

Factorial validity and reliability of the Chinese version of the Pain Vigilance and Awareness Questionnaire (ChPVAQ) in a sample of Chinese patients with chronic pain

Running title: Pain vigilance and awareness among Chinese

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Abstract

Purpose: The Pain Vigilance and Awareness Questionnaire (PVAQ) has been shown to be a reliable measure for assessing attention to pain. Different factor structures have been reported in Western populations; yet, whether the known factor models could be replicated in non-Western populations and the psychometric properties of the scale remain unclear. This study aimed to examine the factorial validity and psychometric properties of the Chinese version of the PVAQ (ChPVAQ).

Methods: A total of 242 Chinese patients with chronic pain completed the ChPVAQ, the Chronic Pain Grade (CPG) questionnaire, the Chinese version of the 11-item version of the Tampa Scale for Kinesiophobia (ChTSK-11), the Hospital Anxiety and Depression Scale (HADS), and questions assessing socio-demographic characteristics.

Results: Results of confirmatory factor analyses showed that of the nine competing models tested, McCracken's [5] two-factor correlated model for the 13-item version of PVAQ (PVAQ-13) demonstrated the best data-model fit ($CFI = 0.93$). The two subscales and the entire scale of ChPVAQ-13 obtained moderately high internal consistency (Cronbach's α s: 0.75 – 0.77). The ChPVAQ-13 scales showed significant positive correlations with HADS, ChTSK11, pain intensity, and disability scores. Results of hierarchical multiple regression analyses showed the ChPVAQ-13 scales predicted concurrent depression ($F(4,187)=6.01, p<0.001$) and pain disability ($F(4,190)=3.54, p<0.05$) scores. Passive Awareness emerged as significant independent predictor of concurrent depression (std $\beta = 0.17, p<0.05$) and pain disability (std $\beta = 0.24, p<0.01$), while Active Vigilance (std $\beta = 0.19, p<0.05$) predicted concurrent pain disability.

Conclusions: Our results offer preliminary evidence for the factorial validity and reliability the ChPVAQ-13.

Key words: Attention to pain; Chronic pain; Chinese; Confirmatory factor analysis.

Introduction

The Pain Vigilance and Awareness Questionnaire was first developed as a 16-item (PVAQ-16) measure of attention to pain [1]. Initial assessment on the psychometric properties of PVAQ-16 showed that the scale possessed good internal consistency (Cronbach's $\alpha=0.86$) and adequate test-retest reliability ($r=0.80$) [1]. The PVAQ-16 was later subjected to principal component analysis (PCA) in a non-clinical Canadian sample, yielding a three-factor solution [2]. Based on a sample of Dutch college students, exploratory factor analyses (EFA) extracted two factors for the PVAQ-16, and this newly extracted two-factor solution and the two-factor model reported earlier [2] demonstrated good data-model fit in confirmatory factor analyses (CFA) [3]. In another study based on Dutch fibromyalgia samples [4], initial EFA identified two items with low factor loading (<0.32). Results of CFA on the remaining 14-items (PVAQ-14) replicated the two-factor structure produced from the earlier Dutch study [3]. In the latest report based on a pain sample in the United States [5], three items were removed due to low item-total correlations. PCA on the remaining 13-item scale (PVAQ-13) extracted two factors and the scale demonstrated good internal consistency (Cronbach's α s ranged 0.83-0.84).

Despite converging evidence supporting the psychometric properties of the PVAQ, there have been no studies evaluating the applicability of the underlying theory and the reproducibility of the factor structures of the scale in a Chinese setting. In light of this, this study aimed to examine whether the factors structures obtained in Western samples could be replicated in a sample of Chinese patients with chronic pain, and to assess the psychometric properties of the Chinese version of the PVAQ (ChPVAQ). Validation of a Chinese PVAQ would inform cross-cultural perspectives of pain hypervigilance and help elucidate similarities and differences in tendency to be hypervigilant to pain sensations between Chinese and other ethnic or national groups.

Method

Subjects

Following ethics approval, patients with chronic pain were recruited from an orthopedics specialist out-patient clinic of a Hong Kong public hospital. Patients were eligible for study participation if they met the following criteria: (1) ≥ 18 years of age; (2) native Cantonese speakers; (3) able to communicate and provide written responses to the study measures; (4) free from confusion or cognitive impairment diagnosis from the medical record; and (5) willing to participate in the study. Face-to-face interviews were conducted on eligible patients who gave informed consent by a research assistant while waiting for medical consultation.

Measures

The Pain Vigilance and Awareness Questionnaire (PVAQ)

The PVAQ consists of 16 items assessing attention to pain [1]. Respondents are asked to indicate how frequently each item is a true description of their behaviour on a 6-point scale (0=never; 5=always). The Chinese version of the PVAQ-16 (ChPVAQ-16) was translated from the original by the first author (WSW). Comprehensibility and appropriateness of the language in the Chinese cultural context were emphasized for the translation and used a cross-cultural adaptation procedure. The Chinese version was back-translated into English by a bilingual psycholinguist. The English back-translation was reviewed by the developer of the original English version (L McCracken) for content equivalence between the back-translation and the original version of the PVAQ-16. Discrepancies were discussed and resolved by consensus, and modifications were made as needed, resulting in the penultimate version of the ChPVAQ-16.

Chronic Pain Grade (CPG)

The Chronic Pain Grade (CPG) questionnaire is a seven-item instrument measuring three domains of pain severity: persistence, intensity and disability/interference [6]. The three intensity items ask respondents to rate their current, average and worst pain intensity on 0 – 10 Numerical Rating Scales (NRS) (0 = “No pain at all”; 10 = “Pain as bad as could be”). A Characteristic Pain Intensity Score (score range: 0-100) is derived by averaging the responses to the intensity items and multiplying this by 10. Three CPG items assess pain interference with (1) daily activities, (2) social activities, and (3) working ability using 0 – 10 NRSs (0 = “No interference/change”; 10 = “Unable to carry on activities/extreme change”). The CPG Disability Score (score range: 0-100) is derived by multiplying the average of the three interference items by 10. Persistence is assessed in the original CPG by asking the respondent to indicate the number of days out of the past six months days that he or she was disabled by pain (although we modified this to “the past three months” because chronic pain is now defined as pain that persists for at least three months²⁴). The Disability Score and the number of disability days are recoded into 5-point scales (Disability Score: 0 = “0-29”, 1 = “30-49”, 2 = “50-69”, 3 = “70 or above”; Disability Days: 0 = “0-6 days”, 1 = “7-14 days”, 2 = “15-30 days”, 3 = “31 days or above”) and summed, yielding “Disability Points”. The English version of the CPG possesses good psychometric properties [7]. The underlying structure of the CPG was replicated in a Chinese sample, and the Cronbach’s α s for the CPG Disability and Characteristic Intensity scales were 0.87 and 0.68, respectively [8]. Existing data suggested hypervigilance to pain was associated with pain chronicity and greater disability [9]; hence, pain intensity and disability were used to examine the construct validity of the ChPVAQ.

Hospital Anxiety and Depression Scale (HADS)

The HADS was used to measure affective and behavioral symptoms of depression over the past week [10]. The 14-item HADS comprises two subscales: depression subscale (HADS-D) and anxiety subscale (HADS-A). Each HADS subscale is scored between 0 and 21, with higher scores indicating greater morbidity. The total score (HADS-Total) is obtained by summing the responses of all items. Test-retest reliability for the HADS scales is good (HADS-A: $r=0.89$; HADS-D: $r=0.92$) [11]. Internal consistency are similarly high for anxiety (Cronbach's $\alpha=0.93$) and depression (Cronbach's $\alpha=0.90$) subscales [11]. The Chinese version of HADS possesses good internal consistency and test-retest reliability [12, 13]. The HADS was employed in this study as a concurrent criterion measure of ChPVAQ because existing data showed pain hypervigilance was associated with negative psychological adjustment outcomes such as depression [14].

The Tampa Scale for Kinesiophobia (TSK)

The TSK was used to assess fear of movement/(re)injury [15]. The original English version of TSK consists of 17 items rating on a 4-point Likert scale (1=strongly disagree; 4=strongly agree) [16, 17]. The scale has consistently shown to have good internal consistency and construct validity [18, 19]. The 11-item version of TSK [20, 21] was translated into Chinese language (ChTSK11) and a two-factor correlated structure, which comprises two first-order factors, Somatic Focus (ChTSK11-SF) and Activity Avoidance (ChTSK11-AA), was replicated in a sample of Chinese orthopaedics patients in Hong Kong [15]. The total score of ChTSK11 (ChTSK11-Total) ranges from 11-44. Adequate to satisfactory internal consistency was reported for the ChTSK11 subscales and total score, with Cronbach's α s ranging from 0.56-0.67 [15]. Since previous studies demonstrated a positive relationship between pain catastrophizing and

pain hypervigilance [22, 23], the ChTSK11 was employed as a concurrent criterion measure of the ChPVAQ.

Data Analysis

CFAs were performed using EQS for Windows 6.1 structural equation modeling program [24]. The data-model fit of nine competing models were examined in the present dataset. The one-factor model (Model 1) specified the 16 items of the ChPVAQ on a single latent construct. Model 2 and 3 were derived from the three-factor model reported by McWilliams and Asmundson [2]. In Model 2, a three-factor correlated model, the ChPVAQ-16 items were presumed to be explained by three latent first-order factors (either “Awareness of change”, “Intrusion”, or “Monitoring”) and the factors were allowed to correlate. In Model 3, a four-factor hierarchical model, the three first-order factors were hypothesized to be explained by a higher-order factor, “Pain Vigilance and Attention”. Based on Roelofs et al [3], Model 4 and 5 specified each item of the ChPVAQ-16 to load on a first-order factor (either “Attention to Pain” or “Attention to changes in pain”), with the two first-order factors allowing to correlate in Model 4 and being explained by a higher-order factor (“Pain Vigilance and Attention”) in Model 5. Following the two-factor solution for the PVAQ-14 reported by Roelofs et al [4], the two-factor correlated model (Model 6) and three-factor hierarchical model (Model 7) presumed the 14 items to load on two first-order factors (either “Attention to Pain” or “Attention to changes in pain”). While the two first-order factors were allowed to correlate in Model 6, a higher-order factor (“Pain Vigilance and Attention”) was hypothesized to cause the two first-order factors in Model 7. Model 8 (a two-factor correlated model) and 9 (a three-factor hierarchical model) were derived from McCracken’s report [5] in which 13 ChPVAQ items were hypothesized a priori that the ChPVAQ-13 could be explained by two first-order factors (either “Passive awareness” or “Active vigilance”), with the two first-order factors were allowed to correlate in Model 8 and a higher-

order (“Pain Vigilance and Attention”) presuming to explain the two first-order factors in Model 9. Model fit was assessed using χ^2 statistics, comparative fit index (CFI) [25], non-normed-fit index (NNFI) [26], root mean square error of approximation (RMSEA) [27], and 90% confidence interval of RMSEA (CI). CFI and NNFI value of ≥ 0.90 , and RMSEA value of ≤ 0.08 were indicative of good fit [25, 27]. Since the Mardia’s normalized estimate of multivariate kurtosis (=53.29) rejected the normality assumptions in the present data, the Satorra-Bentler chi-square statistic was reported [28].

After identification of the best model for the ChPVAQ in CFAs, internal consistency (Cronbach’s α s) for ChPVAQ scales, and associations between the ChPVAQ scales and the validity criteria (Pain Intensity and Disability score, HADS scores, and ChTSK11 score) were examined. Pearson’s correlation tests were performed to evaluate the univariate relationship between the ChPVAQ scales and the four criterion variables (Pain Intensity and Disability score, HADS scores, and ChTSK11 score). To evaluate the predictive validity of the ChPVAQ scales on concurrent criterion variables (depression, pain intensity, and disability), three hierarchical multiple regression models were constructed. In all models, socio-demographic variables that were significant in univariate analyses ($p < 0.05$) were entered in the first block to control for potential confounding effects. Two pain variables, including pain duration and number of pain sites, were entered in the second block, followed by ChTSK11. The ChPVAQ scales were entered in a final step.

Results

Patient Characteristics

A total of 242 patients with the mean age of 45.67 (SD=2.61) completed the interview. About 58% of the sample were women, 66.9% were married or cohabited, and 61.4% had

completed secondary education. The present sample had an average of 2.2 (SD=1.5; range: 1-12) pain sites with 62.3% reporting multiple pain sites. The three most common pain sites were leg (38.6%), hand/arm (37.2%), and low back (33.2%). Patients reportedly experienced an average of 4.0 years (SD=5.5, median=1.5, range, 3 months to 34 years) of pain problems. About 60% had had pain for up to 2 year's duration and 21.1% had suffered from chronic pain for more than 5 years.

Factorial validity of the ChPVAQ

Table 1 presents the results of CFAs applied on the present sample for the nine models. Model 1 to 6 did not represent an acceptable fit to the ChPVAQ measure of attention to pain for the present sample (all CFI<0.90). Although the CFI (=0.90) and RMSEA (=0.06) values of Model 7 were satisfactory, the NNFI (=0.88) did not meet the minimum acceptable fit criterion (≥ 0.90). Both Model 8 and 9 fitted the present data well, with all the fit indexes meeting the acceptable fit criterion. Since a correlated model provided a more parsimonious explanation of the underlying structure of the ChPVAQ, McCracken's [5] two-factor correlated model was chosen as the best model to represent the underlying structure of the ChPVAQ-13 (S-B $\chi^2=104.70$, $df=64$, CFI=0.93). The standardized factor loadings of all items on their respective factors for this model were statistically significant ($p<0.05$) (Figure 1).

Internal consistency of the ChPVAQ-13 scales

As presented in Table 2, all ChPVAQ-13 scales demonstrated good internal consistency, with Cronbach's α s ranging from 0.76 to 0.77. The mean score of the Passive Awareness, Active Vigilance, and the total score of ChPVAQ-13 were 21.55 (SD=6.92), 12.99 (SD=6.90), and 34.50 (SD=12.14) respectively.

Correlations of the ChPVAQ-13 with criterion measures

All ChPVAQ-13 scores were significantly correlated with all criterion variables in a positive direction (all $p < 0.01$) (Table 2). Strong correlations were observed on Passive Awareness with pain intensity and disability (all $r_s = 0.88$, $p < 0.01$). The weakest correlation was found between Active Vigilance and pain intensity ($r = 0.17$, $p < 0.01$).

Multivariate prediction of concurrent chronic pain adjustment from the ChPASS-20 scales

Table 3 reports the results of hierarchical multiple regression analyses. After controlling for socio-demographic and pain variables, both pain-related fear ($F(5,164) = 5.56$, $p < 0.001$) and ChPVAQ-13 scales ($F(7,164) = 6.77$, $p < 0.001$) contributed significantly to the prediction of concurrent depression. ChPASS-20 scales explained 8% of unique variance in the entire model. Both Passive Awareness (std $\beta = 0.17$, $p < 0.05$) and Active Vigilance (std $\beta = 0.19$, $p < 0.05$) emerged as significant independent predictor of concurrent depression.

After adjusting for socio-demographic and pain variables, only pain-related fear ($F(7,167) = 4.77$, $p < 0.001$) contributed significantly to the prediction of concurrent pain intensity. The total variance explained by ChPVAQ-13 scales was not statistically significant ($p > 0.05$).

When socio-demographic and pain variables were controlled, both pain-related fear ($F(6,193) = 3.64$, $p < 0.01$) and ChPVAQ-13 scales ($F(8,193) = 4.21$, $p < 0.001$) contributed significantly to the prediction of concurrent disability. The amount of unique variance explained by ChPVAQ-13 scales was 5%, and only Passive Awareness (std $\beta = 0.24$, $p < 0.01$) significantly predicted concurrent disability.

Discussion

This article reports the factor structure and psychometric properties of the ChPVAQ in a sample of Chinese patients with chronic pain. Results of CFAs showed that the two-factor model for the 13-item version of ChPVAQ proposed by McCracken [5] was replicated in the present sample. The reliability and validity of the ChPVAQ-13 were also supported based on the moderately high Cronbach's α coefficients and significant associations with criterion measures.

The results of CFAs disconfirmed the one-factor model and the models previously obtained in McWilliam and Asmundson [2] and Roelofs et al [3, 4] as the underlying structure of the ChPVAQ. One possible explanation for these discrepant findings is sample heterogeneity as both McWilliam and Asmundson [2] and Roelofs et al [3] employed non-clinical Canadian/Dutch samples whereas Dutch fibromyalgia samples were used in Roelofs et al [4]. Both the hierarchical and correlated model of the two-factor structure reported by McCracken [5] demonstrated good fit in this study, suggesting that the two-factor structure of the ChPVAQ-13 and the latent constructs are similar for the Chinese and the US patients with chronic pain, though direct examination on cross-cultural factorial invariance cannot be determined in this study. Based on these preliminary evidence for cross-cultural validity of the PVAQ, differences on PVAQ scores between Chinese and US patients obtained in future studies might suggest true group (e.g., cultural) differences or true intervention effects, rather than differences in the underlying structure of PVAQ. Yet, future studies that directly evaluate cross-cultural factorial invariance of the PVAQ are warranted.

In line with previous report [5], the ChPVAQ-13 subscales and entire scale had moderately high internal consistency reliability. Construct validity was supported with significant univariate correlations between the ChPVAQ-13 scales and all criterion measures, with higher attention to pain associated with higher depression, anxiety, pain-related fear, pain intensity, and

disability. The strengths of associations of Passive Awareness with pain intensity and disability ($r_s=0.88$) were higher than that reported in McCracken (r_s ranging between 0.22-0.25) [5]. These inconsistent findings might be due to different measures employed for assessing pain intensity and disability.

The predictive validity of the ChPVAQ-13 scales with concurrent criterion measures was also supported. After controlling for sociodemographic characteristics, pain history variables, and pain-related fear, ChPVAQ-13 scales significantly predicted concurrent depression and pain disability, accounting for 8% and 5% additional variance to the models respectively. Both ChPVAQ-13 subscales, Passive Awareness and Active Vigilance, made an independent prediction of concurrent depression whereas only Passive Awareness predicted concurrent pain disability. Yet, ChPVAQ-13 did not make a significant contribution to the prediction of pain intensity. These findings are somewhat different from McCracken [5] in which PVAQ-13 significantly predicted pain intensity, but not depression and disability in multivariate regression models. Again, these inconsistent findings might be explained by the different measures used for assessing criterion measures. Future attempts to validate these tentative findings and to examine cross-cultural differences directly on pain vigilance and awareness and their relationships with pain adjustment outcomes would be invaluable.

Despite these findings, the factorial validity and psychometric properties reported for the ChPVAQ-13 should be considered as tentative. The cross-sectional design of this study cannot determine the stability of the factor structure and causal associations between attention to pain and pain adjustment variables. Future research that employs longitudinal, prospective designs could help overcome these shortcomings. Since the ChPVAQ-13 was translated and validated within a Cantonese-speaking context, future studies should evaluate the extent to which the ChPVAQ-13 can be generalized to other Chinese populations speaking Standard Mandarin. Our

findings also support the adaptation of the ChPVAQ in Western countries, such as the United States and Canada, where the Cantonese –speaking Chinese population is high.

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