Psychometric properties of the Japanese version of short forms of the Pain Catastrophizing Scale in participants with musculoskeletal pain: A cross-sectional study

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ABSTRACT

Background: The Pain Catastrophizing Scale (PCS) is a commonly used as measure of pain catastrophizing. The scale comprises 13 items related to magnification, rumination, and helplessness. To facilitate quick screening and to reduce participant’s burden, the four-item and six-item short forms of the English version of the PCS were developed. The purpose of the present study was to evaluate the psychometric properties of a Japanese version of the short forms of PCS using a contemporary approach called Rasch analysis.

Methods: A total of 216 patients with musculoskeletal disorders were recruited in this study. Participants completed study measures, which included the pain intensity, the Pain Catastrophizing Scale (PCS), and the Tampa Scale of Kinesiophobia (TSK). Furthermore, the four-item (items 3, 6, 8, and 11) and six-item (items 4, 5, 6, 10, 11, and 13) short forms of the Japanese version of PCS were measured. We used Rasch analysis to analyze the psychometric properties of the original, four-item, and six-item short forms of PCS.

Results: Rasch analysis showed that both short forms of PCS had acceptable internal consistency, unidimensionality, and no notable DIF and were functional on the category rating scale. However, four-item short form of PCS had two misfit items.

Conclusions: Six-item short form of PCS has acceptable psychometric properties and is suitable for use in participants with musculoskeletal pain. Thus, six-item can be used as brief instruments to evaluate pain catastrophizing.

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1. Introduction

Pain catastrophizing is defined as an exaggerated-to-negative orientation toward actual or anticipated pain experiences [1,2]. The Pain Catastrophizing Scale (PCS) is a commonly used as measure of pain catastrophizing [3]. The scale comprises 13 items related to magnification, rumination, and helplessness. Pain catastrophizing is associated with adverse pain-related outcomes [1,4,5] and predicts poor long-term postoperative outcomes [6,7]. Moreover, some studies indicate that strategies designed to reduce pain catastrophizing may mediate positive treatment outcomes [8–10].

PCS has been translated into many languages and validated [10–15]. Japanese version of PCS also has been translated [16] and three-factor structure of the Japanese version of the PCS [17] was supported by confirmatory factor analysis as well as the English version. Moreover, the four-item [18] and six-item [19] short forms of the English version of the PCS were developed in order to facilitate quick screening and to reduce participant’s burden. Both the four-item and six-item short forms of PCS are associated with the original PCS and pain intensity [19]. However, there are no Japanese versions of the short forms of PCS, and their psychometric properties have been investigated using only classical test theory approaches. Therefore, the purpose of the present study was to...
evaluate the psychometric properties of a Japanese version of the short forms of PCS using a contemporary approach called Rasch analysis [20].

2. Methods

2.1. Participants

Participants between the age of 20 and 85 years were consecutively recruited from three orthopedic clinics; those with several pain disorders were included. The exclusion criteria were history of surgery, serious pathologies (unhealed fractures, tumors, acute trauma, or serious illness), neurological disorders (muscle weakness, loss of sensation, or reflexes), and a history of severe psychiatric disorders. The revised Hasegawa’s dementia scale (HDS-R) was used to assess cognitive function before performing questionnaires if orthopedist or physical therapist suspects that participants have dementia. Ethical approval was obtained from the Institutional Ethics Committee of our University. Written informed consent was obtained from all participants before the study, and the study was conducted in accordance with the Declaration of Helsinki.

2.2. Procedure

All participants were assessed for demographic data (age, gender, height, and weight) and pain duration, pain intensity, pain-related catastrophizing, and fear of movement. Pain intensity was measured using a 0—100 visual analog scale anchored on the left with “0 = no pain” and on the right with “100 = unbearable pain.” The level of pain-related catastrophizing was measured using the Japanese version of PCS [18]. Furthermore, the four-item (items 3, 6, 8, and 11) [18] and six-item (items 4, 5, 6, 10, 11, and 13) [19] short forms of the Japanese version of PCS were measured. The level of pain-related fear was estimated using the Japanese version of the Tampa Scale of Kinesiophobia (TSK) [21,22].

2.3. Data analyses

Correlation analysis was performed using the Statistical Package for Social Sciences Version 22 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Data distribution was tested for homoscedasticity using the Kolmogorov–Smirnov test. A series of univariate correlations was performed to examine the relationships of the original, four-item, and six-item short form of PCS with pain intensity and kinesiophobia. These correlations were investigated using Pearson’s correlation coefficient. P-values of less than 0.05 were considered significant.

2.4. Psychometric assessment of the PCS

We used Rasch analysis to analyze the psychometric properties of the original, four-item, and six-item short forms of PCS. Rasch analysis allows a comparison of ordinal data to a probabilistic mathematical model that is based on the fundamental principles of measurement [23]. We used Winsteps software (v3.90.2, Chicago, Illinois) to analyze the original, four-item, and six-item short forms of PCS as follows.

2.5. Targeting

Targeting (item-level to person-level) was evaluated by comparing the means of the item and the person measures. We also evaluated targeting by visual inspection of the distribution of the person and item thresholds. Mistrargeting indicates that items are either too easy or too difficult to endorse for the level of pain-related catastrophizing.

2.6. Category order

PCS has five response categories (0 = not at all, 1 = to a slight degree, 2 = to a moderate degree, 3 = to a great degree, and 4 = all the time). Average measure and category fit statistics (infit and outfit) were used to explore the functioning of the rating scale. If a disordered threshold is found, the rating scale collapses. Fit statistics are recommended to be between 0.6 and 1.4 [24,25].

2.7. Unidimensionality

Item fit statistics and principal component analysis (PCA) of residuals were used to assess unidimensionality. Excessively large fit residuals (>1.3 logits) indicate a large difference between the expected and observed performance of an item [26] and may indicate that the item is assessing a construct other than the intended construct. Excessively small fit residuals (<0.7 logits) indicate items that behave too predictably [26]. We compared both infit (information-weighted) and outfit (outlier-sensitive) statistics and inspected the item characteristic curves of misfitting items in order to determine their behavior for participants of differing agreeability.

The PCA residual correlation matrix was visually inspected to identify clusters of items that would be suggestive of a second dimension. Item clusters with substantial positive or negative loadings, equivalent to an eigenvalue greater than 2.0, were reviewed.

2.8. Internal consistency

Rasch analysis uses person separation index (PSI) and Cronbach’s alpha as indicators of internal consistency and reliability. PSI [27] and Cronbach’s alpha [28] are analogous estimates of reliability and should exceed 0.7.

2.9. Person fit

Participants with outfit residuals greater than 2.0 logits were examined to determine the reason for poor fit [27]. They were compared with those who fit the model using Fisher’s exact test of significance (for gender) or the Mann–Whitney U test (for age, pain intensity and pain duration).

2.10. Differential item functioning (DIF)

Items should function in a similar manner for people with similar levels of agreeability. We assessed for DIF across four subgroups: gender, age (<65 years, ≥65 years), disease type (limb pain [knee, shoulder]), back pain (lower back, neck), pain duration (≤12 months, >12 month) and pain intensity (≤50 mm, >50 mm). DIF was considered to be absent if it was less than 0.50 logits, minimal if it was between 0.50 and 1.0 logits, and notable if it was >1.0 logits [29,30].

3. Results

3.1. Participants

Between February 2014 and September 2015, a total of 216 participants were recruited. All of these patients were Japanese. No one was diagnosed with dementia. Their characteristics are summarized in Table 1. Of all the participants, 150 (69.4%) were women,
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