Psychometric validation of the Chinese version of the PaArticular Scales among elderly residents in long-term care facilities with joint contractures

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Abstract

Rationale, aims and objectives: Joint contractures are common complications among elderly residents in long-term care facilities, causing activity limitations and participation restrictions and affecting quality of life (QOL). The aim of this study is to examine the psychometric properties of the Chinese version of the PaArticular Scales in joint contractures population. Methods: A cross-sectional study design. A sample of elderly residents aged over 64 years with joint contractures in one important joint who have lived at a facility for more than 6 months in twelve long-term care facilities in Taiwan (n = 243). The Chinese version of the PaArticular Scales of joint contractures was generated through 5 stages: translation, review, back-translation, a panel of specialists, and a pretest. Test-retest reliability, internal consistency reliability, construct validity, and criterion validity were evaluated, and the results were compared with those for the WHOQOL-BREF and WHODAS 2.0-36 items. Criterion validity was assessed using correlation coefficients to examine changes in the activity limitations and participation restrictions subdomain and predict QOL. Results: The Activities and Participation subscales had excellent internal consistency (Cronbach's α coefficient = .975; SD = 17.34). The correlation coefficients between the PaArticular Scales and the WHODAS 2.0-36 items ($r = .770$, $p < .001$) and WHOQOL-BREF were significant and highly correlated ($r = -.553$, $p < .001$). Conclusions: The underlying theoretical model of the Chinese version of the PaArticular Scales functions well in Taiwan, and the Chinese version has acceptable levels of reliability and validity.

Introduction

Joint contractures are common complications of nervous system diseases, such as stroke and spinal cord injury,[1] and more than one-fifth (22.0%) of elderly residents in long-term care (LTC) facilities suffer from joint contractures,[2] resulting in functional restrictions and limitations of joint mobility and thus activity limitations and participation restrictions.[2-4] Many studies have noted that activity limitations and participation restrictions, such as the inability to write or inability to visit friends, are most relevant to patients with joint contractures.[5,6]

Unfortunately, activity limitations and participation restrictions are closely related to the quality of life (QOL) of elderly residents in LTC facilities.[7] Many experts even believe that QOL is an important outcome indicator for elderly residents in LTC facilities.[8,9] Recent studies have examined the explanatory power of various factors on the QOL of elderly residents in LTC facilities and have found that activity and participation have the best explanatory power (52.1%) on the QOL of elderly residents in LTC facilities.[10] This finding can help scholars and experts concerned about the QOL of elderly residents in LTC facilities to simplify the complex QOL connotation. Therefore, elderly individuals with joint contractures may have severely limited mobility, which could lead to participation restrictions and negatively affect their QOL.[5-7,11]

Currently, the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) is a widely used scale for the global assessment of activity and participation; however, the scale has several issues. First, the population is heterogeneous. Both the individuals who are frail but still able to walk and the individuals who are severely constrained by mobility are included. Second, affected individuals have different preferences in terms of participation. Third, individuals may already have one or more fully developed joint contractures or are at risk of developing joint contractures. Fourth, personal life situations are diverse, including different nursing care and assistance resources.[12] However, the WHODAS 2.0 is deigned to be applicable to all health conditions, including diseases, illnesses, injuries, mental or emotional problems, and alcohol or drug abuse. It does not attempt to assign aetiology or apportion impairment or disability to any particular disorder.[13] The evaluation of activity and participation is complex, and the complex personal experience of impaired individuals must be acknowledged.[12] Therefore, an outcome questionnaire that quantifies the activity and participation of a particular population is particularly important. Thus far, no universally accepted scale can address the abovementioned key issues.[12]However, the International Classification of Functioning, Disability, and Health (ICF) is the common basis of the WHO's patient-centred measures and intervention plan and comprehensively classifies all health and health-related fields.[5] Therefore, the PaArticular Scales, developed using the ICF as a standard, can fill this gap. The purpose of this study was to examine the psychometric properties of the Chinese version of the PaArticular Scales in joint contractures population.

Methods

According to the Declaration of Helsinki, this study was approved by the

Study design and sample

This study was designed as a cross-sectional survey. It was approved by the XXX Research Ethics Committee (No. 201905XXXXX), and official written consent from each facility was obtained. Prior to the study, the research process was explained in detail to the participants. During the period from April to June 2019, random sampling was performed using the multi-stage sampling method. For factor analysis, the sample size for items must be 5-10 according to previous studies.[14,15]The Chinese PaArticular Scales have a total of 35 items; therefore, a sample size of 175-350 participants was appropriate for factor analysis in this study.[16] The inclusion criteria of the participants were as follows: (1) [?] 65 years old; (2) more than 6 months living at the facility; (3) having the language skills to fill out or answer the questionnaire; (4) severe joint contractures in any one important joint (knee, hip, ankle, shoulder, elbow and hand) with confirmation from a doctor, a nurse, or a therapist. Severe joint contractures were defined as 3 on a 4-point scale (loss $>$ 2/3 of joint range of motion).[17,18] Those with cognitive impairment and major mental illness diagnosed by physicians were excluded.

Study instrument

Disease-related and socio-demographic data

Nursing care dependency can be classified as mild, moderate, severe, and extremely severe, which is determined based on the evaluation report of medical service experts of the national statutory LTC insurance system. To further describe the study population, the minimum data set (MDS) tool recommended by InterRAI Country Websites was used to record socio-demographic data (such as gender and age) and the location of joint contractures (based on medical records and the MDS).[19]

Cognitive status

The Mini-Mental Status Examination (MMSE) was used to evaluate the cognitive status of participants.[20] The MMSE has a total of 13 items, with a total score of 33, and only takes 5-10 minutes to complete. It is a simple quantitative assessment scale that is widely used in clinics and research to evaluate cognitive function and screen cognitive impairment. The higher the score is, the better the cognitive function. The test-retest reliability is good, and the correlation coefficient of inter-rater reliability is .8.[20] An MMSE score below 25 is defined as cognitive dysfunction.

Chinese version of the PaArticular Scales

The PaArticular Scales consist of 35 items: The Activity subscale has 24 items, and the Participation subscale has 11 items. As an organized face-to-face questionnaire to evaluate activity limitations and participation restrictions, before the interview, the interviewer emphasized that the participants must consider their current environment, not hypothetical environments or their former home environment. In terms of reliability, the Cronbach's α values of the internal consistency of the Activity subscale and the Participation subscale were .96 and .92, respectively, and the McDonald's ωtotal were .98 and .95, respectively, indicating the high internal consistency. In terms of validity, the Pearson correlation coefficients of the 2 subscales (the Activity subscale and the Participation subscale) using the criterion validity of the visual analogue scale of the EQ-5D, which is one of the most frequently used generic health status measurement tools, demonstrated good validity and reliability at -.40 ($p > .001$) and -.30 ($p > .001$), respectively.[12]

The World Health Organization Quality of Life (WHOQOL)-BREF

To evaluate the criterion validity of the Chinese version of the Scales, we used the Chinese version of the WHOQOL-BREF developed the WHO's WHOQOL group, which contains 26 items. Questionnaires with over 20% of missing data should be discarded. Missing values are replaced by the average domain value. If there are more than 2 missing values in a domain, the domain score is not calculated (except for domain 3, whose score is only calculated if the missing value <1). The Cronbach's α value of the internal consistency of the overall questionnaire is .90, and the test-retest reliability of each category reaches .75 or above. For the Pearson correlation, the correlation between each item and its category ranges from .45 to .82 ($p< .01$), and the correlation between different categories ranges from .48 to .63 ($p <.01$). For the confirmatory factor analysis (CFA) of the construct validity, the structural equation model of the 4 factors echoes the potential structure designed by the questionnaire, and the comparative fitness indices (CFI) of these 2 analyses are all .886, which is equivalent to that of the Hong Kong version of the questionnaire (CFI = .894) and similar to that of the questionnaire using global data (CFI = .903).[21]

WHODAS 2.0 36 items

To evaluate the criterion validity of the Chinese version of the Scales, we used the Chinese version of the WHODAS 2.0-36 items. A 5-point Likert scale is used by participants to answer questions related to difficulties performing activities. The score ranges from 0 (lowest difficulty) to 100 (maximum difficulty) and is calculated as the sum of each domain score.[22] The higher the score is, the higher the degree of disability and the more severe the restricted situation. Restriction severity refers to the difficulty level classification method of the ICF and WHODAS 2.0. The classification of impairment severity is as follows: below 4% is none; 5-24% is mild; 25-49% is moderate; 50-95% is severe; and more than 96% is extremely severe.[23] In this study, only 32 items were calculated because all the participants were retired and unemployed. Among the reliability indices of the Chinese version of the WHODAS 2.0, Cronbach'sα for internal consistency is .70-.99, and the intra-class correlation coefficient is .80-.89.[24,25] Among the validity indices, the content and the concurrent validity have some correlation, and based on exploratory factor analyses (EFAs), 5-7 factors have an explanatory power higher than 55%. The factor loadings of the CFA are all higher than .56.[24] It has excellent reliability and validity and is consistent with the item response theory (IRT).

Data analysis

In the process of completing the survey, due to refusal of the respondents, negligence of the investigators, or issues with the questionnaire itself, missing data occurred but was resolved by linear interpolation. Descriptive statistics were used to characterize the study population. Absolute and relative frequencies are used for categorical variables, while continuous variables are expressed as the mean and standard deviation (SD).

Test-retest reliability

The test-retest reliability of the Chinese version of the questionnaire was evaluated using residents from 2 LTC facilities. Participants were revisited 3 days later by a different interviewer (i.e., not the first interviewer) and asked to fill out the questionnaire again.

Cohen's kappa statistics and 95% confidence intervals (weighted and unweighted) were used to evaluate agreement (above chance level) between the administrations' person rating and the personal items under continuous testing. Kappa ranges from 0 to 1, where 0 indicates no agreement, and 1 indicates complete agreement. Kappa [?] .8 indicates almost perfect agreement, .8-.6 indicates substantial agreement, and .6-.4 indicates moderate agreement.[26]

Internal consistency reliability

The internal consistency reliability was evaluated based on different tests. Cronbach's α ,[27] McDonald's ωhierarchical, and McDonald's ω total were used.[28] All of these tests range from 0 to 1. The higher the value is, the higher the reliability. Two types of item analysis were used, that is, (1) the relevance within-item and (2) the correlation between item-to-total, to analyse the homogeneity of the research tool. Finally, the correlation between the subscale and the total scale was analysed. Cronbach's α coefficient was used to measure the internal consistency reliability between the Chinese version of the PaArticular Scales and its subscales.

Construct validity

According to the principle of the varimax rotation, EFA was used to assess the validity of the Chinese version of the PaArticular Scales. The original English version of the PaArticular Scales has good criterion validity and internal consistency reliability.[12] EFA is used to find the essential structure of multivariate observations. The factors are first selected based on a screening index of the eigenvalue > 1.0.[29] Based on a screen plot, clinical experience and original factor structure of the Scales, the factors are selected again.[30-33] Finally, the items are selected as long as the minimum variance in each factor is 5%.

Criterion validity

Criterion validity was tested by the convergent construct validity of the tool. To evaluate the convergent structure validity of the new scores, we calculated the Pearson correlation coefficients of the scores obtained from the new questionnaires and the WHOQOL-BREF and WHODAS 2.0 36 items and compared the correlation coefficients. This comparison is meaningful because changes in activity limitations and participation restrictions are accompanied by changes in health-related QOL.[34,35] The point-biserial correlation coefficient was used to calculate the correlations between the Chinese version of the WHOQOL-BREF, the Chinese version of the WHODAS 2.0 36 items and the Chinese version of PaArticular Scales total score to establish concurrent validity. All the data were statistically analysed using the SPSS 22.0 software package (IBM, Armonk, NY, USA).

Results

In this study, we randomly sampled 300 participants who met the inclusion criteria from 12 LTC facilities; 8 were unwilling to complete the consent form, and 49 were unwilling to complete the questionnaire due to emotional factors. Finally, 243 participants were enrolled in the study. Among them, 14.8% (n = 36) had upper extremity contractures, 64.2% (n = 156) had lower extremity contractures, and 21.0% (n = 51) had upper and lower extremity contractures. The demographic characteristics of this study are provided in Table 1.

Research flow chart

A flow chart of this study is shown in Figure 1, together with the instruments administered, sampling procedures, and number of responses in each sample.

Reliability test

Cronbach's α of the Activity subscale, which consisted of 24 items, was .973, with an average score of 18.68 (SD = 13.51). Cronbach's α coefficient of the Participation subscale, which consisted of 11 items, was .038, with an average score of 10.30 (SD = 5.85). This meant that both subscales had excellent internal consistency. The 35-item Chinese version of the PaArticular Scales had a Cronbach's α coefficient of .975 and

an average score of 28.98 (SD = 17.34), indicating that the Chinese version of the PaArticular Scales had excellent reliability (Table 2). The correlation analysis of subscale-to-total scale showed that the Pearson correlation coefficient was .881 for the Activity subscale and .843 for the Participation subscale.

Validity testing

Both the Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity tests were performed to determine if the data collected by the questionnaire were suitable for the factor analysis. The test results showed that the KMO values of the Activity subscale and Participation subscale were .914 and .893, respectively; KMO values > .5 indicated that there were common factors in the questionnaire items, i.e., the factors were independent. The results of Bartlett's chi-square test were all statistically significant (p < .001), indicating that the factors were independent and exclusive. Therefore, the questionnaire data collected in this study were suitable for factor analysis.

EFA was used to extract the construct of the scale. The Activity subscale had 3 factors with an eigenvalue > 1, explaining 75.176% of the total variance in the scale. However, according to the scree plot, the curve flattened after the fourth factor. Therefore, based on the standard and scree plots for the factors with eigenvalues > 1.0 and combined with clinical experience and the factorial structure of the raw scores,[30-33,36] we postulated that the Activity subscale of the Chinese version of the PaArticular Scales had 3 main factors: lower-limb activity, upper-limb activity, and self-care activity. Table 3 shows the factor structure after rotation. A factor with an eigenvalue > 1 was obtained from the Participation subscale, explaining 62.83% of the total variance in the scale. However, according to the scree plot, the curve flattens after the second factor. The Participation subscale of the Chinese version of the PaArticular Scales had only 1 major factor: participation. Tables 3 and 4 show the factor structure after rotation of the Activity and Participation subscales.

For content validity, correlation coefficients for factors 1, 2, and 3 and the item-to-subscale were obtained; the ranges for these coefficients were .725-.888, 706-.886, and .622-.853, respectively, and the Cronbach's α was .958, .951, and .910, respectively.

For the criterion-related validity and according to the classification proposed by Cohen,[37] Pearson's product-moment correlation revealed that the correlation coefficient (r) between the Chinese version of the PaArticular Scales and the WHODAS 2.0-36 items was .770, which was interpreted as a large coefficient, with ap -value less than .001, indicating a highly significant result. The correlation coefficient (r) between the Chinese version of the PaArticular Scales and the WHOQOL-BREF was -.553, which was interpreted as a large coefficient, with a p -value less than .001, indicating a highly significant result. The correlation coefficients between the Activity subscale and the WHODAS 2.0 36 items and WHOQOL-BREF were .722 and -.502, respectively, the correlation coefficients between the Participation subscale and the WHODAS 2.0 36 items and WHOQOL-BREF were .742 and -.580, respectively; all the correlation coefficients were highly significant (Table 5).

Discussion

The Chinese version of the PaArticular Scales is a patient-relevant outcome assessment tool and satisfies the objectivity, reliability, and validity of interval scale measurements. This study found that the Activity subscale had 3 factors (i.e., latent variables) and the Participation subscale had a single factor. The 3 factors in the Activity subscale were lower-limb activity, upper-limb activity, and self-care activity; and the 1 factor in the Participation subscale was participation. The 2 subscales explained 75.176% and 62.825% of the variance in the scale, respectively, indicating that the results had practical significance.

The Chinese version of the PaArticular Scales had excellent internal consistency and reliability. Cronbach's α coefficients for the Activity subscale and Participation subscale were .97 and .94, respectively, which were slightly higher than those found by Müller et al. for 191 elderly residents with joint contractures in German LTC facilities (α = .96 and .92).[12] Although the 2 studies were carried out in different countries, the αcoefficient values were found to be very close. According to the standard set by Nunnally and Bernstein (α

coefficient [?] .80),[38] the PaArticular Scales have excellent internal consistency and reliability across ethnic groups.

The criterion validity tests showed that for individuals older than 64 years with severe joint contractures, strong evidence indicates that the Chinese version of the PaArticular Scales is linearly related to the WHO-DAS 2.0-36 items (r = .770, p < .001). The Pearson correlation coefficient is large. These results show that, similar to the WHODAS 2.0 36 items, the PaArticular Scales developed using the ICF of the WHO as the standard can be another simple tool for the clinical measurement of activity and participation, and it addresses the gap for measuring patients with joint contractures.[5] However, although the Chinese version of the PaArticular Scales is also based on the ICF, it is mainly used for patients with joint contractures, which is different from the widely used WHODAS 2.0 36 items. Perhaps this difference can explain why the correlation between the 2 scales was not very high. Another reason may be that the majority of the participants in this study were institutionalized residents and required nursing care. Obviously, these characteristics are not considered to be associated with the applicable subjects of the WHODAS 2.0 36 items; therefore, the result may be caused by many different composition characteristics (for example, physical conditions).

Criterion validity was also assessed to test the correlation between the Chinese version of the PaArticular Scales and the established Chinese version of the WHOQOL-BREF. For individuals older than 64 years with severe joint contractures, very strong evidence indicates that the Chinese version of the PaArticular Scales is linearly related to the WHOQOL-BREF (r = -.553, p < .001). The Pearson correlation coefficient is large. The newly developed scale demonstrated criterion validity, which was consistent with findings by Chen et al.[10] The study noted that activity and participation, personal factors, and body function and structure are determinants of QOL for elderly residents in LTC facilities. Among them, activity and participation have the best explanatory power, up to 52.1%, indicating that activity and participation have practical significance for the QOL of elderly residents. The results also echo the view of Rantanen et al. that providing outdoor activities for elderly residents with severely limited mobility may positively affect QOL.[11]

Some potential limitations should be considered. First, the data in this study were from a self-reported questionnaire. Although most of the responses were fully validated, it is still difficult to predict or estimate the subjective bias of reported data. For example, in the analysis of the reported data, there might be deviations in the actual experience of the participants. Second, the participants were recruited from LTC facilities, and the design considerations of this study could only reflect the view of these ethnic groups. Although the demographic variables, such as the participants' age, gender, education, and visitation rate, were controlled, caution should be used when generalizing these findings to other settings or to other elderly populations. Third, although the sample size of this study satisfied the requirements for establishing stable person and item estimates and power analysis,[16] it is still necessary to study the Chinese version of the PaArticular Scales with a larger sample size to obtain more complete and reliable data. Finally, to ensure that the Chinese version has applicability and generalizability, the samples in future studies should be more representative and more inclusive, for example, additional studies in different domains.

This study demonstrated that the Chinese version of the PaArticular Scales is a reliable and effective tool for measuring the activity and participation of elderly individuals with joint contractures. As a good sound outcome measurement tool, the Chinese version of the PaArticular Scales developed in this study not only fills the gap in assessing the activity and participation of elderly Chinese individuals but also makes the evaluation of elderly individuals with joint contractures more comprehensive, which can be the basis for improving their activity, participation, and QOL. Furthermore, this tool can also be used in the treatment, rehabilitation, prevention, and research programmes of LTC facilities.

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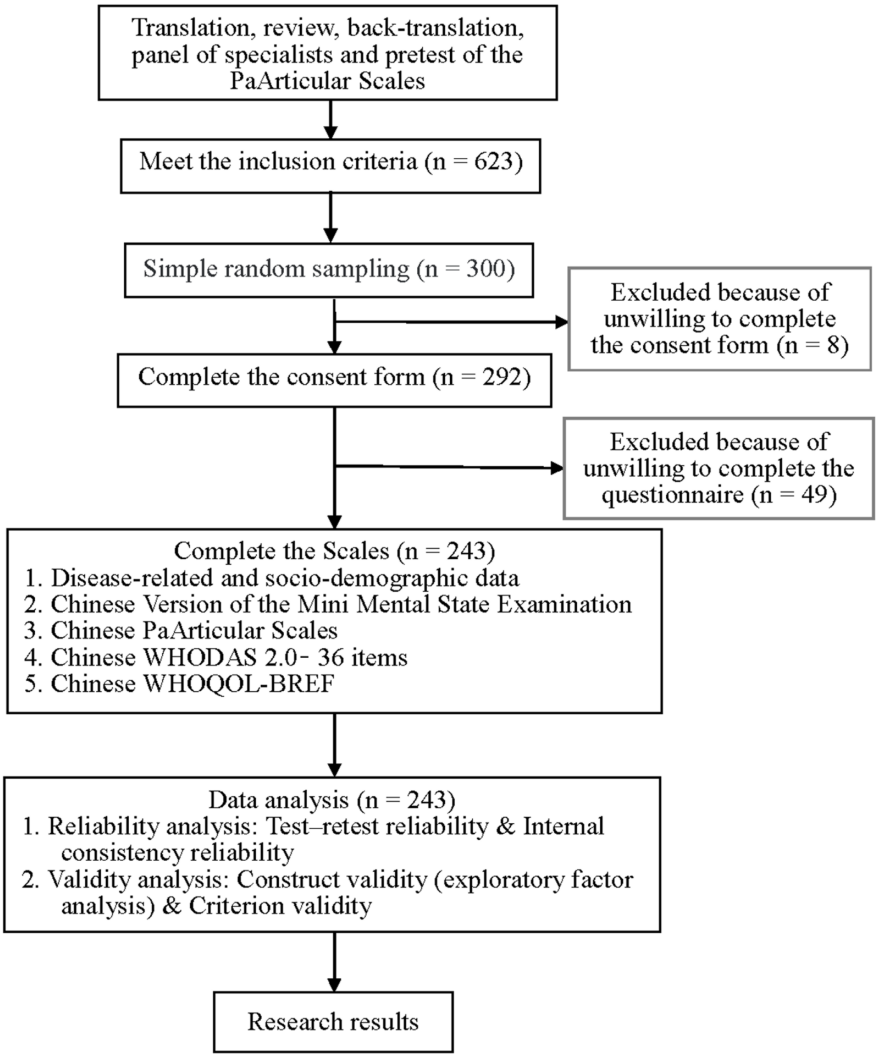
Figure legends

Figure 1. Flow chart describing the samples used in the study including: measurement, sample size and number of responses.



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`Tables.docx` available at https://authorea.com/users/331232/articles/457912-psychometric-validation-of-the-chinese-version-of-the-paarticular-scales-among-elderly-residents-in-long-term-care-facilities-with-joint-contractures