

[original article]

The Development and Test-retest Reliability of Craig Handicap Assessment and Reporting Technique – Short Form (CHART-SF) Chinese Version

Chih-Wen Wang¹⁾ Yuh Jang²⁾ Fusae Tozato³⁾ Yoshiko Tobimatsu⁴⁾ Tsutomu Iwaya⁵⁾

- 1) Department of Rehabilitation, Occupational Therapy Course, Faculty of Medical Science and Welfare, Tohoku Bunka Gakuen University
- 2) School of Occupational Therapy, College of Medicine, National Taiwan University
- 3) Department of Occupational Therapy, School of Health Science, Faculty of Medicine, Gunma University
- 4) Department of Physical Therapy and Occupational Therapy Science, Graduate School of Health Science, Hiroshima University
- 5) National Rehabilitation Center for Persons with Disabilities

Abstract

Rehabilitation clients who do not return to their previous roles may be considered handicapped. Despite the importance and necessity to quantify client's perceived handicaps, there is no reliability and validity confirmed Chinese instrument to evaluate individual's handicap in Taiwan. The purposes of this study were to translate the broadly used handicap measurement CHART-SF (Craig Handicap Assessment and Reporting Technique – Short Form) into Chinese and to examine its test-retest reliability. After getting the permission from authors of CHART, we translated the CHART-SF and its scoring methods into Chinese. Then, the reverse translation and confirmation were held. Test-retest reliability was confirmed in 21 spinal cord injured (SCI) subjects by telephone interviews. Pearson correlation and paired *t* test were used in analysis. As the results, correlation coefficients between test and retest were over 0.80 in all domains except the Social Integration domain. All item responses correlated significantly and there was no significant difference in any items between the first and the second interview. Generally the CHART-SF Chinese version was well developed and the results confirmed it to be a reliable instrument to evaluate handicaps that the SCI individuals suffered. Its application is expected in the future.

【Key Word】 handicap, measurement, reliability

Introduction

Rehabilitation clients who do not return to their previous roles may be considered handicapped¹⁾. As the definition made by the World Health Organization (WHO), handicap is a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual²⁾. Unlike impairment or disability, handicap is a social phenomenon, representing the social and environmental consequences for the individual stemming from the presence of impairments and disabilities.

Despite the importance and necessity to quantify client's received handicaps, it is one of the most poorly measured of all rehabilitation outcomes. In our knowledge, one of the best-developed and most often used measure is the Craig Handicap Assessment and Reporting Technique (CHART)¹⁾.

The CHART was developed to assess handicap based on the International Classification of Impairment, Disability and Handicap (ICIDH) model. The 37-items instrument included objective questions to measure client's degree of handicap that resulted from impairment and disability, and it can be answered through the self-administered questionnaire or through an interview format. In the initial CHART publication, one hundred and thirty-five spinal cord injured (SCI) participants performed its psychometric evaluation. The test-retest reliability coefficients were between 0.80 and 0.95 for each subscale score.

The CHART Short Form (CHART-SF), evolved from a multi dimensional analysis of

CHART by reducing the number of questions, was developed in 1999³⁾. The 19-item instrument is composed of six domains to evaluate handicap. The component items of Physical Independence domain constituted from the number of hours per day needed someone's help to perform daily routines (whether paid or unpaid). Items included in Cognition Independence domain reflect the amount of hours that a person needs supervision in remembering, decision-making, or judgment, both inside and outside the home. Mobility domain quantifies the hours per day out of bed, days per week out of the house, and nights per year spent away from home. Time spent in various activities, such as gainful employment, schooling, active homemaking and maintenance, as well as recreational pursuits, is used to measure Occupation domain. Items included in Social Integration domain assesses household composition; romantic involvement; the number of relatives, business associates, and friends with whom regular written or oral contact is maintained, and the frequency of initiating conversations with strangers. In addition, Economic Self-Sufficiency domain is defined as the remaining disposable household family income after non-reimbursed medical expenses have been excluded.

The same as CHART, each subscale of CHART-SF computed a maximum score of 100, which indicates no handicap exists; and a minimum score of 0, which means totally handicapped in measuring domain. Analysis of CHART-SF has been conducted on various disability populations including spinal cord injury, traumatic brain injury, stroke, multiple sclerosis, burn and amputee populations, and

results indicate that there exists a high correlation between all the CHART-SF subscales and the CHART counterparts. Additionally, CHART-SF achieved 90% explained variance of CHART at Physical Independence, Cognitive Independence, Mobility, Social Integration and Occupation sub-scores in all impairment categories.

To the best of our knowledge, however, there is no Chinese instrument with confirmed reliability and validity to evaluate individual's handicap in Taiwan. There are several well-confirmed and often-used instrument in rehabilitation field in Taiwan, but most of them are focusing on functional movement⁴⁻⁷. Hsieh and Hsueh confirmed the psychometric characteristics of some Chinese version activities in daily living (ADL) instruments⁸⁻¹⁰. Besides those, we need an adequate instrument to quantify SCI individual's handicap in Taiwan. Its development is urged.

Thus, the goal in this study is to develop a Chinese handicap instrument. The first step of our strategy is translating the present CHART-SF into Chinese and using statistical analyses to confirm its reliability.

Methods

After getting the permission from authors of CHART, we translated the CHART-SF and its scoring methods into Chinese. Then, the CHART-SF Chinese version was back translated into English by two Chinese-English bilingual occupational therapists, and the authors of the original CHART-SF confirmed the back-translated questionnaire. Neither of the two translators have used this questionnaire before nor know about it.

Subjects and data collection

A convenient sampling method was used in this study. Twice telephone interviews were held with a 21-25 days interval. Twenty-one SCI subjects who were ever been admitted to National Taiwan University Hospital completed the CHART-SF Chinese version through the telephone interviews. All the participants were 18 years or older; six months or longer duration after onset, and living in great Taipei area when we interviewed.

Statistic analyses

Pearson correlation coefficients between test and retest were calculated both in each subscore and each item response of CHART-SF. In addition, paired-sample *t* test was performed to check the difference in each item response between first and the second interview. SPSS 9.0J^a was used for all of the statistic analyses and $p < 0.05$ was adopted as statistic significance.

Results

Subjects' characteristics

Among the subjects of this study, most of their members were male (90.5%) and the average age was 42.5 years old. Duration after onset was ranged from 1-24 years and the average was 8.76 years. Reason of onset was traffic accident (42.9%), falling (19.0%), sport injury (19.0%) or others (19.0%). Over half of members were tetraplegia while as the residual 38.1% were paraplegia. About one of three of members educated 12 years or more, and the proportion of employed was 28.6% (Table 1).

Table 1. Demographic data (n=21)

variable		frequency	%
gender	male	19	90.5
	female	2	9.5
cause of onset	traffic accident	9	42.9
	falling	4	19.0
	sport injury	4	19.0
	others	4	19.0
	6 years	7	33.3
	9 years	7	33.3
education	12 years	3	14.3
	>12 years	4	19.0
	current employment status		
no	13	61.9	
yes	6	28.6	
others	2	9.5	
injury level	cervical	13	61.9
	thoracic	6	28.6
hospitalization in the past year	lumbar	2	9.5
	no	17	81.0
outpatient visiting	yes	4	19.0
	no	10	47.6
pain	yes	11	52.4
	no	5	23.8
	yes	16	76.2
	range	mean	SD
age(yr)	21-73	42.48	14.0
duration after onset (yr)	1-24	8.76	7.0

Table 2. Subscore of CHART-SF (n=21)

domain		test	retest	r	p
PI	mean	76.10	83.62	.898***	.000
	SD	37.9	30.0		
CO	mean	80.05	82.00	.983***	.000
	SD	26.9	25.5		
MO	mean	69.05	69.05	.872***	.000
	SD	27.8	28.3		
OCC	mean	46.19	48.10	.931***	.000
	SD	43.2	42.2		
SI	mean	85.79	93.88	.593**	.005
	SD	19.9	18.1		

p<.01; *p<.001

PI: physical independence; CO: cognition; MO: mobility; OCC: occupation; SI: social integration

Reliability of the CHART-SF Chinese version

Five out of the six domains in CHART-SF Chinese version were scored following the manual. Economic Self-Sufficiency domain was taken off in scoring because of high proportion of missing data. Subscores in test and retest and its correlation were illustrated in Table 2. Both of the subscores showed the same distribution as the lowest scores in occupation domain and the highest scores in social integration domain. Correlation between rest and retest were very high at all domains ($r > 0.85$, $p < 0.001$) except at social integration domain ($r = 0.593$, $p < 0.01$).

Table 3 shows the response in each item, correlations and difference between test and retest. All item responses correlated significantly. Coefficients in each item were over 0.70 except two items were about 0.60. The two items are: homemaking hour per week; and the number of friends contact at least once a month. Nevertheless, all of the correlation were statistically significant and $p < 0.01$. In addition, there was no significant difference in any items between the first and the second interview by *t* test.

Discussion

Development of the CHART-SF Chinese version

Following the definition of WHO, handicap is a broad concept and it is difficult to measure precisely. Hence there is little measurement in present. Except CHART, the Community Integration Questionnaire (CIQ)¹¹⁾ is also a well-known instrument to measure handicap for individuals living within the community. However, while the

CHART-SF asks for amount of time involvement in occupation performance, the CIQ asks for performance of specific activities (shopping, meal preparation) that

are weighted towards the traditional female gender role. Besides, the CHART-SF includes items that focus on objectively observable criteria, which are less likely to

Table 3. Responses of each item (n=21)

domain	item	mean	r	p	t value	p
physical independence	paid hour (1)	3.81	.938 ^{***}	.000	1.000	.329
	paid hour (2)	3.14				
	unpaid hour (1)	2.17	.907 ^{***}	.000	1.696	.105
	unpaid hour (2)	0.95				
cognition	in home assistance (1)	5.10	.987 ^{***}	.000	-1.000	.329
	in home assistance (2)	5.14				
	outside help (1)	3.33	.944 ^{***}	.000	-1.451	.162
	outside help (2)	3.43				
mobility	out of bed hour (1)	12.57	.805 ^{***}	.000	.794	.437
	out of bed hour (2)	12.10				
	get out day (1)	3.57	.945 ^{***}	.000	-1.793	.088
	get out day (2)	3.95				
	stay out night (1)	1.81	.941 ^{***}	.000	-.568	.576
	stay out night (2)	1.86				
occupation	working hour (1)	16.86	.928 ^{***}	.000	-1.374	.185
	working hour (2)	20.52				
	studying hour (1)	1.24	.997 ^{***}	.000	1.000	.329
	studying hour (2)	1.14				
	homemaking hour (1)	2.86	.638 ^{**}	.002	1.036	.313
	homemaking hour (2)	1.76				
	home maintenance hour (1)	0.71	.966 ^{***}	.000	-.439	.666
	home maintenance hour (2)	0.76				
	leisure hour (1)	8.38	.709 ^{***}	.000	-1.067	.299
	leisure hour (2)	11.10				
social integration	people living with (1)	4.52	1.00 ^{***}	.000	1.000	.329
	people living with (2)	4.48				
	spouse (1)	1.48	.859 ^{***}	.000	-1.826	.083
	spouse (2)	1.62				
	relatives living with (1)	2.57	.972 ^{***}	.000	-.370	.715
	relatives living with (2)	2.62				
	business (1)	2.43	.872 ^{***}	.000	-1.676	.109
	business (2)	3.14				
	friend (1)	2.76	.621 ^{**}	.003	-2.023	.057
	friend (2)	3.57				
	stranger (1)	2.00	.859 ^{***}	.000	-1.826	.083
	stranger (2)	2.29				

(1): test ; (2): retest **: p < .01 ***: p < .001

CHART-SF asks for amount of time involvement in occupation performance, the CIQ asks for performance of specific activities (shopping, meal preparation) that are weighted towards the traditional female gender role. Besides, the CHART-SF includes items that focus on objectively observable criteria, which are less likely to be open to subjective interpretation. Thus, CHART-SF items identify behaviors rather than perceptions or attitudes.

At 2001 WHO developed a new classification entitled International Classification of Functioning, Disability and Health (ICF) to replace ICIDH¹²⁾. ICF provides a description of situations with regard to human functioning and its restrictions, and serves as a framework to organize this information. In the ICF model, participation is the involvement in life situations, which includes being autonomous to some extent or being able to control one's own life. As the ICF has only recently been published, no instruments are available, designed and based on this ICF concept. The CHART-SF is used to measure the involvement of one's daily living, and fulfillment of one's role, which is corresponding to the definition of participation. According to Perenboom and Chorus's study, the most items of CHART (CHART-SF) related to the participation component of ICF¹³⁾.

Among the 19 items of six domains, we took off Economy Self-Sufficiency domain from scoring. The first reason is its inadequate answer and missing data. Most of our subjects refused to answer the questions or just filled out personal income but not

family income. The high rate of refusal for economic questions was also found in United State¹⁴⁾. As Hall and colleagues' words, even though it is an important concept and worthwhile to be measure, it is problematic to obtain this information with reliability and validity¹⁵⁾. In addition, scoring the Economic Self-Sufficiency domain is according to annual family income and medical expenses. When scoring this domain, one step is determining poverty level from family size. The poverty level is set from the average family income of United State and change each year. Therefore it is not suitable for our subjects living in Taiwan. To decrease missing data, we suggest changing the response method from the open question to the scale question. And the accuracy of response might be improved during the period of tax return.

Scores of CHART-SF

Both of the test and retest results in reliability study showed a similar score distribution: the lowest subscore at Occupation domain and the highest subscore at Social Integration domain. The same distribution also observed in initial study of CHART¹⁾, the CHART norm establishment study¹⁷⁾, and at the SCI follow-up study¹⁸⁾. Even though in different evaluation instrument, study in traumatic spinal cord injury in Japan also showed the similar trend: the high fulfillment in orientation category, followed by social integration, mobility, physical independence, economic self-sufficiency, and occupation category¹⁹⁾. These similar score distribution revealed the difficulty of accomplishment in Occupation

domain.

Reliability

Correlation coefficients between test and retest was higher than 0.85 in each domain except in Social Integration domain, but it was still statistically significant ($r = 0.593$, $p < 0.01$). The moderate correlation was also observed in two items: homemaking hours per week ($r = 0.638$, $p < 0.01$) and number of friend whom telephoned, mailed or visited at least once a month ($r = 0.621$, $p < 0.01$). However, there were no significant difference between the twice response revealed by the t test. It is difficult to get perfect agreement at Social Integration domain than in other domains. In Whiteneck and his colleague study (1992), the one-week interval test-retest reliability in Social Integration was 0.81, the lowest coefficient after in Economic Self-Sufficiency domain¹⁾. The reason of low coefficients could be not only its content questions, but also the difficulties in response.

Limitations

There are several limitations in this study. First is the number and composition of the subject. In this study, there were only 21 subjects. The range of subjects' age was broad and only two female subjects completed the interview. We need more data to confirm if it is suitable to some specific age or gender groups among all SCI individuals. Although there was no significant prominent difference in appearance between our subjects and the reported data in Taiwan, it was difficult to say our subjects had the representative capacity among all SCI

individuals in Taiwan.

Difficulty in responding to CHART-SF was observed at data collection. Some subjects complained that it was difficult to reply the items in Occupation and Social Integration domain. To calculate the score of Occupation domain, it needs to count the sum of hours spent each week in working, schooling, homemaking, performing home maintenance, and in recreation. Time spent in each activity was depended on and was different day by day. As the same kind of problem, subject was asked the number of relatives, business associates, and friends with whom "regular" contact is maintained. It was difficult to fill out in writing the numbers. The difficulty in response and the unstable situation in daily life would also affect the results in reliability.

Additionally, the standard norm of CHART-SF Chinese version was not established yet. Scoring in original CHART was adjusted to ensure that the American able-bodied individuals scored 100 points on each domain¹⁾. Scores would differ with each subject groups on the basis of their characteristics, age, education level, or culture thus it is necessary to build a new standard norm for the unique society¹⁸⁻²⁰⁾. To assess the handicap that the subject reserved adequately, establishment of standard norm in Taiwan is rushed and it would be the next target of the series study.

The CHART was developed as a handicap instrument following the definition and concept by WHO¹⁾. Its six domains were key dimensions of experience in which competence is expected of the individual have been²⁾. To judge if someone

demonstrates handicap or not is dependent on variables including age, sex, and social and cultural factors for that individual. In this study, however, we did not find serious cultural gaps between American and Taiwan in using CHART-SF Chinese version. When comparing the score distribution of each domain of CHART (CHART-SF), almost the same trends were found in our study and the studies held in United State^{1, 15}. Dijkers and colleagues indicated the problems in translations between English and the language of other countries¹⁵. Even the basic concept of community participation would be applicable to very different society, and the significant indicators might be the same as those selected for the United State, we cannot always be certain that exactly the same information is collected due to the translation. One of the best solutions to this problem is to develop an original handicap instrument based on its own culture and social characteristics. A new handicap instrument for people lived in Taiwan is expected in the future.

Conclusion

The CHART-SF Chinese version was developed and its reliability was confirmed at this study. The results confirmed it to be a reliable instrument to evaluate handicaps that the SCI individuals suffered. Its application is expected in the future.

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References

1. Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD & Richardson GN: Quantifying handicap: a new measure of long-term rehabilitation outcomes. *Archives of Physical Medicine and Rehabilitation*. 1992; 73: 519-526.
2. World Health Organization. *International Classification of Impairments, Disabilities, and Handicaps*. Geneva: World Health Organization; 1980.
3. Craig Hospital Research Department. *Short Form-Craig Handicap Assessment and Reporting Technique (CHART)*. Englewood (CO): Craig Hospital; 2000.
4. Hsieh C-L, Hsueh I-P, Chiang F-M & Lin P-H: Inter-rater reliability and validity of the Action Research Arm Test in stroke patients. *Age and Ageing*. 1998; 27: 107-114.
5. Hsieh, CL, Hsueh IP & Mao HF: Validity and responsiveness of the Rivermead Mobility Index in stroke patients. *Scandinavian Journal of Rehabilitation Medicine*. 2000; 32: 140-142.
6. Mao H, Hsueh I, Tang P, Hsu C & Hsieh C: Analysis and comparison of the psychometric properties of three balance measures for stroke patients. *Stroke*. 2000; 33: 1022-1027.
7. Mao H-F, Li W & Lo JL: Construct validity of Beery's developmental test of

- visual-motor integration. *The Occupational Therapy Journal of Research*. 1999; 19: 256-272.
8. Hsieh C-L: Reliability and validity of the Frenchay Activities Index [in Chinese]. *Tzu-Chi Medical Journal*. 1997; 9: 123-130.
9. Hsueh IP, Huang SL, Chen MH, Jush SD & Hsieh CL: Evaluation of stroke patient with the extended activities of daily living scale in Taiwan. *Disability and Rehabilitation*. 2000; 22: 495-500.
10. Hsueh IP, Lee MM & Hsieh CL: The psychometric characteristics of the Barthel ADL index in patients with stroke. *Journal of Formosan Medicine Association*. 2001; 100: 526-532.
11. Willer B, Linn R & Allen K: Community integration and barriers to integration for individuals with brain injury. In M. A. J. Finlayson & S. Garner (eds). *Brain Injury Rehabilitation: Clinical Consideration*. Baltimore: Williams & Wilkins, pp. 355-375, 1993.
12. World Health Organization. *International Classification of Functioning, Disability and Health (ICF)*. Geneva: World Health Organization; 2001.
13. Perenboom RJM & Chorus AMJ: Measuring participation according to the International Classification of Functioning, Disability and Health (ICF). *Disability and Rehabilitation*. 2003; 25: 577-587.
14. Whiteneck GG, Brook CA, Charlifue SW, Gerhart KA, Mellick D, Overholser JD, et al.. *New CHART manual 2001*. Englewood(CO): Craig Hospital; 2001.
15. Hall KM, Dijkers M, Whiteneck G, Brooks CA & Krause S: The Craig Handicap Assessment and Reporting Technique (CHART): Metric properties and scoring. *Topics in Spinal Cord Injury Rehabilitation*. 1998; 4: 16-30.
16. Whiteneck G, Tate D & Charlifue S: Predicting community reintegration after spinal cord injury from demographic and injury characteristic. *Archives of Physical Medicine and Rehabilitation*. 1999; 80: 1485-1491.
17. Fujishiro Y, Hasegawa T, Hirabe M, Ihara K, Takayanagi M, Kumakura N, et al.: Social participation of people with traumatic spinal cord injury. *Sogo Rehabilitation*. 2001; 29: 151-159.
18. Segal ME & Schall RR: Assessing handicap of stroke survivors – a validation study of the Craig Handicap Assessment and Reporting Technique. *American Journal of Physical Medicine and Rehabilitation*. 1995; 74: 276-286.
19. Westgren N & Levi R: Quality of life and traumatic spinal cord injury. *Archives of Physical Medicine and Rehabilitation*. 1998; 79: 1433-1439.
20. Kumamoto K: The handicap assessment in home-bonded stroke survivors (Doctoral dissertation). Sendai: Tohoku University; 2001.
21. Kumamoto K, Iwaya T, Tobimatsu Y, Kumano H, Sonoda K & Tozato F: Japanese version of the Craig Handicap Assessment and Reporting Technique. *Sogo Rehabilitation*. 2002; 30: 249-256.

CHART-SF 中国語版の作成および信頼性の検証

王 治文¹⁾ 張 彧²⁾ 外里 富佐江³⁾ 飛松 好子⁴⁾ 岩谷 力⁵⁾

- 1) 東北文化学園大学医療福祉学部リハビリテーション学科作業療法学専攻
- 2) 国立台湾大學醫學院職能治療學系
- 3) 群馬大学医学部保健学科作業療法学専攻
- 4) 広島大学大学院保健学研究科
- 5) 国立身体障害者リハビリテーションセンター

要旨

社会的不利は障害を受けた個人が従来の役割を果すことに制限を受けることと考えられる。社会的不利の測定が重要であるにも関わらず、台湾では信頼性と妥当性が確認された尺度はない。この研究の目的は広く用いられる社会的不利の尺度 **Craig Handicap Assessment and Reporting Technique – Short Form (CHART-SF)** の信頼性を繰り返してストにより検証することである。我々は CHART の原作者の許可を得、CHART-SF とその採点法を中国語に翻訳し逆翻訳と確認作業を行った。信頼性の検証は再テスト法を用い、21名の脊髄損傷者に電話インタビューで行われた。分析はピアソンの積率相関係数と対応のある *t* 検定を使用した。結果では、社会統合領域以外 CHART-SF のすべての領域において1回目と2回目のテスト間の相関係数は0.80以上であり、すべての項目回答において有意な相関があり有意な差はなかった。この結果から CHART-SF 中国語版は社会的不利を測定するための信頼できる尺度であることを検証した。

【キーワード】 社会的不利・尺度・信頼性