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ASSESSMENT PROCEDURE

Validity and reliability of the Turkish version of the hand-use-at-home questionnaire for children with unilateral cerebral palsy and neonatal brachial plexus palsy

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ABSTRACT

Purpose: To translate the Hand-Use-at-Home questionnaire (HUH), assesses the amount of spontaneous use of the affected hand in children with 18 bimanual activities, into Turkish and examine its validity and reliability on children with neonatal brachial plexus palsy (NBPP) or unilateral cerebral palsy (UCP).

Materials and methods: The HUH was translated and cross-culturally adapted to Turkish and administered to children with NBPP ($n=25$) and UCP ($n=42$) between 3 and 10 years. The psychometric analyses included reliability by internal consistency (Cronbach's alpha) and test/retest reliability (intraclass correlation coefficient, ICC) structural validity was evaluated with exploratory factor analysis, and construct validity was investigated by matching the HUH with the Pediatric Outcome Data Collection Instrument Upper Extremity Scale (PODCI) (NBPP only), and Children's Hand-Use Experience Questionnaire (CHEQ) (UCP only).

Results: HUH showed excellent test–retest reliability (ICC2,1 = 0.988 CI (0.977–0.992)), excellent internal consistency (Cronbach's-α = 0.989), and moderate correlation with CHEQ (rs = 0.558) in UCP and high correlation with PODCI Scale (rs = 0.789) in NBPP group. The HUH had low and moderate correlation respectively lesion-extent levels (r=-0.457) in NBPP and 5 Manual Ability Classification System levels (r=-0.688) in the UCP group.

Conclusion: The HUH is a valid and reliable tool to assess the amount of spontaneous use of the affected hand in Turkish children with NBPP and UCP.

IMPLICATIONS FOR REHABILITATION

- The Hand-Use-at-Home (HUH) questionnaire is a reliable and good valid outcome measure to evaluate the amount of spontaneous use of the affected hand.
- We suggest the Turkish version of the HUH be used in the Turkish children to indicate small changes in the severity of disorder of children until a normal quality of life is achieved.
- The HUH can be used with high reliability and validity by experienced and inexperienced doctors and physiotherapists.

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Introduction

Children with unilateral cerebral palsy (UCP) and neonatal brachial plexus palsy (NBPP) experience various upper limb problems. Motor impairments in children with UCP include muscle weakness, hypotonicity, hypertonicity and/or dystonia, and reduced muscle length. In children with NBPP, most commonly the upper trunk of the brachial plexus is affected, leading to weakness in the biceps, deltoid, and external rotators of the shoulder, with eventual development of an internal rotation contracture [1]. These problems often cause difficulties in their daily lives [2] and can also significantly impact an individual's participation in daily life [2–5]. Activities of daily living are life tasks required for self-care and self-maintenance and are conceptualized within the broad "Activities and Participation" domain of the International Classification of Functioning, Disability and Health (ICF) [6]. According to the ICF, it was stated that the upper limbs can be evaluated at the level of body function, activity, and participation [7]. For this reason, sufficient assessment of upper limb function in these children allows both the outline of treatment and allows measurement of efficacy and follow-up over time [8].

In recent research, it has aimed to improve the promotion, exploration, and targeting of the outcomes related to the activities and participation domain of the ICF. For this reason, research studies have begun to focus on what children actually do or how typical their movements appear rather than what they can do in a controlled environment [9]. Therefore, it is important to evaluate

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the use of the upper extremity which affects their participation in daily living activities in a natural environment, such as home.

Several measurement tools have been designed to assess arm activities in children with UCP and NBPP. Each tool involves a different clinical aspect. Some of these tools provide unimanual evaluation while some allow for bimanual evaluation [5]. The Children's Hand-use Experience Questionnaire (CHEQ) focuses on a child's perspective of the affected hand-use in bimanual activities and the Pediatric Outcome Data Collection Instrument (PODCI) is designed to assess different aspects of daily living in children with musculoskeletal disorders [10,11]. The parent-reported Home Hand Use (HUH) questionnaire, categorized under the activity and participation of ICF, was developed to determine the spontaneous function of the arm and hand in the home environment. HUH includes a range of bimanual activities and has been validated in more than 300 children 3-10 years of age with UCP or NBPP [12]. Although these two scales (CHEQ and PODCI) evaluate bimanual activities used in daily life, the advantage of HUH is that it can be used easily in young children and does not take much time because it is a tool reported by caregivers. Especially the fact that the scale is answered by the family allows us to get an insight into the actual performance or amount of hand use in daily life. This study aimed to create a Turkish cross-cultural adapted version of HUH and investigate its validity and test-retest reliability in children with NBPP and UCP.

Methods

Study design, sample size, participants, permission, ethics, and registration

The study included 25 children with NBPP and 42 children with UCP, recruited from Marmara University Pendik Education and Research Hospital. Parents of eligible children were invited to participate in this study.

The GPower V.3.1.9.3 program was used to determine the appropriate sample size based on a similar study [13]. In order to detect a correlation coefficient of $r = 0.50$ with 90% power (alpha =0.05, two-tailed), we would need 37 participants in the UCP group and detect a correlation coefficient of $r = 0.60$ with 90% power (alpha =0.05, two-tailed), we would need 24 participants in the NBPP group.

They could complete the questionnaires online or on paper. Ethical approval to perform this study was obtained from the Marmara University Faculty of Medicine Ethics Committee in accordance with the Declaration of Helsinki (approval number: 09.2018.712) and ClinicalTrials.gov registration was made (ClinicalTrials.gov number: NCT04243590). Informed consent was obtained from all legal guardians of the participating children.

The inclusion criteria for the children were: (1) a diagnosis of UCP or NBPP, (2) age between 3 and 10 years, (3) not having any additional acute orthopedic or neurological disorder within the previous month. The children who met the above-mentioned criteria and whose parents signed the written consent form were included in the study. Children with a history of surgical or botulinum toxin injection for the upper extremity within the previous 6 months, and children receiving treatments, such as robotic rehabilitation or constraint-induced movement, to increase the use of the upper extremity were excluded.

Sociodemographic and disease characteristics (age/gender/diagnosis/affected side) of all children participating in the study were recorded. Lesion localization and treatment history (conservative treatment, primary nerve repair, secondary surgery, etc.) were recorded for children with NBPP. For UCP, the level of the Manual Ability Classification System (MACS) was recorded [14].

Translation and cross-cultural adaptation

The procedure was applied according to reports for translation and cultural adaptation [15]. The scale was translated by the forward and backward translation procedure according to the COSMIN criteria [16]. First, the scale was translated into Turkish by two independent translators, who did not exchange information with each other. Then, they prepared an agreed-upon draft of the first version in Turkish. Next, two native English speakers with a good command of Turkish translated this Turkish scale back into English, and the English scale was compared with the original scale. Finally, the semantically acceptable version in Turkish was created. The latest version was pre-tested with 10 parents to make sure the meaning of the words is understood. All documents, including the pre-final version of the Turkish HUH, were presented and approved by the developer of the original questionnaire. There were no modifications in the HUH items about cultural adaptation.

Feasibility

Feasibility was defined as the acceptance of the questionnaire by the specified audience and indicates the extent to which the measurement tool is appropriate for a specified audience. It was assessed whether there was a problem with situations such as lack of knowledge and too many answers while answering the questions, the time to complete the questionnaire and the parents' ability to read, understand and answer the questions.

Validity and reliability

The PODCI was administered for children with NBPP and the CHEQ was administered for children with UCP immediately after the first session to test the concurrent validity of the HUH. In order to examine the test-retest reliability, HUH was repeated in both groups two weeks apart.

Measures

The HUH assesses the amount of spontaneous use of the affected hand in children with UCP and NBPP aged 3–10 years. The questionnaire includes 18 bimanual activities. Parents rate each item using a 5-point rating scale (never–sometimes–regularly–often–always). After completion, the ratings are converted into a 3-point score (never/sometimes = score 0, regularly/often = score 1, always = score 2). As a result, the total score can be calculated in a range from 0 to 36 [12,13].

The CHEQ is a questionnaire for children with UCP between 6 and 18 years of age. The questionnaire consists of 29 bimanual activities and evaluates children's perceived experiences during bimanual performances. The CHEQ measures both how the hand is used when the activity is performed and the experience of the performance in terms of the efficiency of the grasp, the need for extra time to perform the activities, and the sense of feeling bothered [10]. In this study, the mini version of the CHEQ (http://www.cheq.se/miniquestionnaire) was used. Mini-CHEQ is a new version where the activities have been adjusted to fit younger children, ages 3-8 years. The questionnaires in CHEQ have the

same structure – the difference is the number and type of activities. Mini-CHEQ contains 21 activities; several are the same as in CHEQ 2.0 whereas some have been omitted or replaced. To compare outcomes, we used the percentage of the activities in which the affected hand was used as a measure of bimanual performance.

The PODCI evaluates different aspects of daily living in children with musculoskeletal disorders aged 2–18 years [11]. The instrument has 86 items assessing "upper extremity and physical function", "transfer and basic mobility", "sports and physical function", "pain/comfort", "happiness", "global functioning", and "expectations from treatment domains". The scale allows the calculation of a single total score. Higher scores show better functioning/quality of life. In this study, only the Upper Extremity and Physical Function Scale (8 items) was used and the score range was 8-40. The Turkish version of the CHEQ and PODCI were studied [17,18].

In NBPP, lesion extent is divided into 3 groups based on lesion localization (1) C5, (2) C5-C6, and (3) C5, C6 and C7 and treatment history which consist of conservative treatment, primary and secondary surgery. The treatment history provides information about severe lesions and neurological damage.

In UCP, MACS classified the ability to handle objects in daily activities into 5 levels, with higher levels representing worse performance.

Data analysis

All statistical analyses were carried out using SPSS version 22.0 (SPSS Inc., Chicago, IL). The data was presented with tables and graphs. Statistical significance was accepted as $p < 0.05$. Descriptive statistics were identified as mean ± standard deviation, median (minimum–maximum), and %. Kolmogorov– Smirnov's test was used to determine whether the numeric variables conform to the normal distribution.

The internal consistency of the HUH items was analyzed by the "Cronbach-α coefficient". To evaluate the test-retest reliability of the HUH, Intraclass Correlation Coefficient (ICC) and 95% confidence intervals (CI) with the two-way random-effect model with absolute agreement and Bland-Altman plot were used. Reliability estimates were interpreted as follows: >0.90 = excellent; 0.75-0.90 = good; 0.50-0.75 = medium; <0.50 = low [19,20].

The structural validity of the HUH was examined by the exploratory factor analysis (EFA). The EFA was conducted on HUH items using principal component analysis. The following indices were scrutinized: Kaiser–Meyer–Olkin test (KMO); Bartlett's test of sphericity (BTS); and the percentage of explained variance, eigenvalues, and factor loadings. The acceptable level for KMO, which evaluates the suitability of performing EFA on a set of variables, is stated as 0.50 [21]. Evaluating how similar the covariance matrix is to the identity matrix, BTS values with $p < 0.05$ indicate that the matrix is factorial [22]. The percentage of explained variance is acceptable at 50% or more [23]. Considered factors are the ones with an eigenvalue higher than 1 [21]. Loadings above 0.40 are considered meaningful. Therefore, factor loadings above 0.40 were taken into account [24].

Construct validity was examined by determining hypotheses regarding correlations (Spearman's rank correlation) between HUH and other questionnaires: PODCI and CHEQ. Acceptable levels of construct validity were classified with "Spearman's correlation coefficient" as follows <0.30 = small/negligible; 0.30–0.50 = low; 0.50–0.70 = moderate; 0.70-0.90 = high; >0.90 = very high [25,26].

Results

Sixty-seven children and their parents, 25 of whom were diagnosed as NBPP and 42 UCP, agreed to participate in the study and were recruited. NBPP group consisted of 15 girls (60%), and 10 boys (40%) with a mean age of 5.4 ± 2.0 years and the UCP group consisted of 22 girls (52.4%), 20 boys (47.6%) with a mean age of 8.6 ± 1.3 years. All NBPP children have the same treatment history in terms of conservative treatment. Demographic and clinical characteristics are presented in Table 1.

Adaptation and feasibility

The HUH was adapted into Turkish through a process of forward/backward translation involving four professional translators. All the items were forward- and back-translated without difficulty, and there was no problem during the check of the back translations. During the testing of the pre-final version, there were no problems filling out the questionnaire with the help of a physiotherapist. Cognitive interviews and feasibility confirmed the clarity and the cognitive correspondence of the adaptation without any uncertainty. Therefore, the review by four professional translators confirmed the suitability of the cross-cultural adaptation procedure, the content of the items, and their theoretical concepts. Cultural usage did not make it difficult to adapt to Turkish. Finally, the professional translators compared the initial and final versions and finalized the inventory. There were no problems in terms of patients' reading, understanding, responding, lack of information and giving too many answers.

Among HUH items, holding a fork while cutting foods (item 13) had the least score, whereas picking up a big ball (soccer ball size) from the ground (item 12) had the highest in either group. In addition to item 13; putting toothpaste on the toothbrush (item 1), holding a toy while playing on the floor (item 2) and tearing and folding the toilet paper (item 10) have also been the most difficult and least scored items in the UCP group.

Reliability

Excellent levels of reliability for both the total score and each subscale score of the HUH were found (ICC >0.90). Table 2 shows the test–retest reliability for HUH items.

Test-retest reliability analysis showed excellent reliability over time with an ICC of 0.977 (%95 CI: 0.963-0.986; $p < 0.001$) for all sixty-seven children as well as NBPP and UCP groups. Test-retest reliability was presented in Table 3 and Bland-Altman plot for reliability analysis is in Figure 1.

Table 1. Demographic and clinical characteristics of patients.

	NBPP group ($n = 25$)	UCP group ($n = 42$)
Age in year (mean ± SD)	5.4 ± 2	8.6 ± 1.3
Affected side (*n* (%))		
Right	19 (76)	25 (59.5)
Lesion-extent (*n* (%))		
C5	5 (20)	
C5-C6	17 (68)	
C5-C6-C7	3 (12)	
MACS (n (%))		
I		7 (16.7)
II		6 (14.3)
III		13 (31)
IV		11 (26.2)
V		5 (11.9)

MACS: Manual Ability Classification System; NBPP: Neonatal brachial plexus palsy; UCP: unilateral cerebral palsy.

Table 2. Test–retest reliability of the HUH item scores.

Items How often does your child use the affected hand spontaneously to	Test median (Min-Max)	Retest median (Min-Max)	ICC*	95% CI
1. put toothpaste on a toothbrush?	0 (0-4)	0 (0-4)	0.845	0.759-0.902
2. hold a toy while playing on the floor?	1 (0-4)	1 (0-4)	0.918	0.870-0.949
3. assist undressing the upper body (remove singlet, shirt, sweater)?	1 (0-4)	1 (0-4)	0.889	0.825-0.930
4. move a chair?	1 (0-4)	1 (0-4)	0.951	0.922-0.970
5. pull off socks?	1 (0-4)	1 (0-4)	0.899	0.841-0.937
6. play with construction toys (Lego/Duplo/etc.)?	1 (0-4)	1 (0-4)	0.972	0.955-0.983
7. assist with buttering bread?	1 (0-4)	1 (0-4)	0.799	0.692-0.871
8. hold a toy while walking?	1 (0-4)	1 (0-4)	0.963	0.940-0.977
9. hold a book while reading or looking at pictures?	1 (0-4)	1 (0-4)	0.825	0.730-0.889
10. assist with tearing off and folding toilet paper when using the toilet?	0 (0-4)	0 (0-4)	0.916	0.867-0.948
11. throw a large ball (football size) while playing ball games?	1 (0-4)	1 (0-4)	0.963	0.941-0.977
12. pick up a large ball (football size) from the floor?	2 (0-4)	2 (0-4)	0.989	0.981-0.993
13. hold a fork while cutting food?	0 (0-4)	0 (0-4)	0.907	0.853-0.942
14. stabilize paper while drawing or writing?	1 (0-4)	1 (0-4)	0.894	0.833-0.933
15. catch a large ball (football size) while playing ball games?	1 (0-4)	2 (0-4)	0.978	0.964-0.986
16. hold a shovel while digging a hole in the sand (beach/garden/sandbox)?	1 (0-4)	1 (0-4)	0.918	0.870-0.949
17. assist with opening, closing buttons (jacket/blouse/pants etc.)?	1 (0-4)	1 (0-4)	0.911	0.859-0.944
18. assist in closing a zipper (jacket/cardigan/pants etc.)?	1 (0-4)	1 (0-4)	0.895	0.835-0.934

Min: minimum; Max: maximum ICC: intraclass correlation coefficient; CI: confidence interval.

Table 3. Test-retest reliability of the HUH questionnaire.

	Test median (Min–Max)	Retest median (Min–Max)	ICC	95% CI
NBPP group ($n=25$)	20 (1-35)	22 (5-35)	0.923	0.834 – 0.966
UCP group ($n=42$)	0 (0-14)	0 (0-14)	0.996	0.993 – 0.998
All children ($n=67$)	6 (0-35)	7 (0-35)	0.977	0.963 – 0.986

NBPP: Neonatal brachial plexus palsy; UCP: unilateral cerebral palsy; Min: minimum; Max: maximum; ICC: intraclass correlation coefficient; CI: confidence interval.

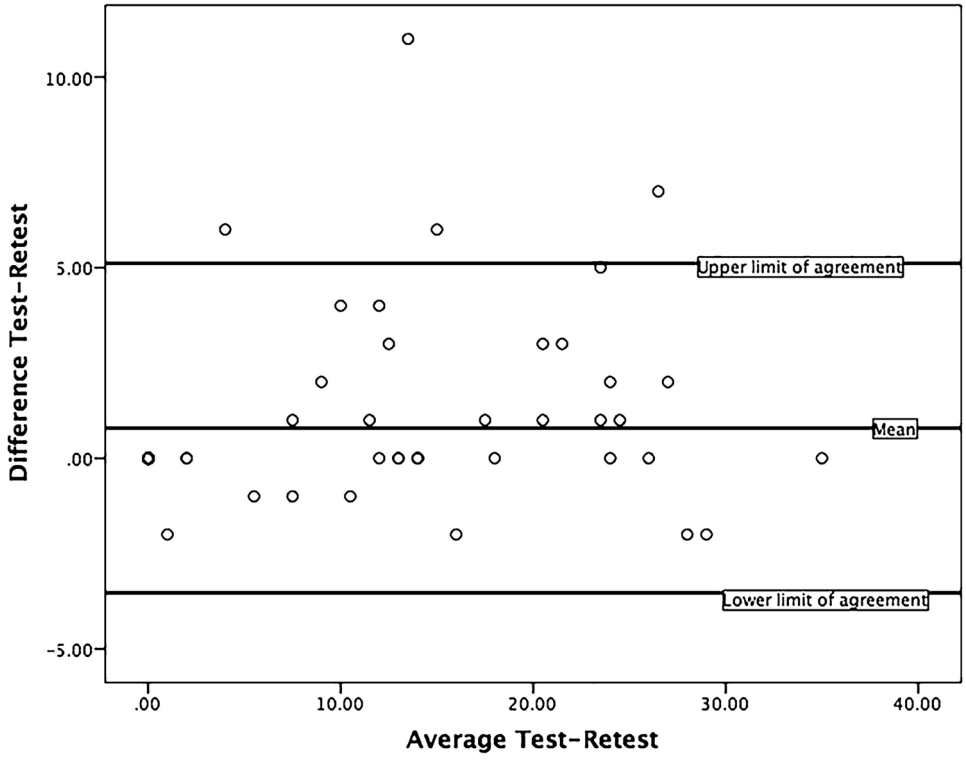

Figure 1. Bland-Altman plot for test-retest reliability of the HUH.

Validity

Age and the HUH scores had a low correlation (r=-0.462). Affected side change (right or left) did not affect HUH scores ($p=0.558$). Internal consistency of the 18 items in the HUH questionnaire was high with a Cronbach's alpha coefficient of 0.989.

We found significant differences between MACS levels in the UCP group ($p<0.001$). Pairwise comparisons were made with the Mann-Whitney U test and significant difference between level I and II, III, IV, V ($p=0.002$, p=<0.001, $p<0.001$, $p=0.003$, respectively) were found. Other between-group comparisons were not statistically significant. On the other hand, the NBPP group showed

no difference amongst the three levels of brachial plexus lesion-extent ($p > 0.05$). The HUH correlated with lesion-extent levels (r=-0.457) in the NBPP group and 5 MACS levels (r=-0.688) in the UCP group (Table 4).

Structural validity

As a result of EFA, Kaiser–Meyer–Olkin's test results were found to be 0.875, and Bartlett's test results were 1480.304. It was determined that the HUH, which consisted of 18 items, consisted of a 2-factor structure and these 2 factors explained 74.16% of the total variance. Accordingly, it concluded that HUH is valid. As shown in Table 5, factor loadings for all items were above 0.40. The factor loading scores of the HUH were good and excellent (0.750–0.911). The scree plot of the HUH is shown in Figure 2.

Table 4. Correlations in both groups.

Neonatal Brachial Plexus Palsy ($n = 25$)		
HUH score		
Median (Min-Max)	20 (1-35)	
PODCI-UE (%)		
Median (Min–Max)	40 (25; 100)	
Correlations		
NBPP lesion-extent	−0.457[a]	$p = 0.091$[b]
PODCI-UE	0.789[a]	$p < .001$
Unilateral Cerebral Palsy ($n = 42$)		
HUH score		
Median (Min-Max)	0 (0-14)	
$CHEQ_{bim}$ score (%)		
Median (Min-Max)	83.33 (33.33-100)	
Correlations		
MACS	−0.688[a]	$p < .001$[b]
$CHEQ_{bim}$ score	0.558[a]	$p < .001$

HUH: Hand-Use-at-Home Questionnaire; Min: minimum; Max: maximum; PODCI-UE: Pediatric Outcome Data Collection Instrument Upper Extremity Functioning Scale; NBPP: Neonatal brachial plexus palsy; $CHEQ_{bim}$: Children's Hand-Use Experience Questionnaire bimanual score (%): Percentage of activities independently executed using both hands; MACS: Manual Ability Classification System.
[a]Spearman's rho.
[b]Difference within the group by Kruskal Wallis Test.

Construct validity

The median PODCI score was 40 points and 4% obtained the maximum score. The CHEQ score was negatively skewed (median 83.33%). The number of independent activities was normally distributed (mean 19, range 9-27 activities). The HUH results in NBPP children had a high correlation with PODCI results (rs = 0,789, $p < 0.001$). Also, in children with UCP, HUH scores correlated moderately with CHEQ bimanual activities scores (rs = 0.558, $p < 0.001$) (Table 4).

Discussion

The HUH, developed by Geerdink et al. [12] in 2017, is distinctive in the way that it assesses the affected hand use according to parent's observation in the daily living environment. The questionnaire was also found as a valid and reliable tool in unilateral hemiparetic children between 3-10 years of age with a diagnosis of UCP and NBPP [12]. This study aimed to adapt the HUH into the Turkish language and to determine its validity and reliability in children with UCP and NBPP.

Test-retest reliability was excellent for unilateral paretic children and subgroups and, internal consistency of the test was found to be very high with a Cronbach alpha coefficient of 0.989.

When the HUH items were examined separately; we observed the least affected hand use in "holding fork while cutting food" (item 13), "putting toothpaste on the toothbrush" (item 1), "holding a toy while playing on the floor" (item 2) and "tearing and folding the toilet paper" (item 10) items. Affected hand was most frequently used in "picking up a large ball (soccer ball size) from the ground" (item 12) activity in either group. Excellent test-retest

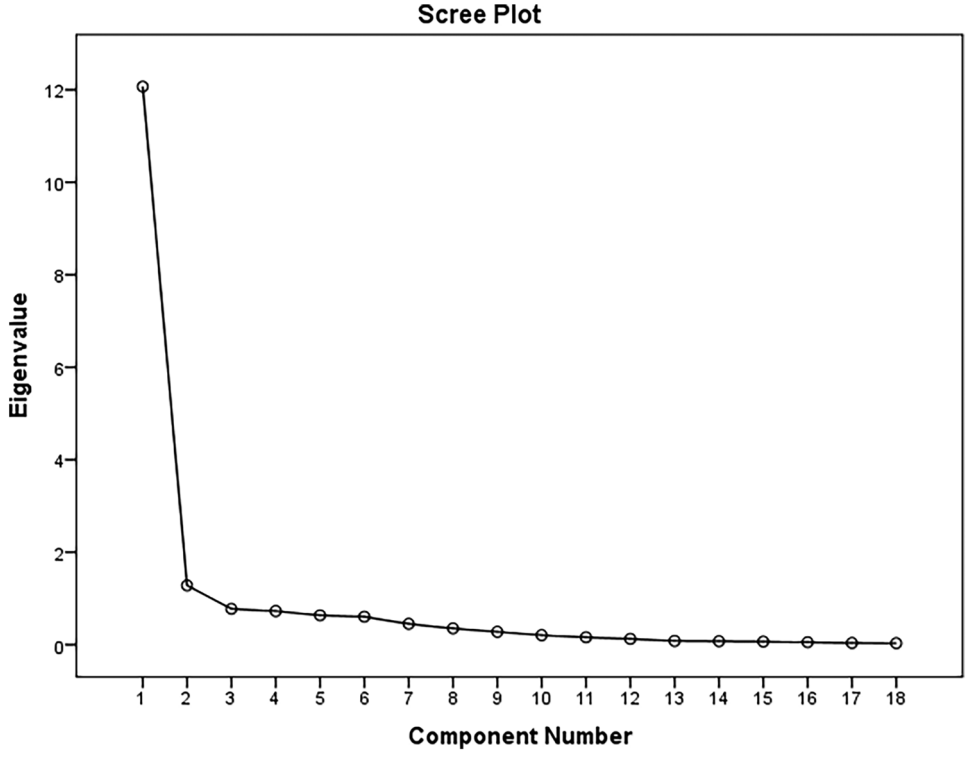

Figure 2. Scree plot of the HUH.

Table 5. Factor analysis results for the HUH.

Items How often does your child use the affected hand spontaneously to .	Factor 1	Factor 2
1. put toothpaste on a toothbrush?	.836	
2. hold a toy while playing on the floor?	.835	
3. assist undressing the upper body (remove singlet, shirt, sweater)?	.789	
4. move a chair?	.911	
5. pull off socks?	.909	
6. play with construction toys (Lego/Duplo/etc.)?	.910	
7. assist with buttering bread?	.750	
8. hold a toy while walking?	.865	
9. hold a book while reading or looking at pictures?	.830	
10. assist with tearing off and folding toilet paper when using the toilet?	.792	
11. throw a large ball (football size) while playing ball games?	.847	
12. pick up a large ball (football size) from the floor?	.889	
13. hold a fork while cutting food?		.834
14. stabilize paper while drawing or writing?		.813
15. catch a large ball (football size) while playing ball games?	.881	
16. hold a shovel while digging a hole in the sand (beach/garden/sandbox)?		.887
17. assist with opening, closing buttons (jacket/blouse/pants etc.)?		.852
18. assist in closing a zipper (jacket/cardigan/pants etc.)?		.849

Values refer to the factor loadings of items. Factor loadings >0.40 were considered significant in the present study.

reliability was determined in all items except number 10. Geerdink et al. [12] also found high internal consistency with a Cronbach alpha coefficient of 0.941 in their study, which they developed the HUH. They found "holding a fork while cutting food" was the most difficult item and "picking up the large ball from the ground" was the activity that most stimulates affected hand use [12]. Van der Holst et al. [13] found good test-retest reliability of the original questionnaire (ICC = 0.89).

Spontaneous hand use correlated highly with upper extremity use and physical function domain of PODCI in NBPP children and with CHEQ bimanual activities score in the UCP group. In their study, Van der Holst et al. found a positive moderate correlation between HUH and CHEQ bimanual activity score (r_s=0.5, $p < 0.001$) and PODCI-upper extremity score (r_s=0.6, $p < 0.001$). While there was a similar correlation with the previous study between HUH and CHEQ bimanual activity score; we found a higher correlation between the HUH and PODCI-upper extremity score compared to the previous study [13].

In the NBPP group, we found less spontaneous hand use as the root lesion expanded; however, no statistically significant difference was found between lesion-extend groups. Also, our study found a negative low relation between (greater) lesion-extent and (lower) amount of spontaneous hand use. Holst et al. [13] found less spontaneous hand use in extended lesion levels compared to C5-6 affected children and moderate relation. Although our result may seem incompatible with previous research, statistical insignificance may be due to the small group sizes in the subgroups. Our study found a low relation between (greater) lesion-extent and (lower) amount of spontaneous hand use.

In the UCP group, HUH scores showed significant difference between MACS levels. Particularly, spontaneous affected hand use was higher in MACS level I patients compared to other MACS levels ($p < 0.05$). There is a negative moderate correlation between HUH scores and MACS levels. In the previous study, Holst et al. [13] found a significant difference only between MACS level I-II and level III and suggested that good ability of affected hand use (MACS level 1) may not be related to the higher amount of use; however, they had no patients in MACS level IV and V. However, there is a high correlation between HUH scores and MACS levels. These findings may be due to varying numbers of patients at different MACS levels. Therefore, further research should be made with larger subgroups and wider levels of lesion-extend in order to predict actual group differences.

The limitation of the study was the unequal numbers of children in terms of MACS levels in UCP and lesion levels and treatment histories in NBPP.

In conclusion, our study demonstrated that the Turkish version of HUH is a valid and reliable test in assessing spontaneous hand use in daily life, according to parents' reports. The Turkish version of HUH could be used in unilateral paretic children diagnosed with UCP or NBPP between the ages of 3 and 10.

This study showed evidence of the reliability and validity of the Turkish version of the Hand-Use-at-Home Questionnaire.

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Disclosure statement

The authors report no conflict of interest.

Ethics approval and consent to participate

Ethical approvals were obtained from the Marmara University Faculty of Medicine Ethics Committee in accordance with the Declaration of Helsinki (approval number: 09.2018.712). Written informed consent and assent were obtained from all legal guardians of the participating children, respectively. The content experts submitted signed informed consent forms to indicate their willingness to participate. The trial is registered with ClinicalTrials.gov (NCT04243590).

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References

[1] Mosqueda T, James MA, Petuskey K, et al. Kinematic assessment of the upper extremity in brachial plexus birth palsy. J Pediatr Orthop. 2004;24(6):695–699. doi: 10.1097/01241398-200411000-00018.
[2] Eren B, Karadağ Saygı E, Tokgöz D, et al. Modified constraint-induced movement therapy during hospitalization in children with perinatal brachial plexus palsy: a randomized controlled trial. J Hand Ther: off J Am Soc Hand Ther. 2020;33(3):418–425. doi: 10.1016/j.jht.2019.12.008.
[3] James S, Ziviani J, Ware RS, et al. Relationships between activities of daily living, upper limb function, and visual perception in children and adolescents with unilateral cerebral palsy. Dev Med Child Neurol. 2015;57(9):852–857. doi: 10.1111/dmcn.12715.
[4] Klingels K, Demeyere I, Jaspers E, et al. Upper limb impairments and their impact on activity measures in children with unilateral cerebral palsy. Eur J Paediatr Neurol. 2012;16(5):475–484. doi: 10.1016/j.ejpn.2011.12.008.
[5] Karadag Saygi E. Hand function in cerebral palsy. In: Duruoz MT, editor. Hand function. 2nd ed. London (UK): Springer; 2019. p. 181–188.
[6] World Health Organization. ICF: international classification of functioning, disability and health. Geneva (Switzerland): World Health Organization; 2001.
[7] Bourke-Taylor H. Melbourne assessment of unilateral upper limb function: construct validity and correlation with the pediatric evaluation of disability inventory. Dev Med Child Neurol. 2003;45(2):92–96. doi: 10.1111/j.1469-8749.2003.tb00911.x.
[8] Klingels K, Jaspers E, Van de Winckel A, et al. A systematic review of arm activity measures for children with hemiplegic cerebral palsy. Clin Rehabil. 2010;24(10):887–900. doi: 10.1177/0269215510367994.
[9] Hoare B, Imms C, Randall M, et al. Linking cerebral palsy upper limb measures to the international classification of functioning, disability and health. J Rehabil Med. 2011;43(11):987–996. doi: 10.2340/16501977-0886.
[10] Sköld A, Hermansson LN, Krumlinde-Sundholm L, et al. Development and evidence of validity for the children's hand-use experience questionnaire (CHEQ). Dev Med Child Neurol. 2011;53(5):436–442. doi: 10.1111/j.1469-8749.2010.03896.x.
[11] Merder-Coskun D, Kenis-Coskun O, Celenlioğlu AE, et al. Reliability of cross-cultural adapted Turkish version of the pediatric outcomes data collection instrument (PODCI). J Pediatr Rehabil Med. 2016;9(2):101–105. doi: 10.3233/PRM-160370.
[12] Geerdink Y, Aarts P, Van der Holst M, et al. Development and psychometric properties of the hand-use-at-home questionnaire to assess amount of affected hand-use in children with unilateral paresis. Dev Med Child Neurol. 2017;59(9):919–925. doi: 10.1111/dmcn.13449.
[13] van der Holst M, Geerdink Y, Aarts P, et al. Hand-use-at-home questionnaire: validity and reliability in children with neonatal brachial plexus palsy or unilateral cerebral palsy. Clin Rehabil. 2018; 32(10):1363–1373. doi: 10.1177/0269215518775156.
[14] Akpinar P, Tezel CG, Eliasson AC, et al. 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):1910–1916. doi: 10.3109/09638281003763796.
[15] Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000;25(24):3186–3191. doi: 10.1097/00007632-200012150-00014.
[16] Terwee C, Bot S, Boer M, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol. 2007; 60(1):34–42. doi: 10.1016/j.jclinepi.2006.03.012.
[17] Keskin Dilbay N, Kerem Günel M, Aktan T. Reliability and validity of Turkish version of pediatric outcome data collection instrument (PODCI) for people with cerebral palsy. Fiz Rehabil. 2013; 24:118–126.
[18] Eren M, Ekici G, Alkan H. Reliability and validity of Turkish version of children's hand use experience questionnaire for children with hemiparetic cerebral palsy. J Health Adm Educ. 2021;7(1):85–92.
[19] Cicchetti DV. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. Psychol Assess. 1994;6(4):284–290. doi: 10.1037/1040-3590.6.4.284.
[20] Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016; 15(2):155–163. doi: 10.1016/j.jcm.2016.02.012.
[21] Taherdoost H, Sahibuddin S, Jalaliyoon N. Exploratory factor analysis; concepts and theory. Ad Appl Pure Math. 2022;27:375–382.
[22] Tabachnick BG, Fidell LS, Ullman JB. Using multivariate statistics. Vol. 5. Boston, MA: pearson; 2007.
[23] Beavers AS, Lounsbury JW, Richards JK, et al. Practical considerations for using exploratory factor analysis in educational research. Pract Assess Res Eval. 2013;18(1):6.
[24] Portney LG. Foundations of clinical research: applications to evidence-based practice. Philadelphia, PA: FA Davis; 2020.
[25] Jurs H, Hinkle D, Wiersma W. Applied statistics for the behavioral sciences. Boston (USA): Houghton Mifflin Company; 1998.
[26] Mukaka MM. A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24(3):69–71.