Internal Consistency and Concurrent Validity of Korean Language Version of WHODAS 2.0: 12 Item-Self Administered

The Journal of Korean Society of Physical Therapy

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Purpose: The aim of this study was to validate the Korean version of World Health Organization Disability Assessment Schedule 2.0 (KWHODAS 2.0) in 12 item-self administered version (12-self).

Methods: The KWHODAS 2.0 and Korean Functional Rating index (KFRI) were tested for internal consistency, ceiling and floor effects, and concurrent validity in 111 patients with low back pain and/or neck pain.

Results: A very high level of internal consistency was shown for both instruments; α=0.96 with KWHODAS 2.0; 12-self and α=0.97 for KFRI. No ceiling and/or floor effects were found in both the instruments. The KWHODAS 2.0 and KFRI were highly correlated (r=0.77), and the relationship of each item between KWHODAS 2.0 and KFRI was ranging from r=0.09 to 0.72.

Conclusion: We conclude that the KWHODAS 2.0: 12-self and KFRI are reliable and are valid instruments for the measurement of disability in Korean speaking patients with low back and/or neck pain. Both instruments, the KWHODAS 2.0; 12-Self and KFRI are now suitable for use in clinical practice and research applications.

Keywords: WHODAS 2.0, Functional Rating Index, Validity, Low back pain, Neck pain

Received: November 14, 2011
Revised: November 24, 2011
Accepted: November 26, 2011
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I. Introduction

Self-report measures are often used by clinicians as well as researchers to measure the health status or treatment outcome in patients with disability. Self-report measures are very useful for both clinicians and researchers as they can save time in collecting purposed data, and it is inexpensive to be administered.[1] Furthermore, they are efficient for assessing large number of respondents with minimum effort. However, the self-report instrument should be carefully chosen based on their validity. Usage of invalidated instruments should be avoided.

Most of the self-report measures for low back and/or neck pain are developed in English. This makes it difficult for clinicians being able to access validated tools to document their treating non-English patients, as well as for researchers being able to enroll patients, who do not speak English, into their trials and to pool of results of trials from different countries. Therefore, other language translated versions of instruments would also be needed for non-English-speakers. Further, validation of translated versions of instruments should also be achieved. Korean is a language which is spoken not only in Korea but across the world with a population of more than 50 million. Spinal problems are the most common musculoskeletal conditions,[2] yet access to validated instruments is lacking.

Spinal pain is one of the most common reasons for visiting health professionals.[3] Major problems of low back and/or neck pain is usually associated with disability.[45] The annual prevalence rate is ranging from 30 to 80% among the adult population.[6,7] Spinal pain may have an impact on the functional status of patients, interfering with basic activities such as standing, walking, dressing, and many work-related activities.[8] Thus, It is important for both clinicians and researchers to measure and quantify the disability resulting from spinal pain. Several questionnaires for low back and/or neck pain are available with approved validations: Neck Disability Index

(NDI),[9] Neck Pain and Disability Scale,[10] Copenhagen Neck Functional Disability Scale,[11] Cervical Spine Outcome Questionnaire,[12] Roland-Morris Disability Questionnaire,[13] Oswestry Disability Index (ODI),[14] Quebec Back Pain Disability Questionnaire[15] and Functional Rating Index.[16] Korean versions of NDI, ODI[17], and FRI[18] are available and have been used recently by the Korean population.[19,20,21] However, among those, FRI is shorter than other instruments. It was developed to measure perceived disability in patients with low back and/or neck pain at the same time. Moreover, Korean version of FRI had already been identified good in reliability, validity and responsiveness.[18]

The World Health Organization Disability Assessment schedule 2.0 (WHODAS 2.0) is one of the comprehensive measures of disability based on International Classification Functioning, Disability and Health (ICF).[22] Disability was defined in the ICF as "a difficulty in functioning at the body, person, or society level, in one or more life domains as experienced by an individual with a health condition in interaction with contextual factors".[23] The WHODAS 2.0 is a generic assessment instrument and it can be used for measuring health and disability at general population and/or at clinical settings.

Recent studies reported that the WHODAS 2.0 was a reliable and a valid instrument for a person with spinal pain.[24,25,26] Validation of translated versions for existing questionnaires is able for both clinicians and researchers to share the clinical outcomes of interventions, and to increase the statistical power of clinical studies. Therefore, the aim of our study was to compare the disability from patients with low back pain and/or neck pain using both the instruments. The objectives of this study were: (1) to examine the internal consistency of the *K*WHODAS 2.0 and *K*FRI; (2) to compare the distribution of the *K*WHODAS 2.0 and *K*FRI and evaluate the floor and ceiling effects; and (3) to investigate the concurrent validity.

II. Methods

1. Subjects

Patients with a primary complaint of low back and/or neck pain, aged between 18 and 65 years, were invited to the study. Volunteers were recruited from different physical therapy clinics belonging to 6 private hospitals in Busan metropolitan area. Those from the clinics were well representing musculoskeletal conditions in Busan. All participants were using Korean as their mother tongue and could read Korean. The general characteristics of participants are described in Table 1.

Table 1. Characteristic of Subjects (n=111)

Characteristic	Summary count
Age (yr), mean (±SD)	40.8 (±12.9)
Gender (n)	
Male	55 (49.5%)
Female	56 (50.5%)
Pain Regions (n)	
Neck	32 (28.8%)
Back	74 (66.7%)
Neck & Back	5 (4.5%)

2. Experimental methods

1) Measurement

(1) Instrument

① *K*WHODAS 2.0

The WHODAS 2.0: 12-self version asks about difficulties due to health conditions, which includes disease or illnesses, other health problems that may be short or long lasting, injuries, mental or emotional problems, and problems with alcohol or drugs. It covers over 30 days. It is comprised of 12 items, S1-12, to exam the level of functioning in 6 domains of life: 1. Cognition (learning a new task, concentrating); 2. Mobility (standing, walking); 3. self-care (washing, dressing); 4. getting along (interaction with stranger, maintaining friendship); 5. life activities (household responsibility, day-to-day work/school); and 6. participation (community activity, emotionally affected). Each item has 5-points scale, the patients ranks his or her perceived ability to perform a function (0=no difficulty, 1=mild difficulty, 2=moderate difficulty, 3=severe difficulty and 4=extreme or cannot do). This questionnaire also includes 3 items, H1-3, which may assess number of days averagely affected on individual's functioning, mentioned items S1-12.[22]

② *K*FRI

The FRI is an instrument specifically designed to quantitatively measure the subjective perception of function and pain of the spinal musculoskeletal system. It consists of 10 items to assess the functional status. Those of 10 items (pain intensity sleeping, personal care including washing and dressing, travel including driving, work, recreation, frequency of pain, lifting, walking, standing), 8 refer to activities of daily living that might be adversely affected by a spinal condition, and those of 2 refer two different attributes of pain. Using a 5-points scale for each item, the patients ranks his or her perceived ability to perform a function and/or the quantity of pain at response points with 0 (no pain with full ability to function) to 4 (worst possible pain and/or inability to perform this function at all.[16]

2) Procedure

One-hundred and eleven patients with low back and/or neck pain completed both questionnaires after their usual physical therapy session. Questionnaires were administered by a physical therapy receptionist. All participants could read the questionnaires and respond each item based on their health status. The completed questionnaire was concealed in an envelope and collected to a box at the reception area in each clinic. The collected questionnaires were posted to the authors.

3) Analysis

(1) Internal Consistency

Internal consistency is the extent to which items in a (sub)scale are correlated (homogeneous). It is as important measurement property for questionnaires that intend to measure a single underlying concept by using multiple items. In this study, internal consistency of *K*WHODAS 2.0 and kFR was evaluated using Cronbach's alpha. To have good internal consistency, Cronbach's alpha should be more than 0.70 and the measurement has good internal consistency.[28]

(2) Ceiling and Floor Effects

The ceiling and floor effects are the number of respondents who achieved the lowest or highest possible score. They are considered to be present if more than 15% of respondents achieved the lowest and highest possible score respectively.[27] Potential ceiling and floor effects in this study were examined by assessing the distribution of answers across items and calculating the percentage of patients, indicating the minimum and maximum possible scores in both the questionnaires.

(3) Concurrent validity

Concurrent validity was examined using correlation analysis with Pearson correlation coefficient. A recommended score of 0.70 was for instruments that measure the same construct. When similar constructs were compared, scores lower than 0.70 should also be accepted.[28]

III. Results

One-hundred and eleven participants were recruited from 6 physical therapy clinics and answered questionnaires. The means of total scores in *K*WHODAS 2.0 and *K*FRI were 12.23±9.14 and 15.70±7.11 respectively.

1. Internal consistency

An excellent internal consistency was observed in *K*WHODAS 2.0 and *K*FRI. The Cronbach's α value for the *K*WHODAS 2.0 12 items and 3 H-items were 0.94 and 0.87 respectively. The obtained value of Cronbach's α was 0.89 in *K*FRI.

2. Floor/ceiling effects

The distribution of response to both questionnaires was presented in Figure 1 and 2. In case of *K*WHODAS 2.0, the minimum was "0", accounting 4.5% (n=5), the maximum was "34", accounting for 0.9% (n=1) of all subjects (n=111). The Minimum total score for *K*FRI was "2", accounting for 2.7% (n=3) and the maximum was "32", accounting for 4.5% (n=5) of all subjects (n=111). Thus, there were no floor and/or ceiling effects for the total score of these instruments.

3. Concurrent validity

The relationship between the items of *K*WHODAS 2.0 and *K*FRI is shown in Table 2. Both questionnaires were highly correlated ($r=0.77$, $p<0.01$). Correlation across items and between the questionnaires was observed to be ranging from $r=0.09$ ($p=0.34$) to $r=0.72$ ($p<0.01$).

IV. Discussion

The aim of the study was to test the psychometric properties of the Korean version of WHODAS 2.0: 12-self version in

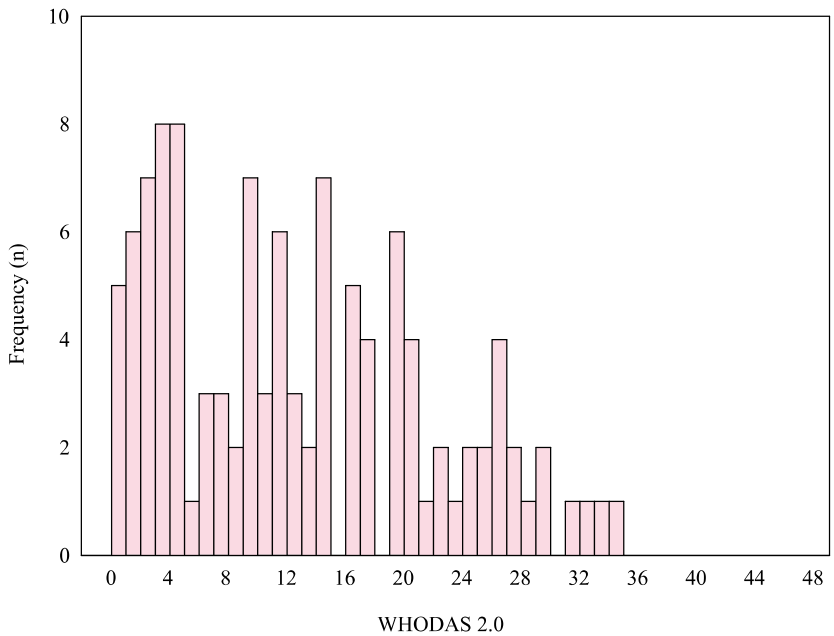

Figure 1. Distribution of KWHODAS 2.0. The lowest and highest possible total scores of the scale are 0 and 48 respectively. Five participants responded that there was no restriction indicated in their lives due to low back and/or neck pain.

patients with spinal pain. The results of the study indicate that *K*WHODAS 2.0: 12-self is reliable and is a valid instrument for the measurement of disability in Korean-speaking patients with low back pain and/or neck pain. It makes it suitable for usage in the field studies and in clinical settings.

The reliability of *K*WHODAS2.0 and *K*FRI was tested

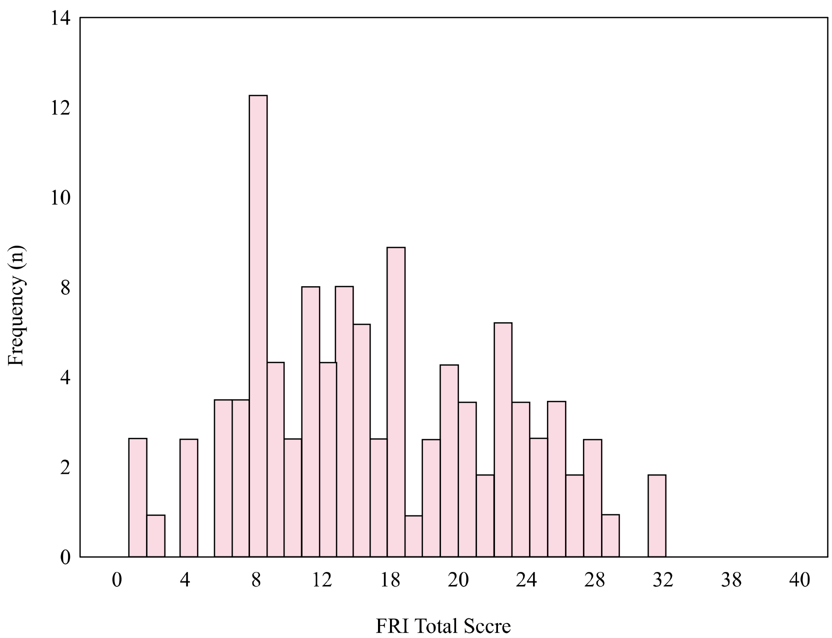

Figure 2. Distribution of KFRI. The lowest and highest possible total scores are 0 and 40 respectively. three participants indicated almost no restriction from their low back and/or neck pain with two out of 40.

Table 2. Correlations between KWHODAS 2.0 and KFRI

KFRI \ KWHODAS2.0	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0.43†	0.41†	0.09	0.22*	0.33†	0.25*	0.38†	0.13	0.19*	0.26*	0.32†	0.30†	0.36†
2	0.41†	0.48†	0.36†	0.22*	0.36†	0.40†	0.37†	0.31†	0.25†	0.39†	0.49†	0.38†	0.48†
3	0.33†	0.51†	0.31†	0.46†	0.29†	0.39†	0.27†	0.49†	0.60†	0.53†	0.58†	0.41†	0.56†
4	0.44†	0.46†	0.43†	0.44†	0.38†	0.46†	0.43†	0.35†	0.45†	0.41†	0.50†	0.49†	0.57†
5	0.42†	0.63†	0.48†	0.53†	0.45†	0.36†	0.31†	0.49†	0.57†	0.48†	0.53†	0.54†	0.62†
6	0.42†	0.54†	0.46†	0.55†	0.41†	0.42†	0.34†	0.44†	0.52†	0.52†	0.54†	0.47†	0.60†
7	0.41†	0.43†	0.32†	0.35†	0.42†	0.34†	0.40†	0.33†	0.30†	0.36†	0.35†	0.40†	0.48†
8	0.47†	0.59†	0.54†	0.54†	0.42†	0.53†	0.32†	0.52†	0.51†	0.41†	0.51†	0.51†	0.63†
9	0.51†	0.44†	0.38†	0.44†	0.40†	0.40†	0.54†	0.34†	0.31†	0.28†	0.38†	0.34†	0.52†
10	0.65†	0.64†	0.47†	0.53†	0.50†	0.53†	0.53†	0.39†	0.40†	0.37†	0.50†	0.46†	0.65†
Total	0.64†	0.72†	0.55†	0.61†	0.56†	0.57†	0.56†	0.53†	0.57†	0.55†	0.65†	0.60†	0.77†

* $p<0.05$
† $p<0.01$

using internal consistency. Good internal consistency was obtained in both questionnaires. Therefore, it confirms the items of KWHODAS2.0 and KFRI are measuring a similar construct. Both instruments demonstrated good internal consistency which was proposed recently for health status questionnaires.[28] The internal consistency of KWHDOAS 2.0 consistent with findings from previous studies.[28,29] It is also notable that KFRI in the current study had similar internal consistency coefficient to the previous findings including Korean study,[18,30,31] which fall within the range of 0.70 to 0.95. This suggests an acceptable Cronbach's α.

Concurrent validity is an important psychometric property of an assessment tool. The concurrent validity of the instruments here was confirmed by significant correlations between KWHODAS 2.0 and KFRI. The total scores of KWHODAS 2.0 and KFRI were showing clear association ($r=0.77$, $p<0.01$), in which 12 items in KWHODAS 2.0 could be attributed to questions related to disability in the KFRI. A previous study reported that WHDOAS 2.0 has satisfactory concurrent validity with other instruments, such as the WHO Quality of Life measure ($r=0.68$), the London Handicap Scale ($r=0.75$) and the Functional Independent Measure ($r=0.68$).[32] However, it is difficult to compare our result to the previous study, which is a 36 item version in WHODAS 2.0 was evaluated. The WHODAS 2.0 is designed for covering disability and measuring the restrictions in daily life activities and social participation, while the FRI addresses patients with low back and/or neck pain. Various magnitudes of the associations between the items of both instruments reflect on how the WHODAS 2.0 and the FRI measure different aspects of related concepts.

To maximize the generalizability of our findings, a broad inclusion criterion was used in the study to select samples. Only illiterate patients were excluded, by choosing patients presenting for treatment of their spinal pain and by recruiting from across the entire city. The findings of the study indicated that KWHODAS2.0 is reliable and valid to use for patients with spinal pain. However, it is not clear from the current data whether the changes of a patient's condition are sensitively screened by the instrument. This could be ascertained with a prospective longitudinal study which would enable researchers to determine the responsiveness of the instrument.

In conclusion, the results of our study demonstrate that the KWHODAS 2.0 and KFRI are reliable. They are also valid tools in the assessment of disability in Korean speaking patients with low back pain and/or neck pain presenting for physical therapy management. The KWHODAS 2.0 and KFRI can be used in both clinical and research practices. It is now possible to perform intercultural comparisons between randomized clinical trials performed in Korea and those performed in English-speaking countries. Future studies are required for longitudinal design to obtain responsiveness and discriminative validity in samples with different levels of disability compared with this study.

Author Contributions

Research design: Lee HJ, Kim DJ
Acquisition of data: Lee HJ, Kim DJ
Analysis and interpretation of data: Lee HJ, Kim DJ
Drafting of the manuscript: Lee HJ, Kim DJ
Research supervision: Lee HJ

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