

Original Article

Validity and reliability of Persian version of Craig Hospital Inventory of Environmental Factors (CHIEF) in children with cerebral palsy

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Objectives: The aim of this study was to translate the Craig Hospital Inventory of Environmental Factors (CHIEF) into Persian language and to evaluate the validity and reliability of Persian version of CHIEF to use for children with cerebral palsy.

Methods: The CHIEF was translated from English into Persian based on the International Quality of Life Assessment (IQOLA) approach. The Persian version of the CHIEF has been completed with a convenience sample of 75 caregivers of children with cerebral palsy. Two weeks after the first completion, 20 caregivers completed CHIEF again in the retest session. The CHIEF questionnaire consists of 25 items divided in to 5 subscales. Its item discriminant validity was calculated using spearman's rank correlation, test-retest reliability using Intraclass Correlation Coefficient (ICC) and Standard Error of Measure (SEM), and Internal consistency using Cronbach's coefficient α .

Results: The results demonstrated that more than 96% of items correlated strongly with its own subscale rather than other subscales ($r > 0.40$). The values of the ICC were > 0.70 and the values of the SEM were ≤ 1 for the score of subscales and total score. Cronbach's coefficient α for the overall scale was 0.86.

Conclusions: The Persian version of the CHIEF has acceptable levels of face validity, construct validity, item discriminant validity, test-retest reliability, and internal consistency to use for children with cerebral palsy.

Keywords: Validity, Reliability, Participation, Environmental factors, Cerebral palsy and CHIEF questionnaire.

Introduction

Cerebral palsy is the most common type of permanent movement and posture disorders in children leading to contractures, deformities and activity limitations. These limitations influence participation of these children (1, 2). Children's participation is essential in developing a healthy identity and becoming active and productive members of society (3, 4). The International Classification of Functioning, Disability and Health (ICF) defines participation as "involvement in a life situations" (5). Children's participation are influenced by their functional ability, skills, interests and environmental factors (6). These environmental factors include: (a) products and technology; (b)

natural environment and human-made changes to environment; (c) support and relationships; (d) attitudes; and (e) services systems and policies. They are called facilitators when these factors influence participation of children positively, and called barriers when these influence participation negatively (5).

The districts or environment within which the children live, influence their participation. Participation may be enhanced when the districts provide more facilities for children with disabilities (7, 8). In opposite, it may be limited in districts with poor facilities. Knowledge about these factors is essential to enable participation of children with CP by decreasing barriers and increasing facilitators.

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There are a number of measures specifically designed for assessing environmental factors; however most of them have been developed for adults (8). Ziviani et al (2010) (9), in a systematic review of the literature identified Craig Hospital Inventory of Environmental Factors (CHIEF) and European Child Environment Questionnaire (ECEQ) as the measures of environmental factors which influence participation of children with CP. The study of participation of children with CP living in Europe (SPARCLE) project (10) works on the psychometric properties of the ECEQ (11). There is no tool to be used in Persian to measure environmental barriers to participation. Therefore, this study aimed to translate and validate CHIEF in Persian.

CHIEF has been recently used in various studies with children with physical disabilities and CP. Law et al (2007), in a study conducted on 427 children and youth with physical disabilities including CP used the CHIEF and found that environmental barriers to participation were most encountered in school and work environment than in physical and built environment and other aspects (6). In another study, Vogets et al (2010) used the CHIEF in a sample of New Zealand children with CP and found the most encountered barriers were attitudes at school and difficulty accessing personal equipment (12). The CHIEF is a questionnaire developed to measure physical, attitudinal and policy barriers (13).

The purpose of the present study was to translate the CHIEF into Persian and to evaluate various types of validity and reliability including the face validity, construct validity, item discriminant validity, test-retest reliability, and internal consistency in a group of children with CP.

Materials and methods

This study was conducted in two stages including translation process and main study.

Translation process

The International Quality of Life Assessment (IQOLA) approach (14) was used to translate CHIEF from English into Persian. First, two independent translators (translators 1 and 2) who were native Persian speakers translated the original version of CHIEF from English to Persian. Then, during a meeting these translators and the investigators of the present study discussed the disputes and agreed upon a final version. Second,

two other translators (translators 3 and 4) examined quality of forward translation from the aspect of clarity, common language and conceptual equivalence on a 0-100 point visual scale. Comments from the third and the forth translators were used to modify items with quality score less than 90. The results of quality examination stage by translators 3 and 4 leading to small changes in some items from the aspect of clarity. Third, translators five and six translated the forward version back into English in order to test the equivalence of translated version with the original version. Then, the understandability and clarity of the translation and cultural appropriateness of the questionnaire were determined in an expert panel consisting of 4 experienced occupational therapists from the University of Social Welfare and Rehabilitation Sciences. Finally, a pilot study was conducted with 10 caregivers of children with CP. The caregivers were asked to complete Persian version of CHIEF to identify any difficult and confusing items. No difficulties encountered by participants in the pilot study. Any problems in wording and clarity were resolved within research team. The results of this process helped to develop a Persian version of CHIEF.

Main Study

Participants and procedure

A convenience sampling was employed for this study. Participants included 75 caregivers of children with CP who were receiving services at two outpatient clinics in Tehran (Valiasr Rehabilitation Center and Tavanyab). The participants included in this study if (a) they were caregivers of children with CP; (b) their children were between 5 and 12 years old; (c); they have lived in Tehran since last year; and (d) they were able to read and write in Persian language. Children with CP were classified topographically and physiologically according to the "Surveillance of Cerebral Palsy in Europe (SCPE)" classification (2). During the data collection process an occupational therapist described the aims of the study and the questionnaire for the participants. The participants completed a Persian version of the CHIEF and a demographic questionnaire. In addition, to examine test-retest reliability, a sample of 20 caregivers completed CHIEF again 2 weeks later in the same location. All participants signed an informed consent form approved by the Ethics Committee at the University of Social Welfare and Rehabilitation Sciences.

Instruments

The CHIEF questionnaire consists of 25 items (Long form) assessing environmental barriers to participation. It also has a short form with 12 items. These 25 and 12 items divided into 5 subscales consisting of policies, physical and structural, work and school, attitudes and support, and services and assistance subscales. Each item is scored in 2 parts regarding frequency and magnitude of the barrier. Participants are, first, asked to rate the frequency with which their child encounter barriers (daily=4, weekly=3, monthly=2, less than monthly=1, or never=0). When the participants indicate that their children encounter environmental barriers at any frequency other than never, a follow-up question is asked about whether their child consider the barrier to be a big problem=2 or a little problem=1. Scoring of each item is the product of the frequency score and the magnitude of impact score that ranges between 0 and 8. A score of each subscale is calculated as the mean of frequency-magnitude product score across items of subscale and a total score is calculated as the mean of frequency-magnitude product score across all items (15).

The CHIEF has good test-retest reliability and internal consistency. It also has evidence of construct validity for children with physical disabilities (9, 13, 15). Although, it was originally designed to be used with adults, parents were able to complete the questionnaire for their children (12). In this study, we used CHIEF (long form) questionnaire as a caregiver proxy report of children with an adjustment of replacing "your child" instead of "you".

The gross motor function and the manual ability of all children were determined according to the Gross Motor Function Classification System (GMFCS) (16) and the Manual Ability Classification System (MACS) (17) respectively. These two ordinal standardized and validated scales are based on self-initiated movement and manual ability respectively. The GMFCS classify the gross motor function of children with CP into five levels. While children in the first level have the most independent motor function, children in the fifth level have the least. The MACS classify how children with CP use their hands when handling objects in daily activities. While children in the first level have minor limitations, children in the fifth level have major limitations in handling the objects compared to typically developing children. The GMFCS and MACS levels of children were determined by the

same occupational therapist with the help of caregivers and observation of the children if needed (18).

The cognitive levels of the children were estimated using a form which was filled in by the caregivers. It was taken from the impairment form in SPARCLE project. In this form the cognitive levels are defined according to ICD 10 (18).

Statistical analysis

The floor and ceiling effect were calculated as the percentage of participants receiving the lowest possible score and the highest possible score for the CHIEF subscales and total scores respectively. The floor and ceiling effect were noticeable if more than 15% of participants rated them (19).

Correlation analysis between participants' CHIEF scores and their physical functioning according to the MACS and the GMFCS were used to evaluate construct validity (20).

Item discriminant validity evaluates the item correlation with its own subscale. Item must correlate more strongly with its own subscale than with any other subscales. It was calculated by using spearman's rank correlation. Values ≥ 0.40 was considered to be acceptable (21, 22).

Two-way random effects model of Intraclass Correlation Coefficient (ICC) with 95% Confidence Interval (95% CI) was used to evaluate test-retest reliability. Values more than 0.70 was considered to be satisfactory. Standard Error of Measurement (SEM) was calculated to estimate measurement precision. The most common way of calculating this value is the following equation ($SEM = SD \sqrt{1 - ICC}$) (23). Also, SEM is useful for calculating the Minimal Detectable Change (MDC) to determine the real change in an individual performance between two measurements. The MDC was defined as 95% CI of the SEM

($\pm 1.96 \times \sqrt{2} \times SEM$). Paired t-test was used to verify systematic change between tests and retests scores of CHIEF (24). Cronbach's coefficient α was used to assess the degree of inter item correlation. Value more than 0.70 was considered to be satisfactory (25).

Results

Descriptive statistics

The mean age of children in this study was 8.09 (SD = 2.07) years. The mean age of starting the rehabilitation program was 1.57 (SD = 1.3) years

and rehabilitation duration was 5.48 (SD = 2.54) years. Most of the children were in level II and IV of the MACS (26.7% and 21.3%, respectively) and the least were in level III (16%). Most of the children were in level II and IV of the GMFCS (25.3%) and the least were in level III (10.7%) (table 1).

Table 2 represents the mean, SD, range, number, and percent of floor and ceiling effects for the CHIEF subscales and total score. The greatest barriers encountered in services and assistance subscale (Mean = 3.53; SD = 2.1) and policies subscale (Mean = 3.34; SD = 2.67) and the least barriers encountered in attitudes and support subscale (Mean = 2.71; SD = 2.18). The most ceiling and floor effects were found 10.7% of participants for policy subscale and 15.91% of participants for work and school subscale.

Construct validity

The relationships between children's physical functioning (MACS and GMFCS levels) and their CHIEF scores were examined using Spearman's correlation coefficients. As demonstrated in Table 3, the CHIEF subscales and total scores moderately correlated with the MACS levels (0.23-0.47) and the GMFCS levels (0.10-0.40).

Item discriminant validity

Item-subscale correlation coefficients were between 0.78 and 0.87 for policies subscale, between 0.22 and 0.75 for physical and structural subscale, between 0.66 and 0.79 for work and school subscale, between 0.62 and 0.76 for attitudes and support subscale, and between 0.49 and 0.81 for services and assistance subscale. The correlation between each item and its own subscale was stronger than other subscales, just one item (question 11 in physical and structural subscale) correlated strongly with another subscale. All item-subscale correlation coefficients were greater than 0.40 (statistically significant at $p < 0.001$), except item 11 which the item-subscale correlation coefficient was less than 0.40 (statistically significant at $p < 0.05$) (Table 4).

Test-retest reliability

The values of the ICC were between 0.79 and 0.94, the values of the SEM were between 0.44-1, and the values of the MDC were between 1.22 and 2.58 for the score of subscales and total score. According to the paired t-test no significant difference between test and retest scores were obtained, indicating absence of any systematic changes (Table 5).

Internal consistency

Cronbach's coefficient α was calculated as a measure of the internal consistency and found 0.86 for the overall scale.

Discussion

The translation and back-translation processes in this study resulted in developing a Persian version of CHIEF. The result of present study also provided the evidence for psychometric properties of the Persian version of the CHIEF for children with CP. The results of this study demonstrated that CHIEF-Persian version is similar to its original.

To study validity of CHIEF-Persian version, we examined face validity, construct validity, item discriminant validity and floor and ceiling effects. Face validity of the questionnaire was obtained from the translation process that conducted according to the IQOLA approach. This process included four stages and helped to achieve high level of face validity. Construct validity was evaluated by examining the relationship between functional ability of the children and their CHIEF scores. Our result shows positive and moderate correlation between these tools that were similar to the findings of Law et al (6), and Colver et al (26). According to the item discriminant validity except one item (question 11 in physical and structural subscale), all items correlated more strongly with their respective subscale. Question 11 correlated strongly with services and assistance subscale. This low value appears to be related to the fact that majority of the caregivers (68%) reported "never" for frequency response part of this question. Vogets et al (2010) (12), found similar result (65%) for this question. In this study, the high percent of reporting "never" may be related to the lack of information about the kinds of technologies that are available and useful for children with physical disabilities or may be related to the fact that these technologies are not available and accessible to the participants of the study. Also, all floor and ceiling effects were not noticeable, except floor effect for work and school subscale. This may be due to the participant's level of function. "Work and school" subscale was scored for the children if they went to school. Furthermore, majority of these children had high ability in their function according to the MACS and the GMFCS. They mostly classified in level I and II of these measures. The caregivers reported these children encountered less barriers when they participated in the school environment. These findings are similar

to Law et al (6), and Colver et al (26). They found environmental barriers were less encountered in children with better functional abilities, which, in this subscale, seems to be related to the lowest possible score.

To examine reliability of CHIEF-Persian version, we examined test-retest reliability and internal consistency. For the test-retest reliability, absolute and related reliability with the calculation of the values of SEM and ICC were used respectively. We found satisfactory level of ICC for subscales and total score close to the values observed in the study of Whiteneck et al (13). The values of the SEM were low resulted in the low values of the MDC. Also, no significant changes were found between the test and retest means of subscales and total scores, referring to the paired t-test. This means that the Persian version of the CHIEF has satisfactory test-retest reliability. Also, we found satisfactory level of the Cronbach's coefficient α for the overall scale. Whiteneck et al (13), found high level of the Cronbach's coefficient α , for the overall scale. This

means that the Persian version of the CHIEF has satisfactory internal consistency.

Future studies should investigate other psychometric properties of the CHIEF-Persian version including factor analysis and construct validity with other tools with the same concept.

To conclude, this study developed the Persian version of the CHIEF to use for children with CP. It is now suitable for the use in future surveys in Persian speaking population. Findings of such studies can increase awareness of communities to enhance participation of children with CP by providing services and supports, making policies and adapting physical and structural environment.

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Table 1. Characteristics of children and their parents

| | Test (n=75) | |
|--|-------------|------|
| | N | % |
| Gender | | |
| Female | 36 | 48 |
| Male | 39 | 52 |
| cerebral palsy classification | | |
| Spastic unilateral | 22 | 29.3 |
| Spastic bilateral | 39 | 52 |
| Ataxic | 5 | 6.7 |
| Dyskinetic | 3 | 4 |
| Unclassified | 6 | 8 |
| Manual ability classification system | | |
| I | 13 | 17.3 |
| II | 20 | 26.7 |
| III | 12 | 16 |
| IV | 16 | 21.3 |
| V | 14 | 18.7 |
| Gross motor function classification system | | |
| I | 12 | 16 |
| II | 19 | 25.3 |
| III | 8 | 10.7 |
| IV | 19 | 25.3 |
| V | 17 | 22.7 |
| Intellectual impairment | | |
| < 50 | 7 | 9.3 |

| | Test (n=75) | |
|-----------------------------|-------------|------|
| | N | % |
| 50-70 | 19 | 25.3 |
| >70 | 49 | 65.3 |
| Educational level of mother | | |
| Under diploma | 23 | 30.7 |
| diploma | 34 | 45.3 |
| university education | 18 | 23.9 |
| Educational level of father | | |
| Under diploma | 26 | 35.6 |
| diploma | 27 | 37 |
| university education | 20 | 27.4 |
| parental employment | | |
| mother employment | 12 | 16 |
| father employment | 69 | 94.5 |

Table 2. Mean, SD, range and floor and ceiling effects for the CHIEF subscales and total score

| Item | mean | SD | Range | Floor effect | Ceiling effect |
|-------------------------|------|------|-------|------------------|------------------|
| | | | | N(% of patient) | N(% of patient) |
| policies | 3.34 | 2.67 | 8 | 8 (10.7) | 8 (10.7) |
| physical and structural | 2.72 | 1.91 | 8 | 4 (5.3) | 1 (1.3) |
| work and school * | 2.73 | 2.24 | 8 | 7 (15.98) | 1 (2.27) |
| attitudes and support | 2.71 | 2.18 | 8 | 10 (13.3) | 1 (1.3) |
| services and assistance | 3.53 | 2.1 | 8 | 2 (2.7) | 1 (1.3) |
| Total | 3.09 | 1.69 | 7.18 | 2 (2.7) | 0 |

*some children attended the school (n=44)

Table 3. correlation between physical functioning and the CHIEF subscales and total score

| Item | MACS | GMFCS |
|-------------------------|------|-------|
| Policies | .45* | .24* |
| Physical and Structural | .35* | .40* |
| Work and School | .32* | .10 |
| Attitudes and Support | .23* | .13 |
| Services and Assistance | .45* | .35* |
| Total | .47* | .35* |

*Statistically significant at $p < 0.05$

Table 4. Correlation matrix showing the relationship of each item to its own subscale and to the other subscales

| Items | CHIEF subscales | | | | |
|------------------------|-----------------|-------------------------|-----------------|-----------------------|-------------------------|
| | policies | physical and structural | work and school | attitudes and support | services and assistance |
| policies | | | | | |
| Services in community | 0.79 | 0.29 | 0.65 | 0.37 | 0.5 |
| policies of businesses | 0.8 | 0.35 | 0.16 | 0.26 | 0.34 |
| policies of education | 0.78 | 0.19 | 0.57 | 0.54 | 0.52 |

| Items | CHIEF subscales | | | | |
|---|-----------------|-------------------------|-----------------|-----------------------|-------------------------|
| | policies | physical and structural | work and school | attitudes and support | services and assistance |
| policies of government physical and structural | 0.87 | 0.24 | 0.35 | 0.39 | 0.48 |
| Design of home | 0.19 | 0.75 | - 0.17 | 0.18 | 0.23 |
| Design of school | 0.2 | 0.66 | 0.14 | 0.14 | 0.07 |
| Design of community | 0.12 | 0.65 | - 0.01 | 0.24 | 0.32 |
| Natural environment surroundings | 0.26 0.28 | 0.56 0.63 | 0.23 - 0.06 | 0.38 0.26 | 0.33 0.29 |
| Technology | 0.24 | 0.22 | 0.22 | 0.16 | 0.29 |
| work and school | | | | | |
| Help at school | 0.54 | 0.27 | 0.79 | 0.34 | 0.57 |
| attitudes at school | 0.14 | - 0.06 | 0.66 | 0.53 | 0.23 |
| support at school | 0.34 | - 0.02 | 0.66 | 0.49 | 0.22 |
| attitudes and support | | | | | |
| attitudes at home | 0.41 | 0.27 | 0.49 | 0.76 | 0.55 |
| Attitudes in community | 0.41 | 0.22 | 0.41 | 0.76 | 0.42 |
| support at home | 0.15 | 0.18 | 0.28 | 0.65 | 0.33 |
| support in community | 0.22 | 0.28 | 0.37 | 0.7 | 0.42 |
| Discrimination | 0.33 | 0.27 | 0.26 | 0.62 | 0.36 |
| services and assistance | | | | | |
| transportation | 0.23 | 0.32 | 0.13 | 0.2 | 0.5 |
| Information | 0.29 | 0.38 | 0.35 | 0.37 | 0.49 |
| Education/training | 0.37 | 0.32 | 0.46 | 0.48 | 0.74 |
| Medical care | 0.47 | 0.26 | 0.5 | 0.38 | 0.71 |
| Personal equipment | 0.29 | 0.20 | 0.05 | 0.22 | 0.52 |
| Help at home | 0.46 | 0.28 | 0.44 | 0.55 | 0.81 |
| Help in community | 0.42 | 0.29 | 0.48 | 0.46 | 0.73 |

Table 5. Mean (SD) for the test and retest stage and ICC, SEM and MDC for the CHIEF subscales and total score

| Item | Mean (SD) | Mean (SD) | P-Value* | ICC | SEM | MDC |
|-------------------------|-------------|-------------|----------|------------------|------|------|
| | Test | Retest | | | | |
| Policies | 3.17 (2.74) | 3.28 (2.40) | 0.762 | 0.89 (0.72-0.96) | 0.84 | 2.33 |
| Physical and Structural | 2.30 (2.19) | 2.45 (1.88) | 0.702 | 0.79 (0.46-0.92) | 0.93 | 2.58 |
| Work and School | 3.39 (2.52) | 3.27 (2.94) | 0.839 | 0.86 (0.48-0.96) | 1 | 2.77 |
| Attitudes and Support | 3.24 (2.20) | 3.75 (2.97) | 0.157 | 0.90 (0.75-0.96) | 0.82 | 2.27 |
| Services and Assistance | 3.85 (2.16) | 3.64 (2.01) | 0.364 | 0.94 (0.84-0.98) | 0.51 | 1.41 |
| Total | 3.25 (1.88) | 3.34 (2.12) | 0.660 | 0.94 (0.86-0.98) | 0.44 | 1.22 |

* paired t-test

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