the items in order of difficulty, allowing to identify activities closer to being achieved[13].

Data such as sex and age were collected for sample characterization, and the children were classified using the Gross Motor Function Classification System (GMFCS) based on the report of parents or caregivers. The GMFCS Family Report Questionnaire is a classification filled by the family, based on their child's age group, aged 2 to 18 years. Caregivers should read the items and show the one closest to

their child's or adolescent's mobility performance[24,25]. This questionnaire is reliable and has good reliability with the GMFCS classification applied by therapists[24]. Both instruments classify children and adolescents into one of five functional levels, level I having the least impaired mobility and level V having the greatest impaired mobility[24,25].

Procedures

Data collection occurred remotely and the invitation to parents or caregivers was sent via WhatsApp, as well as the consent form. PEDI-CAT was applied via the Google Meet platform. Two evaluators who underwent reproducibility training were present in each collection to avoid variations among execution, minimizing the risk of intra- and inter-evaluator bias. The speedy version was applied on the first day of collection, always by the same person, who asked the questions to the parents/caregivers, whereas the other evaluator observed the application of the test. Moreover, the child was also classified using the GMFCS Family Report Questionnaire. On the second meeting, the content-balanced version was applied by the second evaluator.

Data analysis

Initially, descriptive statistics were conducted with measures of central tendency, dispersion, and frequency for sample characterization. After verifying the normal distribution by the Shapiro-Wilk test, Pearson correlation tests were used to verify the association between the scaled scores of the speedy and content-balanced versions of PEDI-CAT. The analysis of the association between the variables was performed according to Portney's study[26], for which correlation values between 0.00 and 0.25 represent little or no association between variables, between 0.25 and 0.50 weak association, between 0.50 and 0.75 moderate association, and above 0.75 strong association. A $p<0.05$ value was considered.

RESULTS

We evaluated 11 children diagnosed with CP and mean age of 8 (±3.41) years and 36.4% were female. Most individuals were classified as spastic (90.9%), with bilateral impairment (63.6%), and GMFCS IV (45.5%). All children underwent physical therapy treatment, nine (81.8%) with an occupational therapist and four (36.4%) with speech therapists.

Table 1 shows individual data of each child and mean values of the scaled and normative standard score of each domain in the speedy and content-balanced versions. The mean values found in both versions in the scaled domain are similar.

Children with bilateral impairment had higher levels of GMFCS, i.e., more severe motor impairment. These children seem to present lower scaled scores in the Mobility and Daily Activity domains.

Regarding the normative standard score, seven (63.6%) children were classified as delayed regarding performance in daily activities in both versions, and five of these presented bilateral motor impairment and two, unilateral impairment. Most children (81.8%) were classified as delayed regarding the mobility domain, but the two who showed normal performance according to age presented unilateral impairment. Only one child (9.1%), with unilateral impairment, was classified as delayed in the Responsibility domain.

However, the classifications were different for the Social/Cognitive domain: two children (18.2%) were considered delayed in the speedy version, one with bilateral impairment, and the other with unilateral impairment, as well as four (36.4%) in the content-balanced version, three with bilateral impairment, and one with unilateral impairment.

We observed a strong significant association between the mean values of the scaled scores of the speedy and content-balanced versions in all domains ($p<0.05$) (Table 2).

Table 1. Individual data of each child and mean values of the scaled and normative standard scores of each domain in the speedy and content-balanced versions

P	Age	Sex	Types od CP	Topography	GMFCS	Daily activity				Mobility				Social/Cognitive				Responsibility			
						Speedy version		Content-balanced version		Speedy version		Content-balanced version		Speedy version		Content-balanced version		Speedy version		Content-balanced version	
						EN	EC	EN	EC	EN	EC	EN	EC	EN	EC	EN	EC	EN	EC	EN	EC
1	6	M	Spastic	Bilateral	4	32	51	27	49	19	56	20	57	33	60	29	59	52	46	39	41
2	7	F	Spastic	Bilateral	5	<10	40	<10	39	<10	46	<10	43	32	61	16	56	30	38	31	39
3	11	M	Spastic	Unilateral	2	24	57	26	57	<10	62	<10	62	41	70	44	71	60	59	59	59
4	12	M	Spastic	Bilateral	4	<10	56	11	57	<10	57	<10	55	38	72	36	72	43	55	39	53
5	9	M	Spastic	Bilateral	4	<10	51	11	51	<10	45	<10	49	31	66	31	66	46	52	51	54
6	6	M	Spastic	Unilateral	1	42	55	45	56	37	64	41	65	44	65	48	66	64	54	65	54
7	8	M	Spastic	Unilateral	1	52	61	44	59	51	70	53	71	47	68	53	70	47	49	46	49
8	8	F	Spastic	Bilateral	3	29	54	33	55	<10	54	<10	52	41	67	45	68	50	51	48	50
9	5	M	Dyskinetic	Bilateral	4	20	45	24	47	13	53	<10	51	23	55	21	54	32	36	31	35
10	14	F	Spastic	Unilateral	2	<10	55	<10	55	<10	63	<10	62	13	64	<10	63	28	47	24	45
11	2	F	Spastic	Bilateral	4	48	51	46	50	13	47	14	47	58	63	60	64	-	-	-	-
X±DP							52,36±5,82		52,27±5,83		56,09±5,13		55,81±8,48		64,64±4,82		64,45±6,01		45,18±13,56		44,45±13,55

P: participants; F: female; M: male; NS: normative standard score; SS: scaled score; X: mean; SD: standard deviation.

Table 2. Association between the scaled scores of the speedy and content-balanced versions

Domain	r	p
Daily activities	0.98	0.0001*
Mobility	0.97	0.0001*
Social/Cognitive	0.96	0.0001*
Responsibility	0.99	0.0001*

r: Pearson coefficient; *p<0.05 value.

DISCUSSION

This study aimed to compare the two versions of PEDI-CAT, and the outcomes showed a strong association between them in Daily Activities, Mobility, Social/Cognitive, and Responsibility domains. They also showed a strong agreement between the results obtained in the scaled scores of both versions of PEDI-CAT, showing that they are comparable and can provide similar information for research and clinical practice.

The scaled score informs the child's level of performance, regardless of their age group, showing the current classification of the child or adolescent in each domain[8]. Thus, an increase in this score means that the performance in the abilities or the level of responsibility of the child or adolescent increased, that is, the differences in the scores mean the absolute number of changes that occurred from one evaluation to another. This score can help in the monitoring of functional progress in children and young people with disabilities, allowing to compare their performance over time and verify the effectiveness of interventions[8]. The scaled PEDI-CAT score has already been used in studies to evaluate the effectiveness of interventions, being valid and responsive to record changes over time in children with CP[12,27]. According to our results, we could observe a strong association between the mean values of the scaled score comparing the two versions of PEDI-CAT. Thus, the speedy version of the instrument is viable to monitor the performance of children and adolescents in the long term. Based on the scaled score, the instrument provides a map of items representing the location of the scores of the individual items along the continuum of difficulty of each domain, allowing for the placement of each child along this continuum[8]. Since it has more items, the map of items of the content-balanced version is more complete and provides detailed information about the child's performance. Thus, it can be considered for a better planning of interventions in clinical practice[8].

Regarding normative standard score, it describes the desired performance of children in comparison with their peers, at one-year intervals, as a T score. Since the score is on chronological age, it is intended for health professionals to understand whether delay is present in the child's performance in each domain[8]. This information can be used to identify the need for intervention in specific aspects of activity and participation[8].

In this study, we observed an agreement in the classification of the normative standard score between both versions of PEDI-CAT for Daily Activities, Mobility, and Responsibility domains in all children in the sample, showing that the speedy version can classify the child's performance. However, when observing children's performance in the Social/Cognitive domain, the results showed a divergence in the classification of two children in each version of PEDI-CAT. Among them, children 1 (GMFCS IV) and 2 (GMFCS V) were classified as normal in the speedy version, but were classified as delayed in the performance of Social/Cognitive activities in the content-balanced version. Another study showed that the test-retest reliability of this domain, although high, is still lower than that of other test domains (ICC=0.98, 95%CI 0.95–0.99)[15]. A possible explanation for the divergence in the Social/Cognitive domain may be related to an inconsistency of the caregivers' responses, identified in the Fit score, obtained from PEDI-CAT. For this score, the instrument manual indicate that values higher than –1.64 suggest a high inconsistency of responses, and one of the participants who had different classifications obtained a Fit score of –5.19 for the Social/Cognitive domain in one of the versions[8].

This study has some limitations, as the small sample size, containing only 11 children, which was sufficient to identify a strong significant association between the two versions analyzed. Moreover, it is important to consider the wide age group of the sample, which may not have reflected the specific results for each age. Notably, two different examiners applied the two versions. Thus, we recommend caution interpreting the data.

This study shows that both versions of PEDI-CAT are similar and can contribute to research and clinical practice. We should note that the speedy version proved to be viable and may be the choice for professionals who work in clinical practice but have time restriction for using the standardized tests. This version can facilitate the implementation of standardized evaluations in clinical practice since the time of application of the instruments was implied to be a barrier to their use[19].

Notably, this was the first study comparing the two versions of PEDI-CAT in children and adolescents with CP, contributing to the professional's decision regarding which version of the test should be used.

CONCLUSION

Both versions of PEDI-CAT showed agreement regarding the scaled score when applied in children with CP. However, one must be cautious when interpreting the normative standard score in the Social/Cognitive domain depending on the version used.

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