ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2021 32(1)81-88

Ayşe YILDIZ, MSc, PT[1]
Ramazan YILDIZ, MSc, PT[1]
Erkan EROL, PhD, PT[2]
Umut APAYDIN, PhD, PT[1]
Derya GÖKMEN, PhD[3]
Bülent ELBASAN, PhD, PT[1]

1 *Gazi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Turkey.*
2 *Tokat Gaziosmanpaşa University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Tokat, Turkey.*
3 *Ankara University, Faculty of Medicine, Department of Biostatistics, Ankara, Turkey.*

Correspondence (İletişim):

Ramazan YILDIZ, MSc, PT
Emek, Bişkek Cad., 6. Sok,
Gazi Üniversitesi No: 2,
06490, Çankaya, Ankara
E-mail: fztramazanyildiz@gmail.com
Phone: +90-312-216 2643
ORCID: 0000-0002-8007-7854

Ayşe YILDIZ
E-mail: simsekayse38@gmail.com
ORCID: 0000-0002-1101-1069

Erkan EROL
E-mail: erkanerol@gmail.com
ORCID: 0000-0002-0087-1821

Umut APAYDIN
E-mail: fzt.umut28@gmail.com
ORCID: 0000-0002-0866-5870

Derya GÖKMEN
E-mail: dgokmen2001@yahoo.com
ORCID: 0000-0001-6266-3035

Bülent ELBASAN
E-mail: bulentelbasan@gazi.edu.tr
ORCID: 0000-0001-8714-0214

Received: *02.12.2019 (Geliş Tarihi)*
Accepted: *14.09.2020 (Kabul Tarihi)*

RELIABILITY AND VALIDITY OF THE TURKISH VERSION OF THE CAREGIVER FUNCTIONAL USE SURVEY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Poor bimanual performance is usually a major functional impairment for children with unilateral cerebral palsy (CP). This study was performed to examine the reliability and validity of the Turkish version of the Caregiver Functional Use Survey (CFUS), which assesses manual function of children with unilateral CP.

Methods: Fifty children with unilateral CP and their parents were included in the study. The test-retest reliability was assessed using Intraclass Correlation Coefficient (ICC), and internal consistency by calculating Cronbach alpha values. Association level between other outcomes measures (Jebsen Taylor Hand Function Test, JTT, and Manual Ability Classification System, MACS) and the Turkish version of the CFUS was analyzed to determine the criterion validity. Four one-factorial confirmatory factor analyses to validate uni-dimensionality of the CFUS were performed. Confirmatory factor analyses confirmed the one-dimensional structure of the "amount of use" and "quality of movement" parts of the CFUS for unimanual and bimanual tasks.

Results: The Turkish version of the CFUS showed a high degree of internal consistency (Cronbach alpha=0.92-0.94). The ICCs ranged between 0.90 and 0.93. There was a negative correlation between all the subscales of the CFUS and the MACS and the JTT ($p<0.05$).

Conclusion: The Turkish version of CFUS is a reliable and valid tool for assessing the upper extremity functions in children with unilateral CP.

Key Words: Cerebral Palsy; Questionnaires; Caregivers.

BAKIMVEREN FONKSİYONEL KULLANIM ANKETİNİN TÜRKÇE VERSİYONUNUN GEÇERLİK VE GÜVENİRLİĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Zayıf bilateral performans unilateral etkilenimi olan serebral palsili (SP) çocuklarda önemli bir fonksiyonel limitasyondur. Bu çalışma, unilateral SP tanılı çocukların el fonksiyonlarını değerlendiren Caregiver Functional Use Survey (CFUS) Türkçe versiyonunun geçerlik ve güvenirliğini değerlendirmek amacıyla yapıldı.

Yöntem: Unilateral SP'li 50 çocuk ve ebeveynleri çalışmaya dahil edildi. Test-tekrar test güvenirliği, sınıf içi korelasyon katsayısı (ICC) ile; iç tutarlılık ise, Cronbach alfa değeri hesaplanarak değerlendirildi. Dış yapı geçerliğini belirlemek için Jebsen Taylor El Fonksiyon Testi (JTT) ve Manuel Yetenek Sınıflandırma Sistemi (MACS) ile CFUS'un Türkçe versiyonu arasındaki ilişki incelendi. Faktör analizi ile CFUS un tek boyutlu olduğu doğrulandı. Faktör analizleri, unimanuel ve bimanuel görevler için CFUS'un "kullanım miktarı" ve "hareket kalitesi" bölümlerinin tek boyutlu yapısını incelemek için kullanıldı.

Sonuçlar: CFUS'un Türkçe versiyonu yüksek derecede iç tutarlılık gösterdi (Cronbach α=0,92–0,94). ICC değerlerinin 0,90 ile 0,93 arasında değiştiği bulundu. Tüm CFUS ve MACS ve JTT alt ölçekleri arasında negatif korelasyon vardı ($p<0,05$).

Tartışma: Unilateral SP'li çocuklarda üst ekstremite fonksiyonlarının değerlendirilmesinde CFUS'un Türkçe versiyonunun geçerli ve güvenilir bir araç olduğu sonucuna varıldı.

Anahtar Kelimeler: Serebral Palsi; Anket; Bakımveren.

INTRODUCTION

Cerebral palsy (CP) is a complex condition that involves motor impairments, activity limitations, and participation restrictions that are caused by a lesion in the immature brain (1). The most common form of CP is unilateral CP and accounts for one in 1300 live births (2). Children with unilateral CP are characterized by motor impairments mainly lateralized to one side of the body, with more significant upper limb than lower limb involvement (3). These children are confronted with various motor and sensory impairments (4). Motor impairments include muscle weakness, spasticity, dystonia, and reduced muscle length. Stereognosis and two-point discrimination, proprioception disorder are among the sensory impairments (8).

Children with unilateral CP have impaired bimanual coordination beyond their involved upper limb impairments. These impairments may result in the functional limitation that affects their independence adversely (7). Although these motor impairments in children with unilateral CP are clinically recognized, their occurrence and distribution have not been systematically investigated by standardized assessments (5). Whereas, according to the International Classification of Functioning, Disability and Health (ICF), the upper limbs could be assessed at the level of body function, activity and participation (9). For this reason, adequate evaluation of upper extremity function in these children is not only essential to draw out the outline of treatment but also critical in terms of measuring efficacy and allowing follow-up over time (8).

In the literature, several measurement tools have been designed to assess arm activities in children with unilateral CP. Each tool involves different clinical aspects. Some of these tools provide unimanual (9,10) evaluation, while some allow for bimanual evaluation (11). Poor bimanual performance is usually a major functional impairment for children with unilateral CP. For this reason, the bimanual ability should be evaluated carefully during the evaluation of the upper limbs.

According to the ICF, the "capacity" and "performance" of qualifications should be evaluated. Capacity refers to the child's ability to execute a task on the highest possible level of functioning that the child may reach in the environment. The components of the capacity are the quality of movement (e.g., active range of motion, fluency, accuracy), dexterity and movement speed. Performance is spontaneous use of affected hand during the child's activities or play. To obtain a complete representation of the child's abilities, these different qualifiers of arm function have to be considered (8).

The Caregiver Functional Use Survey (CFUS), designed by Charles et al., allows evaluating both bimanual and unimanual tasks (7). Therefore, CFUS is an alternative test to assess upper limb functions in children with unilateral CP. In addition, the CFUS assesses caregivers' perceptions of "how much" and "how well" their children used the involved upper extremity. Thus provide information on the quality of movement and amount of use of the upper extremity. In this way, evaluates the "capacity" and "performance" specified in the ICF. The questionnaire evaluates children across a wide age span; it includes developmentally appropriate activities, even for children at the younger end of the age range. Young children do not have difficulty completing stipulated bimanual tasks. Although the CFUS has such important properties, its validity and reliability have not been established. Therefore, this study was planned to test the validity and reliability of the Turkish version of the CFUS.

METHODS

Before the study, permission was received from Andrew Gordon, who developed the CFUS (7). Firstly, the translation and the cultural adaptation of the CFUS were completed, considering the stages indicated by Beaton (12). The scale was translated into Turkish; independent translators who did not exchange information with each other carried out two translations. Secondly, the synthesis of the first version in Turkish was performed by two physiotherapists, with an average of 13 years of experience in pediatric rehabilitation. Two people who are native English speakers and speak Turkish very well translated this Turkish scale back to English and the English scale was compared with the original scale. Finally, the semantically acceptable version for Turkish was created.

Participants

This study was conducted at Gazi University Faculty of Health Sciences Department of Physiotherapy and Rehabilitation. Children with CP were screened and invited to participate if they (1) were diagnosed as unilateral CP, (2) are aged between 5 and 15 years, (3) ability to follow verbal directions, and (4) were accepted as inclusion criteria. Patients with major ataxia or dystonia and within the last six months history of surgical or Botox injection for upper extremity were excluded. All parents provided written informed consent for participation. Ethical approval to perform this study was obtained from Gazi University Ethical Committee. The sample size was calculated with 90% power and a 5% type I error level with 50 children. All of these children were receiving therapy including upper extremity training.

Caregiver Functional Use Survey: The CFUS was designed to assess caregivers' perceptions of "how well" and "how much" their child used the involved upper extremity. Its first version, 14 bimanual items, was developed as a 6-point Likert scale in terms of frequency and quality of hand use (5). In the last version modified by Gordon et al., 10 bimanual and 10 unimanual items were rated on a six-point (0-5) (7). The Likert scale was used for the frequency and quality of hand use. "0 points" means the affected arm was not used at all for that activity. "5 point" means the ability to use the affected arm for that activity was equal to the ability to use the unaffected arm (7). The average score of the separately "amount of use" and "quality of movement" parts for unimanual and bimanual tasks is calculated. The CFUS was used in children between the ages of three years and six months and 15 years and six months (7).

Jebsen Taylor Hand Function Test (JTT): The JTT is a standardized test to assess a person's overall hand function (13). Seven subsets of the test simulate hand function in activities of daily living, which includes writing, simulated page-turning, stacking checkers, simulated feeding and picking up small everyday objects, large light objects, large, heavy objects. In this study, the JTT was modified by the removal of the writing task. Each task completion time was limited to three minutes. The maximum test completion time was 1080 seconds for a single upper extremity (14).

Manual Ability Classification System (MACS): The MACS is developed tool to assess children's ability to handle objects in daily activities (15). It was designed for children with CP aged four to 18 years in levels ranging from I to V. The children at the level I can handle objects easily, and at level V, the children do not handle objects (15). The Turkish version of the MACS is reliable, valid and appropriate for the assessment of manual ability within the Turkish population (16).

A cross-sectional survey study design was used to assess the reliability and validity of the Turkish version of the scale. The demographic characteristics included age, gender and hemiplegic side of children. The MACS levels of all children included in the study were recorded, and upper extremity functions were evaluated with the JTT. The parents of children filled the CFUS scale.

For test-retest, the sample size was calculated using G*Power 3 (G*Power, Version 3.0.10, Franz Faul, Universität Kiel, Germany). Thirty children with CP included for the test-retest reliability analysis (17). The CFUS was repeated with these children after one week (Figure 1).

Statistical Analysis

All statistical analyses were performed using SPSS (IBM SPSS Statistics 22.0, IBM, Ehningen, Germany). The psychometric properties of CFUS were evaluated through tests for validity and reliability. Four one-factorial confirmatory factor analysis (CFA) for categorical data was applied to test whether each set of items (for both unimanual and bimanual tasks in terms of "amount of use" and "quality of movement") measured a single uni-dimensional construct, MPlus (Muthén & Muthén, Los Angeles, CA, USA) (18). Items with factor loadings above 0.40 were retained. The ratio of the Chi-square test of model fit to the degrees of freedom (x^2/df) [values of five or less]. The Tucker Lewis Index (TLI: >0.90 acceptable and >0.95 excellent), the Comparative Fit Index (CFI: >0.90 acceptable and >0.95 excellent), standardized root mean square residual (SRMR: <0.08 acceptable and <0.05 excellent) and the Root Mean Square Error of Approxi-

mation (RMSEA: <0.08 acceptable and <0.05 excellent) were used as goodness-of-fit statistics (19). After confirmation of construct validity, reliability was tested in terms of both internal consistency and test-retest reliability. While internal consistency was evaluated using Cronbach's alpha coefficient (20), test-retest reliability was examined via intraclass correlation coefficient (ICC) with its confidence interval (21). For the evaluation of criterion validity, the Spearman's correlation coefficient was calculated between the CFUS scores and the JTT, and the MACS. Level of relationship was classified with Spearman's correlation coefficient as follows: "<0.30=small/negligible," "0.30–0.50=low," "0.50-0.69=moderate," "0.70-0.90=high," and ">0.90=very high" (22). Descriptive level of significance was set at p<0.05.

RESULTS

A total of 50 children (26 boys, 24 girls) with CP were evaluated in this study. The mean age of the children was 10.61±3.00 years (Table 1).

Structural Validity

In the present study, we performed four CFAs for the "amount of use (AOU)" and "quality of movement (QOM)" parts of CFUS for unimanual and bimanual tasks. In our study, the 10 items were subjected to one-factor CFA to confirm the structure of CFUS. According to factor loadings and goodness-of-fit statistics, one-factor structure was confirmed for unimanual and bimanual tasks in terms of "amount of use" and "quality of movement". Three of the four goodness of fit statistics examined demonstrated good model fit for bimanual and unimanual subscales. The CFI values were 0.933, 0.946, 0.958, and 0.976 for the Bimanual AOU and QOM Subscales and the Unimanual AOU and QOM Subscales, respectively. Similarly, the TLI values were 0.973, 0.979, 0.986, and 0.990 the Bimanual AOU and QOM Subscales and the Unimanual AOU and QOM Subscales, respectively. All SRMR values were <0.08, and these were acceptable values. In contrast, the RMSEA was larger than the desired in all subscales. Recent studies have shown that this marker may be sensitive to the distribution of the underlying data set (23). Items, factor loadings and goodness-of-fit measures are given in Table 2.

Criterion Validity

In order to analyze criterion validity, correlation analysis was conducted between the CFUS and the JTT. The score of the Bimanual AOU and QOM subscales had a negative correlation with JTT (r=-0.606, p<0.001 and r=-0.652, p<0.001 respectively). While the Unimanual AOU Subscale score showed a negative correlation with the JTT (r=-0.576, p<0.001), the Unimanual QOM Subscale score had a negative correlation with JTT (r=-0.613, p<0.001). There was a negative and strong correlation between MACS and all subscales of CFUS (Table 3). When all these values are analyzed, it was seen that the CFUS has sufficient criterion validity (Table 3).

Internal Consistency

As a result of the internal consistency analysis, Cronbach's alpha coefficient was found to be α=0.928 for the Bimanual AOU Scale and α=0.936 for the QOM Scale. In addition, Cronbach's alpha coefficients were α=0.945 and α=0.947 for the unimanual AOU Scale and Unimanual QOM Scale, respectively. These values indicated that the scale has a high level of internal consistency.

Table 1: Demographic Characteristics of the Participants.

Characteristics	**CP (n=50)**
Age (years), Mean±SD	10.61±3.00
Gender (Female/Male) (n)	24/26
Side of Hemiplegia (Right/Left) (n)	28/22
Manual Ability Classification System, n (%) Level I Level II Level III Level IV Level V	 20 (40) 10 (20) 5 (10) 3 (6) 12 (24)
Usual Therapy Included Upper Limb Training, n (%)	50 (100)

Table 2: Results of the Confirmatory Factor Analysis.

Items	Bimanual AOU Scale	Bimanual QOM Scale	Unimanual AOU Scale	Unimanual QOM Scale
Item 1	0.758	0.764	0.848	0.899
Item 2	0.874	0.910	0.852	0.877
Item 3	0.852	0.879	0.801	0.830
Item 4	0.821	0.818	0.851	0.856
Item 5	0.865	0.853	0.916	0.900
Item 6	0.794	0.813	0.883	0.915
Item 7	0.842	0.885	0.832	0.868
Item 8	0.850	0.891	0.885	0.896
Item 9	0.668	0.677	0.810	0.790
Item 10	0.681	0.616	0.880	0.877
Goodness of Fit Measures	Bimanual AOU Scale	Bimanual QOM Scale	Unimanual AOU Scale	Unimanual QOM Scale
x^2/df 3.5 3.56 3 2.73				
CFI	0.933	0.946	0.958	0.976
TLI	0.973	0.979	0.986	0.990
RMSEA	0.193	0.195	0.172	0.161
SRMR	0.070	0.064	0.062	0.057

x^2: Chi-square test of model fit, df: degrees of freedom. CFI: Comparative Fit Index, TLI: The Tucker Lewis Index, SRMR: Standardized Root Mean Square Residual, RMSEA: Root Mean Square Error of Approximation. AOU: Amount of Use, QOM: Quality of Movement.

Reliability

The test-retest ICC scores of the CFUS were found as ICC=0.939 for the Bimanual AOU Scale, ICC=0.966 for the Bimanual QOM subscale, ICC=0.901 for the Unimanual AOU Scale and ICC=0.969 for the Unimanual QOM subscale. When all the ICC values were analyzed, the questionnaire was found to have high test-retest reliability. The results of the reliability analysis are summarized in Table 4.

DISCUSSION

We found that the Turkish version of the CFUS is reliable and valid in children with unilateral CP. The study was of critical importance to define the psychometric properties of the CFUS.

The CFUS was developed as an outcome measure in a study to investigate the effectiveness of constraint-induced movement therapy (CIMT). This version involved 14 bimanual items. "How Well" and "How Much" scales were parent-rated on 6-point (0–5) ordinal scales with 0.5 unit increments (5). Another study, using a similar version of the CFUS examined the relationship between the efficacy of the CIMT and age on involved upper-extremity function (24). Gordon et al. reported a modified version of CFUS containing 10 unimanual and 10 bimanual items (7). In the literature, there is no evidence for development or psychometric properties of the CFUS. Therefore, this study was of critical importance to define the psychometric properties of the CFUS.

In clinical environments, there are clinical measures such as Quality of Upper Extremity Skills Test

Table 3: Correlation between the Caregiver Functional Use Survey and the Jebsen Taylor Hand Function Test, and the Manual Ability Classification System.

Subscales of CFUS	JTT	MACS
Bimanual AOU Scale	-0.606*	-0.798*
Bimanual QOM Scale	-0.652*	-0.825*
Unimanual AOU Scale	-0.576*	-0.784*
Unimanual QOM Scale	-0.613*	-0.804*

*p<0.001. CFUS: Caregiver Functional Use Survey, JTT: Jebsen Taylor Hand Function Test, MACS: Manual Ability Classification System, AOU: Amount of Use, QOM: Quality of Movement.

Table 4: Internal Consistency (Cronbach's alpha) and Test-retest Reliability Intraclass Correlation Coefficients (ICC) For the CFUS.

Subscales of CFUS	Cronbach's Alpha Coefficient	ICC (95% Confidence Interval)
Bimanual AOU Scale	0.928	0.939 (0.862-0.973)
Bimanual QOM Scale	0.936	0.966 (0.923-0.985)
Unimanual AOU Scale	0.945	0.901 (0.777-0.956)
Unimanual QOM Scale	0.947	0.969 (0.929-0.986)

ICC: Intraclass Correlation Coefficient. CFUS: Caregiver Functional Use Survey, AOU: Amount of Use, QOM: Quality of Movement.

(25) and Melbourne Assessment (26) that evaluate the capacity of the upper limb or the ability to use the upper limbs of children. However, children with CP are less likely to spontaneously use their affected upper limbs during daily living activity or self-care tasks (27). Therefore, it is more appropriate to evaluate the use of upper limbs of children with CP during daily living activities rather than clinical-based assessment or therapy sessions. The importance of evaluating the performance of the upper limb in their environment is reflected by specific self- or parent report measures such as Children's Hand-use Experience Questionnaire (CHEQ) (28) and the Pediatric Motor Activity Log (PMAL) (29). The CHEQ consists of bimanual activities and evaluates children's perceived experiences during bimanual performances. The CHEQ measures hand usage during the activity. It also evaluates the experience of performance (efficiency of grasp), and the need for extra time to perform activities. The questionnaire also assesses the sense of feeling of bothered (28). The PMAL and the CFUS evaluate unilateral and bilateral tasks for capturing fine to gross motor functions in children with CP. Both assessments include subscales documenting the amount of hand use and quality of hand use. The CFUS would contribute to clinical and research studies as it provides the opportunity to evaluate the wider age range.

As a result of the analyzes, the CFUS has shown

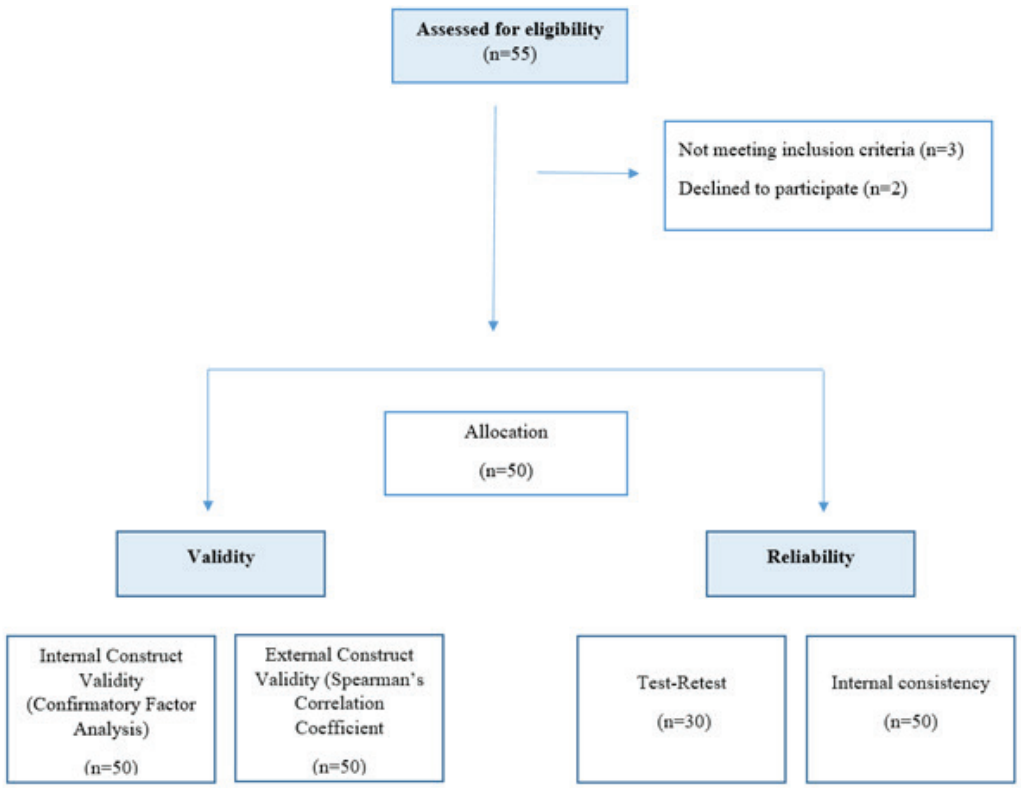

Figure 1: Flow Chart of Participants.

that there is a uni-dimensional structure and acceptable item fit statistics supporting its use as a measure of upper extremity function. Also, the analyses indicated that the CFUS showed acceptable criterion- validity in children with unilateral CP. The ICC demonstrated the high test-retest reliability in this study. Therefore, the Turkish version of CFUS may be considered as a valid and reliable tool.

A few limitations warrant consideration. Children between the ages of five and 15 years were included in the study. Since the JTT is not suitable for children <five years of age, these children were not included in the study. Another limitation of this study was the difficulty to find the equal number of participants in each level of MACS. Further study may include more children on the broader age range.

In conclusion, the results of this study showed that the Turkish version of the CFUS is a reliable and valid scale for the assessment of manual ability in children with unilateral CP through parental reporting. Also, the CFUS represents a uni-dimensional set of items with a good range of content appropriate for application to the population of unilateral children CP.

Sources of Support: No external funding was secured for this study.

Conflict of Interest: Authors declare that there is no conflict of interest.

Ethical Approval: The ethical approval of this study has been obtained from the Gazi University Ethics Committee of Clinical Research (Approval Date: 02.12.2016 and Approval Number: 77082166-604.01.02).

Informed Consent: Written informed consent was obtained from each subject.

Peer-Review: The authors will comply with the editor's decision on this matter.

Author Contributions: Concept – AY, RY, BE; Design – AY, EE, UA; Supervision – AY, DG, BE; Resources and Financial Support – BE; Materials – RY, UA; Data Collection and/or Processing – AY, RY, EE, UA; Analysis and/or Interpretation – AY, DG, BE; Literature Research – AY, RY, EE, UA; Writing Manuscript – AY, RY, EE, UA, DG, BE; Critical Review – DG, BE.

Acknowledgements: In order to use the CFUS questionnaire in the study, permission was obtained from Andrew M Gordon, New York, USA. Clinical Trials number is NCT03130075.

REFERENCES

1. Aisen ML, Kerkovich D, Mast J, Mulroy S,Wren TA, Kay RM, et al. Cerebral palsy: clinical care and neurological rehabilitation. Lancet Neurol. 2011;10(9):844-52.
2. Sakzewski L, Ziviani J, Boyd RN. Efficacy of upper limb therapies for unilateral cerebral palsy: a meta-analysis. Pediatrics. 2014;133(1):e175-e204.
3. Gordon AM. To constrain or not to constrain, and other stories of intensive upper extremity training for children with unilateral cerebral palsy. Dev Med Child Neurol. 2011;53(4):56-61.
4. Bleyenheuft Y, Gordon AM. Precision grip control, sensory impairments and their interactions in children with hemiplegic cerebral palsy: a systematic review. Res Dev Disabil. 2013;34(9):3014-28.
5. Charles JR, Wolf SL, Schneider JA, Gordon AM. Efficacy of a child-friendly form of constraint-induced movement therapy in hemiplegic cerebral palsy: a randomized control trial. Dev Med Child Neurol. 2006;48(8):635-42.
6. Klingels K, Demeyere I, Jaspers E, De Cock P, Molenaers G, Boyd R, et al. Upper limb impairments and their impact on activity measures in children with unilateral cerebral palsy. Eur J Paediatr Neurol. 2012;16(5):475-84.
7. Gordon AM, Schneider JA, Chinnan A, Charles JR. Efficacy of a hand–arm bimanual intensive therapy (HABIT) in children with hemiplegic cerebral palsy: a randomized control trial. Dev Med Child Neurol. 2007;49(11):830-8.
8. Klingels K, Jaspers E, Van de Winckel A, De Cock P, Molenaers G, Feys H. A systematic review of arm activity measures for children with hemiplegic cerebral palsy. Clin Rehabil. 2010;24(10):887-900.
9. Lemmens RJ, Timmermans AA, Janssen-Potten YJ, Smeets RJ, Seelen HA. Valid and reliable instruments for arm-hand assessment at ICF activity level in persons with hemiplegia: a systematic review. BMC Neurol. 2012;12(1):21.
10. Gilmore R, Sakzewski L, Boyd R. Upper limb activity measures for 5 to 16 year old children with congenital hemiplegia: a systematic review. Dev Med Child Neurol. 2010;52(1):14-21.
11. Spironello C, Hay J, Missiuna C, Faught B, Cairney J. Concurrent and construct validation of the short form of the Bruininks Oseretsky Test of Motor Proficiency and the Movement ABC when administered under field conditions: implications for screening. Child Care Health Dev. 2010;36(4):499-507.
12. Epstein J, Santo RM, Guillemin F. A review of guidelines for cross-cultural adaptation of questionnaires could not bring out a consensus. J Clin Epidemiol. 2015;68(4):435-41.
13. Sears ED, Chung KC. Validity and responsiveness of the Jebsen–Taylor hand function test. J Hand Surg Am. 2010;35(1):30-7.
14. Green D, Schertz M, Gordon AM, Moore A, Schejter Margalit T, Farquharson Y, et al. A multi site study of functional outcomes following a themed approach to hand–arm bimanual intensive therapy for children with hemiplegia. Dev Med Child Neurol. 2013;55(6):527-33.
15. Eliasson A-C, Krumlinde-Sundholm L, Rösblad B, Beckung E, Arner M, Öhrvall A-M, et al. The Manual Ability Classification System (MACS) for children with cerebral palsy: scale development and evidence of validity and reliability. Dev Med Child Neu-

rol. 2006;48(7):549-54.
16. Akpinar P, Tezel CG, Eliasson AC, Icagasioglu A. Reliability and cross-cultural validation of the Turkish version of Manual Ability Classification System (MACS) for children with cerebral palsy. Disabil Rehabil. 2010;32(23):1910-6.
17. Faul F, Erdfelder E, Lang AG, Buchner A. G* Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-91.
18. Li CH. Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. Behav Res Methods. 2016;48(3):936-49.
19. Geldhof GJ, Preacher KJ, Zyphur MJ. Reliability estimation in a multilevel confirmatory factor analysis framework. Psychol Methods. 2014;19(1):72.
20. Peterson RA, Kim Y. On the relationship between coefficient alpha and composite reliability. J Appl Psychol. 2013;98(1):194.
21. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016;15(2):155-63
22. Mukaka MM. A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24(3):69-71
23. Cook KF, Kallen MA, Amtmann D. Having a fit: impact of number of items and distribution of data on traditional criteria for assessing IRT's unidimensionality assumption. Qual Life Res. 2009;18(4):447-60.
24. Gordon AM, Charles J, Wolf, SL. Efficacy of constraint-induced movement therapy on involved upper-extremity use in children with hemiplegic cerebral palsy is not age-dependent. Pediatrics. 2006;117(3):363-73.
25. Thorley M, Lannin N, Cusick A, Novak I, Boyd R. Reliability of the quality of upper extremity skills test for children with cerebral palsy aged 2 to 12 years. Phys Occup Ther Pediatr. 2012;32(1):4-21.
26. Arnould C, Penta M, Renders A, Thonnard JL. ABILHAND-Kids: a measure of manual ability in children with cerebral palsy. Neurology. 2004;63(6):1045-52.
27. Louwers A, Meester-Delver A, Folmer K, Nollet F, Beelen A. Immediate effect of a wrist and thumb brace on bimanual activities in children with hemiplegic cerebral palsy. Dev Med Child Neurol. 2011;53(4):321-6.
28. Sköld A, Hermansson LN, Krumlinde-Sundholm L, Eliasson AC. Development and evidence of validity for the children's hand-use experience questionnaire (CHEQ). Dev Med Child Neurol. 2011;53(5):436-42.
29. Wallen M, Bundy A, Pont K, Ziviani J. Psychometric properties of the Pediatric Motor Activity Log used for children with cerebral palsy. Dev Med Child Neurol. 2009;51(3):200-8.