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ORIGINAL REPORT

FEAR OF MOVEMENT/(RE)INJURY IN CHINESE PATIENTS WITH CHRONIC PAIN: FACTORIAL VALIDITY OF THE CHINESE VERSION OF THE TAMPA SCALE FOR KINESIOPHOBIA

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Objective: **To assess the factor structure of the Chinese version of the Tampa Scale for Kinesiophobia (TSK).**
Design: **Chinese patients with chronic pain attending either orthopaedic specialist services (*n*=216) or multidisciplinary specialist pain services (*n*=109) participated in this study.**
Methods: **Subjects completed the Chinese version of TSK, The Chronic Pain Grade Questionnaire, Hospital Anxiety and Depression Scale, and questions assessing socio-demographic characteristics. Confirmatory factor analyses were used to compare hierarchical and correlated models of 5 different factor solutions previously reported in patients with chronic pain in the West.**
Results: **Confirmatory factor analyses demonstrated inequality of the TSK factor structure, in that the TSK11 for the orthopaedics sample was best represented by a two-factor correlated model (S-Bχ^2=49.593; comparative fit index (CFI)=0.93; normed filt index (NFI)=0.911; root mean square error of approximation (RMSEA)=0.025) comprising 2 first-order factors, Somatic Focus (TSK11-SF) and Activity Avoidance (TSK-AA). The pain clinic sample showed a one-factor structure as best representing the TSK4's underlying dimensions (CFI=0.971; NFI=0.912; RMSEA=0.048). There was no evidence to support a single overarching concept of kinesiophobia.**
Conclusion: **The TSK appears to have utility in Chinese chronic pain populations. Elucidation of the TSK's psychometrics properties in other Chinese/Asian pain populations with different diagnoses and presentations of pain problems is warranted.**

Key words: Tampa Scale for Kinesiophobia; Chinese; chronic pain; confirmatory factor analysis.

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INTRODUCTION

Pain-related fear can both maintain and exacerbate pain and associated disability (1, 2). Patients with chronic low back pain (CLBP) with higher levels of pain-related fear report more pain (3, 4), greater disability (5–7) and reduced physical functioning (8, 9). Similar findings are also documented for patients with acute low back pain (ALBP) (10, 11). Conversely, a number of intervention studies show that lowering pain-related fear is associated with reduced work absence (12) and compensation costs (13), improved functional abilities (14, 15) and increased physical activity levels (16).

The 17-item Tampa Scale for Kinesiophobia (TSK) (17, 18) was designed to assess fear of movement/(re)injury. Different factor structures for the TSK have been reported. In a sample of subjects with CLBP, Vlaeyen et al. (8) identified 4 factors for the Dutch version of the 17-item TSK (TSK17) using principal component analysis (PCA). Clark et al. (19) later reported a two-factor model for a 13-item version for inpatients with chronic pain. This two-factor structure was replicated using confirmatory factor analysis (CFA) by Geisser et al. (20) in patients with CLBP. In a sample of ALBP, Swinkels-Meewisse et al. (11) failed to replicate Vlaeyen et al.'s (8) four-factor structure and Clark et al.'s (19) two-factor model, and instead identified a different two-factor solution for the TSK17. This new two-factor structure, which omitted the 4 reverse-scored items was later confirmed by CFA. Goubert et al. (21) suggested Clark et al.'s (19) two-factor structure was invariant across 188 patients with CLBP and 89 patients with fibromyalgia (FM). The Swedish version of TSK demonstrated good internal consistency and construct validity in a sample of patients with CLBP (22).

Subsequently, Woby et al. (23) documented that, in a sample of ALBP, not only did the 4 reverse-scored items have low item-total correlations, item analyses further showed that items 9 and 14 deviated from a normally distributed pattern. Given these

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findings, the authors excluded these 6 items and examined the psychometric properties of the remaining 11 items (TSK11). The TSK11 possessed good internal consistency, test-retest reliability, responsiveness, concurrent validity, and predictive validity. Roelofs et al. (24) re-examined Woby et al.'s (23) TSK11 in patients with chronic musculoskeletal pain drawn from the Netherlands, Sweden and Canada. CFAs offered support for a two-factor structure for the TSK11. Based on a sample of patients with sciatica due to disc herniation, a recent study identified 3 factors in the Norwegian version of the 13-item TSK, using PCA, and concluded that the scale possessed good internal consistency and construct validity (25).

Hence, the TSK's psychometric properties have been determined in different patient groups, such as those with CLBP (8, 20, 21, 23), ALBP (26), other pain conditions (19, 24, 27) and FM (21, 28). The differences in factor structure seen across studies are probably mainly due to sample heterogeneity and the different statistical methods employed. Thus far, the TSK has been examined only in Western countries. Chronic pain is common among Chinese adults in Hong Kong's general population, with a prevalence of ~35% (29). Specialist services for chronic pain in Hong Kong are currently limited to 4 multidisciplinary pain clinics in public hospitals. Most patients with chronic pain are managed by orthopaedics specialists. This study aimed to evaluate the factorial validity of a Chinese version of the TSK in a sample of Chinese patients with chronic pain. In particular, we examined whether the TSK could be extended to patients with chronic pain attending orthopaedic specialist services and pain clinic multidisciplinary services in Hong Kong.

MATERIAL AND METHODS

Subjects

Following ethics approval, subjects were recruited from 2 orthopaedic specialist outpatient clinics (SOPC) and an outpatient pain clinic in Hong Kong. Patients were invited to participate in the present study during visits for clinical consultations with doctors. Patients were eligible for study participation if they met the following criteria: (*i*) age 18 years or more; (*ii*) native Cantonese speakers; (*iii*) having no communication problems or physical conditions that would prevent the completion of the interview; (*iv*) no confusion or cognitive impairment diagnosis from the medical record; and (*v*) willingness to participate in the study. All eligible patients gave informed consent and were interviewed while they were waiting for medical consultation.

Measures

Tampa Scale for Kinesiophobia. Rated on a 4-point Likert scale (1 = strongly disagree; 4 = strongly agree), the TSK was designed to assess fear of movement/(re)injury. Of the original 17 items, 4 (items 4, 8, 12 and 16) are negatively phrased and thus reverse scored. The total score ranges from 17 to 68. The Chinese version of the TSK was translated by the first author. The initial Chinese version was back-translated by a bilingual local psychologist. To evaluate the semantic equivalence of the Chinese items with the English version, the items were reviewed by an orthopaedics physician, a clinical psychologist and a postgraduate student, all of whom were bilingual in Chinese and English. Discrepancies were discussed and resolved by joint agreement between translator and reviewers and the translation amended as necessary. Comprehensibility and appropriateness of the language in the Chinese cultural context were emphasized in the translation and cross-cultural adaptation procedure. The penultimate Chinese TSK version was piloted on 20 local Chinese patients attending a public hospital orthopaedics SOPC in Hong Kong. Subsequently, patients were asked to explain their responses on each item to the researchers. The finalized translation of the Chinese version of TSK was prepared based on the results of this pilot.

Chronic Pain Grade. The presence of chronic pain was first identified by affirmative answers to 2 questions: (*i*) "Are you currently troubled by physical pain or discomfort, either all the time, or on and off?"; and (*ii*) Have you had this pain or discomfort for more than 3 months?"(30). Subjects answering yes to both questions were then asked about site of their pain. Chronic pain severity was assessed using the Chronic Pain Grade (CPG) questionnaire (31), a 7-item instrument that measures severity in 3 dimensions: persistence, intensity and disability. Rating on an 11-point scale (0 = no pain at all; 10 = pain as bad as could be), 3 pain intensity items assess the present, average, and worst pain of the respondents. Three items measured pain interference with daily activities, social activities, and working ability on an 11-point rating scale (0 = no interference/change, 10 = unable to carry on activities/extreme change). The original questionnaire enquires about current pain and pain over the previous 6 months, and classifies chronic pain into 5 hierarchical grades: Grade Zero (pain free), Grade I (low disability–low intensity), Grade II (low disability–high intensity), Grade III (high disability–moderately limiting) and Grade IV (high disability–severely limiting). Considering the definition of chronic pain by the International Association for the Study of Pain (IASP) (30) as pain that has persisted for at least 3 months, we changed the time-frame of CPG items from 6 months to 3 months. The CPG is valid and reliable when used as a self-completion postal questionnaire in the UK general population ($\alpha > 0.9$) (32) and is responsive to change over time (33). It is also suitably brief. Respondents were classified as having chronic pain if they reported having any pain symptom that had persisted for at least 3 months.

Hospital Anxiety and Depression Scale. Respondents' mental health was evaluated with the Hospital Anxiety and Depression Scale (34) (HADS), which was utilized because the scale, designed for assessing emotional well-being in those with physical illness, measures affective and behavioural symptoms of depression rather than cognitive and physical symptoms that may be attributable to underlying medical illness and not psychological causes. The 14-item HADS comprises 2 subscales measuring anxiety (HADS-A, 7 items) and depression (HADS-D, 7 items). Individuals indicate their feelings over the past week on 3-point Likert scales. Each HADS subscale is scored between 0 and 21, with higher scores indicating greater levels of anxiety and depressive symptoms. Both anxiety (Cronbach's $\alpha = 0.93$) and depression (Cronbach's $\alpha = 0.90$) subscales have good internal consistency (35). Psychometrics for Chinese populations suggest cut-offs of 15/16, 8/9 and 5/6 for the full, depression, and anxiety scales, respectively (36, 37). Both the anxiety and depression subscales for Chinese versions have good test-retest reliability (35), and good internal consistency (36).

Socio-demographic and pain-related characteristics. The socio-demographic section included questions on sex, age, education, marital status and employment status. In addition to the CPG, 4 pain-related variables were assessed, including whether the patients were pursuing litigation because of pain (no/yes), whether the patients were pursing medico-legal compensation because of pain (no/yes), whether pain was the reason for the first clinic visit (no/yes, pain was the main reason/yes, pain was 1 of the symptoms, but not the main reason), pain duration, and the number of days of pain-associated sick leave.

Statistical analysis

Using SPSS (Statistical Package for the Social Sciences) version 15.0 (38), descriptive statistics summarized socio-demographic and pain characteristics of the sample, then *t*-tests and χ^2 tests were used to examine whether pain characteristics and fear of movement/(re)injury differentiated between the types of pain service received.

To examine univariate and multivariate normality assumptions in the present Chinese sample data, univariate skew and kurtosis as well as Mardia's coefficient for skewness and kurtosis were computed (39). CFA using EQS for Windows 6.1 structural equation modelling program (40) was used to examine the factor structure of the TSK. Five different factor solutions have been reported previously in the literature (8, 11, 19, 24, 28). Which of these solutions would be best for these 2 Chinese samples was unknown. Therefore all 5 different factor solutions were independently assessed for fit to each of the 2 samples, and both hierarchical and correlated models were compared (except for the one-factor model, where these are not applicable). This generated 4 models for each of the 4 different previous multi-factor solutions examined on each of the 2 samples, and 2 models for the one-factor solution.

A number of fit indices were employed to assess data-model fit. Since the χ^2 statistic has known limitations in relation to sample size and evaluation of model approximations, the comparative fit index (CFI) (41), normed-fit index (NFI) (42), root mean square error of approximation (RMSEA) (43) and 90% confidence interval (CI) of RMSEA were used as primary indices given their widespread use, good interpretive guidelines, and sensitivity to number of estimated parameters (43). CFI and NFI value of ≥ 0.90, and RMSEA value of ≤ 0.08 were indicative of good fit (41, 43).

After confirming the factor structure in CFA, the internal consistency of the Chinese version of TSK for the subscales and the entire scale was determined based on Cronbach's α. The correlation of the TSK factors with the pain intensity and pain interference measures of the CPG, and the HADS scores were evaluated to determine the concurrent validity. We hypothesized that TSK scores would significantly and positively correlate with all these criterion measures.

RESULTS

Sample characteristics

Overall 216 patients from the orthopaedic outpatient clinics and 109 patients from the pain clinic participated in the study (Table I). Pain clinic participants were older (mean age = 54.69, SD = 16.11 years; $t = 5.69$, $p < 0.001$) and more (62.2%) reported low monthly household income (<HK$15,000; $\chi^2 = 15.28$, $p < 0.01$) compared with the orthopaedics participants. More orthopaedic clinic participants (38.1%) were never married ($\chi^2 = 22.02$, $p < 0.001$), achieved tertiary education (21.4%; $\chi^2 = 49.21$, $p < 0.001$) and were in full-time employment or housewives (59.7% and 14.4%, respectively).

Table I. *Socio-demographic profile of the sample*

Socio-demographic characteristics	Orthopaedics (n=216)	Pain clinic (n=109)	Group difference
Gender, %			
Male	47.7	43.6	2.52
Female	52.3	55.4	
Age, years; mean (SD)	39.72 (13.88)	54.69 (16.11)	5.69**
18–29, %	15.0	1.0	
30–39, %	26.2	16.0	
40–49, %	30.6	21.0	
50–59, %	24.8	26.0	
≥ 60, %	3.4	36.0	
Monthly household income[1], %			
<HK$15,000	40.4	62.2	15.28*
HK$15,000–24,999	29.0	15.9	
HK$25,000–39,999	17.1	8.5	
HK$40,000–59,999	3.6	7.3	
≥ HK$60,000	9.8	6.1	
Marital status, %			
Never married	38.1	17.2	22.02**
Married/cohabiting	53.5	63.6	
Divorced/separated	7.0	10.1	
Widowed	1.4	9.1	
Education level, %			
No schooling/pre-primary	0.9	13.1	49.21**
Primary	8.8	25.3	
Secondary	53.0	48.5	
Matriculation	6.5	1.0	
Post-secondary	9.3	6.1	
Tertiary	21.4	6.1	
Religion, %			
No religion	58.3	50.5	3.00
Catholic	6.0	5.1	
Christian	10.6	10.1	
Buddhism/Daoism/ Ancestor Worship	25.0	34.3	
Employment status, %			
Full-time	59.7	28.0	60.47**
Part-time	4.6	4.0	
Retired	4.2	31.0	
Unemployed	12.0	17.0	
Housewife	14.4	2.0	
Student	2.8	0	
Others	2.3	0	

*$p < 0.01$; **$p < 0.001$. Mean differences analysed with t-test and proportional differences analysed with χ^2 test.
[1] $1 US = $7.8 HK.

Pain characteristics

While more pain clinic participants (23.2%) reported pursuing pain-related litigation than did their orthopaedics counterparts (13%) ($\chi^2 = 5.19$, $p < 0.05$), proportions pursuing pain-related medical-legal compensation (orthopaedics: 10.3%; pain clinic: 17.3%) did not differ significantly (Table II). Compared with just 30.3% of pain clinic participants, most orthopaedics participants (84.3%) indicated that pain was the main reason for their first clinic visit ($\chi^2 = 34.1$, $p < 0.001$). Pain clinic participants reported duration of chronic pain with a mean of 7.3 years/2680 days (SD = 8.0 years/2918 days), 50% longer than the mean duration reported by orthopaedics participants (mean = 5 years/1835 days; SD = 6.6 years/2398 days) ($t = 3.32$, $p < 0.01$). Most orthopaedics participants (52.8%) had had chronic pain for ≤2 years, while 20.8% of the pain clinic participants reported having had chronic pain for more than 10 years.

Pain clinic participants (present pain: mean = 5.32, SD = 2.74; average pain: mean = 5.99, SD = 2.04; worst pain: mean = 8.42, SD = 1.98) reported greater pain intensity than their orthopaedics counterparts (present pain: mean = 4.35, SD = 2.50; average pain: mean = 5.20, SD = 1.87; worst pain: mean = 7.61, SD = 2.10) (all $p < 0.01$). However, the 2 samples did not differ on pain interference measures (all $p > 0.05$); mean days of pain-associated disability days (orthopaedics 27.65 days (SD = 79.65), pain clinic 28.01 days (SD = 39.13)); or average days of pain-associated leave of absence (orthopaedics: mean = 19.01, SD = 62.08; pain clinic: mean = 20.67, SD = 36.68). The CPG classified 55% of orthopaedics participants as Grade II or below, (high pain intensity but low related disability), while 33.3% and 24.2% of pain clinic participants

Table II. *Pain characteristics of the sample*

Pain characteristics	Orthopaedics ($n=216$)	Pain clinic ($n=109$)	Group difference
Pursuing litigation because of pain, %	13.0	23.2	5.19*
Pursuing medico-legal compensation because of pain, %	10.3	17.3	3.01
Whether pain is the reason for the first clinic visit, %			
No	9.7	6.1	34.10***
Yes, pain is the main reason	84.3	63.6	
Yes, pain is one of the symptoms, but not the main reason	6.0	30.3	
Number of pain sites, mean (SD)	2.21 (1.77)	1.84 (1.01)	1.94
1, %	38.2	39.6	
2, %	26.4	40.6	
3–5, %	29.9	18.8	
≥ 6, %	5.6	0.9	
Pain site, %			
Head	3.8	8.3	2.46
Face	0.6	4.6	4.63**
Neck	24.5	17.4	1.92
Shoulder	27.7	12.8	8.39**
Arm	32.1	17.4	7.19**
Chest	3.8	3.7	0.01
Upper back	16.4	15.6	0.03
Low back	26.4	33.0	1.37
Pelvis	18.2	11.9	1.95
Knee	8.2	9.2	0.08
Leg	37.1	32.1	0.71
Muscle	15.7	3.7	9.74**
Pain duration (days); mean (SD)	1835 (2398)	2680 (2918)	3.32**
≥ 3 months – 2 years, %	52.8	25.7	
> 2–5 years, %	16.2	35.6	
> 5–10 years, %	18.1	17.8	
> 10 years, %	13.0	20.8	
Pain intensity[a]; mean (SD)			
Present pain	4.35 (2.50)	5.32 (2.74)	–3.12**
Average pain	5.20 (1.87)	5.99 (2.04)	–2.77**
Worst pain	7.61 (2.10)	8.42 (1.98)	–2.73**
Pain interference[b]; mean (SD)			
Daily activities	5.50 (2.37)	5.67 (3.39)	–0.53
Social activities	4.89 (2.83)	5.44 (3.44)	–1.49
Working ability	5.37 (3.05)	5.84 (3.65)	–0.95
Pain associated disability (days); mean (SD)	27.65 (79.65)	28.01 (39.13)	0.55
Pain associated sick leave (days); mean (SD)	19.01 (62.08)	20.67 (36.68)	0.93
Chronic Pain Grade classification[c], %			
Grade I	29.2	10.1	11.55**
Grade II	25.8	32.3	
Grade III	29.2	33.3	
Grade IV	15.7	24.2	
Psychological distress; mean (SD)			
HADS-Depression	4.40 (3.86)	7.57 (5.41)	–5.92***
HADS-Anxiety	6.35 (4.68)	7.95 (5.45)	–2.66**
HADS-Total	10.74 (7.91)	15.36 (9.97)	–4.39***
Fear of movement/(re)injury; mean (SD)			
TSK11-SF	13.73 (1.88)	13.49 (1.70)	1.11
TSK11-AA	16.42 (2.01)	15.96 (2.06)	1.95
TSK11-Total	30.13 (3.25)	29.36 (3.03)	1.12
TSK4	11.36 (1.50)	11.06 (1.41)	1.67

*$p<0.05$; **$p<0.01$; ***$p<0.001$.

Mean differences analysed with t-test for 2-group comparison; proportional differences analysed with χ^2 test. The pain intensity and pain interference scores were drawn from individual items of the Chronic Pain Grade questionnaire. HADS: Hospital Anxiety and Depression Scale; HADS-D: HADS depression subscale; HADS-A: HADS anxiety subscale. TSK: Chinese version of the Tampa Scale for Kinesiophobia; SF: Somatic Focus subscale; AA: Activity Avoidance subscale.

[a]Scores range from 0 to 10; higher scores indicate higher intensity of pain.

[b]Scores range from 0 to 10; higher scores indicate higher level of interference.

[c]Grade I: low disability – low intensity; Grade II: low disability – high intensity; Grade III: high disability – moderately limiting; Grade IV: high disability – severely limiting.

were classified as Grade III and IV, respectively. Significantly more pain clinic than orthopaedics participants achieved a higher CPG classification ($\chi^2 = 11.55$, $p < 0.01$).

Pain clinic participants scored significantly higher HADS-D (mean = 7.57, SD = 5.41), HADS-A (mean = 7.95, SD = 5.45), and HADS total scores (mean = 15.36, SD = 9.97) than did orthopaedics participants (HADS-D: mean = 4.30, SD = 3.86; HADS-A: mean = 6.35, SD = 4.68; HADS total score: mean = 10.74, SD = 7.91) (all $p < 0.01$) (Table II).

Underlying factor comparisons

We compared the underlying factor structure against the models reported in the literature to determine the best fit for our Chinese sample. First, Vlaeyen et al.'s (8) four-factor solution for the TSK17 specified that 12 of 17 TSK items could be explained by 4 first-order factors, labelled Harm, Fear of (Re)injury, Importance of Exercise, and Avoidance of Activity (Models 1, 2, 10 and 11). Secondly, Clark et al.'s (19) two-factor solution for the TSK17 was examined. The 4 reverse-scored items (items 4, 8, 12 and 16) were excluded and the remaining 13 items were hypothesized to load on 1 of 2 first-order factors (Activity Avoidance (8 items) or Pathological Somatic Focus (5 items)) (Models 3, 4, 12 and 13). Thirdly, we tested Swinkels-Meewisse et al.'s (11) two-factor solution. This assumed that the 17 TSK items were loaded on 2 first-order factors, Activity Avoidance (9 items) and Harm (8 items) (Models 5, 6, 14 and 15). Fourthly, Roelofs et al.'s (24) two-factor solution for the TSK11 specified that after excluding the 4 reverse-scored items and 2 additional items (items 9 and 14), the remaining 11 items were assumed to be explained by 2 latent first-order factors, namely Somatic Focus (SF) (5 items) and Activity Avoidance (AA) (6 items) (Models 7, 8, 16 and 17). Finally, we tested Burwinkle et al.'s (28) one-factor 4-item solution suggesting that the 17 TSK items are reducible to 4 (items 3, 6, 7 and 11), which were hypothesized to load on one single factor (Models 9 and 18). Except Burwinkle et al.'s (28) one-factor solution, the other 4 factor solutions were tested on both hierarchical and correlated structures, hence, a total of 4+4+1 = 9 models were fitted for each sample (9+9 = 18). In a hierarchical structure, a higher, second-order factor, kinesiophobia, is assumed to account for the first-order factors. For a correlated structure, first-order factors were allowed to correlate, but no higher order was hypothesized.

Factorial validity of the Chinese version of TSK

Univariate skew estimates for the 17 TSK items ranged from –0.817 to 0.525 for the orthopaedics clinic sample and from –1.247 to 0.363 for the pain clinic sample. Univariate kurtosis estimates ranged between –0.818 and 1.995 for the orthopaedics clinic sample and between 0.582 and 3.226 for the pain clinic sample and Mardia's estimate was 39.017 and 52.863, respectively. These results indicated that the data were not normally distributed. Hence, we report the Satorra-Bentler (S-B) χ^2 statistic because it incorporates a scaling correction for non-normal sampling distributions (44).

Table III presents the results of CFAs applied on the 2 samples independently for the 9 competing models.

Orthopaedics sample. Except for Model 8, fit indices for all other models (Models 1–7 and 9) failed to meet the minimum acceptable fit criterion (CFI ≤ 0.825; NFI ≤ 0.787). The fit in deces for Roelofs et al.'s (24) two-factor correlated model for TSK11 (Model 8) supported factorial validity, (S-B$\chi^2 = 49.593$ (df = 43); CFI = 0.930; NFI = 0.911; RMSEA = 0.025, (90% CI: 0.000–0.051)). Consequently, the two-factor correlated model represented the best fit underlying structure for the TSK11 in

Table III. *Results of confirmatory factor analysis (CFAs) testing factorial validity of 9 competing models applied to the Chinese version of Tampa Scale for Kinesiophobia (TSK) for the orthopaedics and pain clinic sample independently*

Model	S-Bχ^2	df	*p*-value	CFI	NFI	RMSEA	90% CI
Orthopaedics sample							
1. Five-factor Hierarchical Model (Vlaeyen et al. (8))	90.415	49	< 0.001	0.786	0.712	0.058	0.039–0.077
2. Four-factor Correlated Model (Vlaeyen et al. (8))	83.038	48	0.001	0.819	0.750	0.054	0.034–0.073
3. Three-factor Hierarchical Model (Clark et al. (19))	146.324	62	< 0.001	0.721	0.649	0.074	0.058–0.089
4. Two-factor Correlated Model (Clark et al. (19))	92.625	64	0.011	0.825	0.787	0.042	0.021–0.060
5. Three-factor Hierarchical Model (Swinkels-Meewisse et al. (11))	371.92	101	< 0.001	0.401	0.288	0.105	0.093–0.116
6. Two-factor Correlated Model (Swinkels-Meewisse et al.(11))	176.337	103	< 0.001	0.559	0.473	0.064	0.050–0.077
7. Three-factor Hierarchical Model (Roelofs et al. (24))	76.997	41	0.001	0.798	0.728	0.059	0.038–0.079
8. Two-factor Correlated Model (Roelofs et al. (24))	49.593	43	< 0.001	0.930	0.911	0.025	0.000–0.051
9. One-factor Four-Item Model (Burwinkle et al. (28))	38.992	9	< 0.001	0.213	0.364	0.146	0.103–0.192
Pain clinic sample							
10. Five-Factor Hierarchical Model (Vlaeyen et al. (8))	71.89	49	0.018	0.805	0.738	0.069	0.029–0.101
11. Four-Factor Correlated Model (Vlaeyen et al. (8))	70.78	48	0.017	0.806	0.733	0.070	0.030–0.102
12. Three-Factor Hierarchical Model (Clark et al. (19))	105.94	62	< 0.001	0.702	0.625	0.085	0.056–0.111
13. Two-Factor Correlated Model (Clark et al. (19))	75.226	64	0.159	0.815	0.774	0.042	0.000–0.076
14. Three-Factor Hierarchical Model (Swinkels-Meewissee et al. (11))	181.611	101	< 0.001	0.487	0.391	0.090	0.068–0.110
15. Two-Factor Correlated Model (Swinkels-Meewissee et al. (11))	124.142	103	0.076	0.611	0.547	0.046	0.000–0.072
16. Three-factor Hierarchical Model (Roelofs et al. (24))	62.715	41	0.016	0.801	0.734	0.074	0.032–0.108
17. Two-factor Correlated Model (Roelofs et al. (24))	62.715	43	0.026	0.820	0.769	0.068	0.024–0.103
18. One-factor Four-Item Model (Burwinkle et al. (28))	22.048	9	0.291	0.971	0.912	0.048	0.000–0.209

TSK: Tampa Scale for Kinesiophobia; S-Bχ^2: Satorra and Bentler scaled χ^2 statistics; df: degrees of freedom; CFI: comparative fit index; NIF: normed fit index; RMSEA: root mean square error of approximation; CI: confidence interval.

Table IV. *Standardized factor loadings of the two-factor correlated model for the Chinese 11-item version of The Tampa Scale for Kinesiophobia (TSK11) for the orthopaedics sample (*n *= 216)*

Item	Somatic Focus	Activity Avoidance
1. I'm afraid that I might injure myself if I exercise.	–	0.33
2. If I were to try to overcome it, my pain would increase.	–	0.38
3. My body is telling me I have something dangerously wrong.	0.44	–
5. People aren't taking my medical condition seriously enough.	0.33	–
6. My accident has put my body at risk for the rest of my life.	0.61	–
7. Pain always means I have injured my body.	0.56	–
10. Simply being careful that I do not make unnecessary movements is the safest thing I can do to prevent my pain from worsening.	–	0.30
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body.	0.16	–
13. Pain lets me know when to stop exercising so that I don't injure myself.	–	0.30
15. I can't do all the things normal people do because it's too easy for me to get injured.	–	0.47
17. No-one should have to exercise when he/she is in pain.	–	0.17

Item numbers refer to items as reported by Vlaeyen et al. (8). Items 4, 8, 9, 12, 14 and 16 are not shown as they were not included in the 11-item shortened version reported by Roelofs et al. (24).

the orthopaedics sample. Table IV reports the standardized factor loadings of the two-factor correlated model for TSK11 on the respective latent factors, Somatic Focus (TSK11-SF) and Activity Avoidance (TSK11-AA).

Pain clinic sample. Models 10–17 demonstrated poor fit. All fit indices failed the minimum acceptable fit criterion ($CFI \leq 0.820$; $NFI \leq 0.774$), suggesting poor data-model fit for the TSK measure of fear of movement/(re)injury. However, Model 18, Burwinkle et al.'s (28) one-factor, 4-item model fitted the pain clinic sample well, ($CFI = 0.971$; $NFI = 0.912$; $RMSEA = 0.048$ (90% CI: 0.000, 0.209)), though S-B$\chi^2 = 22.048$, $df = 9$ was not significant ($p > 0.05$). Consequently, the underlying factorial structure of the TSK was best represented by the one-factor solution for the 4-item version of TSK. The standardized factor loadings of the TSK4 one-factor model for the pain clinic sample are presented in Table V.

Reliability and concurrent validity

Cronbach's α for the TSK11 and its subscales, TSK11-SF and TSK11-AA, were 0.67, 0.56 and 0.60, respectively, for the orthopaedics sample, while the internal consistency of the TSK4 for the pain clinic sample was 0.61. Among orthopaedics participants, the correlation between the TSK11-AA and TSK11-SF, was modest ($rs = 0.37$, $p < 0.01$) (Table VI). However, moderately high correlations existed between the TSK11 total score and TSK11-AA ($rs = 0.85$, $p < 0.01$)/TSK11-SF ($r = 0.81$, $p < 0.01$) scores. Though TSK11 scores were significantly correlated with average pain (r ranging from 0.23 to 0.30; $p < 0.05$), they were not significantly correlated with worst pain (all $p > 0.05$). Modest ($r \leq 0.31$) correlations with TSK11 scores were observed for measures of pain interference in daily activities and social activities ($p < 0.05$). Except for the HADS-D–TSK11-AA correlation, all remaining TSK11–HADS-A/HADS-Total scores were significantly correlated (all $p < 0.05$). In the pain clinic sample, the TSK4 significantly correlated with pain intensity measures (rs ranging between 0.20 and 0.27, all $p < 0.01$), pain interference measures (all $r = 0.25$, all $p < 0.01$) and HADS scores (rs ranging between 0.28 and 0.35, all $p < 0.01$) (Table VII).

Table V. *Standardized factor loadings of the one-factor correlated model for the Chinese 4-item version of Tampa Scale for Kinesiophobia (TSK4) for the pain clinic sample (*n *= 109)*

Item	Kinesiophobia
3. My body is telling me I have something dangerously wrong.	0.54
6. My accident has put my body at risk for the rest of my life.	0.41
7. Pain always means I have injured my body.	0.78
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body.	0.13

Item numbers refer to items as reported by Vlaeyen et al. (8).

Comparison of TSK scores between pain and orthopaedics samples

Despite having different factor structures, scores of TSK11 and TSK4 were computed for both samples to compare fear of movement/(re)injury (Table II). No significant difference was found between the 2 samples on the mean scores for TSK11-Total, TSK11-SF and TSK11-AA ($p > 0.05$). The mean TSK4 score was 11.36 ($SD = 1.50$) and 11.06 ($SD = 1.41$) for the orthopaedics and pain clinic sample, respectively ($p > 0.05$).

DISCUSSION

This study compared possible TSK factor structures in 2 samples of Chinese patients with chronic pain drawn from orthopaedic and pain clinic settings. CFAs replicated the factor structures reported by Roelefs et al. (24) in the orthopaedics sample and Burwinkle et al. (28) in the pain clinic sample. Specifically, the TSK, when used with Chinese patients with chronic pain receiving specialist orthopaedics service, was most adequately represented by the two-factor correlated model for the TSK11, which comprises 2 first-order factors (24). When used with Chinese chronic pain patients who are attending specialist pain services, the TSK was best represented by the 4-item single factor model (28).

Table VI. *Correlation coefficients of Tampa Scale for Kinesiophobia (TSK11), pain intensity, pain interference, and Hospital Anxiety and Depression Scale (HADS) scores for the orthopaedics sample (*n = *216)*

	1	2	3	4	5	6	7	8	9	10	11
1. TSK11-AA	–										
2. TSK11-SF	0.37**										
3. TSK11-Total	0.85**	0.81**									
4. Pain intensity-Present Pain	0.08	0.16*	0.14*								
5. Pain intensity-Average Pain	0.23*	0.28**	0.30**	0.61**							
6. Pain intensity-Worst Pain	0.10	0.15	0.15	0.33**	0.61**						
7. Pain interference-Daily activities	0.17*	0.26**	0.24**	0.52**	0.45**	0.43**					
8. Pain interference-Social activities	0.22**	0.31**	0.31**	0.43**	0.42**	0.43**	0.75**				
9. Pain interference-Working abilities	0.16	0.19	0.20	0.37**	0.59**	0.62**	0.53**	0.59**			
10. HADS-Depression	0.13	0.22**	0.21**	0.37**	0.38**	0.29**	0.24**	0.24**	0.41**		
11. HADS-Anxiety	0.19**	0.31**	0.30**	0.37**	0.48**	0.32**	0.23**	0.26**	0.35**	0.71**	
12. HADS-Total	0.18*	0.29**	0.28**	0.40**	0.46**	0.32**	0.25**	0.27**	0.40**	0.91**	0.94**

*$p < 0.05$; **$p < 0.01$.
The upper horizontal row of numbers indicates the different instruments listed in the first column.
AA: Activity Avoidance; SF: Somatic Focus; HADS: Hospital Anxiety and Depression Scale. The pain intensity and pain interference scores were drawn from individual items of the Chronic Pain Grade questionnaire.

The better fit of the TSK11 correlated model in the orthopaedics sample and the TSK4 in the pain clinic sample offers tentative evidence for the cross-cultural validity of the TSK. On the one hand, the underlying latent constructs of the TSK11 are similar for the present Chinese and the Dutch, Swedish and Canadian chronic musculoskeletal samples, as reported by Roelofs et al. (24). On the other hand, the superiority of the one-factor model for the TSK4 over other models in the present pain clinic sample indicates that the underlying latent construct of the TSK4 is similar to that underlying an American FM sample (28). From a cross-cultural perspective, although we cannot directly evaluate cross-cultural factorial invariance, these findings tentatively suggest that there would be no differences between Chinese and Western patients with chronic pain in terms of the elements comprising kinesiophobia, as indexed by the TSK11 and TSK4. Differences in the TSK11 and TSK4 mean scores would therefore probably indicate true group differences or effects of an intervention on the underlying construct, rather than a change in the factor structure and loadings of the scale. The replication of the TSK11 structure reported by Roelofs et al. (24) in the present Chinese orthopaedics sample might be partly explained by patient similarity, in that both studies employed patients with various chronic musculoskeletal pain conditions. However, the results for the pain clinic sample were less clear. Our pain clinic sample did not include patients with FM, and reported a shorter pain duration (mean = 7.3 years) but higher pain intensity (mean worst pain = 8.42) than that of Burwinkle et al.'s (28) American FM sample (mean pain duration = 10.3 years; mean worst pain = 4.23). Future studies that attempt to directly evaluate cross-cultural factorial invariance of TSK would be valuable.

The TSK11 and TSK4 factor structures in these Chinese samples support the shortened version of the TSK over the full, 17-item version (Models 1, 2, 10 and 11) being a more appropriate instrument for assessing fear of movement/(re)injury among patients with chronic pain. Previous studies generally support the exclusion of the 4 inversely scored items because removing these items increased the internal consistency of the scale (11, 26). In studies assessing the TSK factor structure, CFAs showed that these 4 items consistently loaded poorly on first-order factors under different factor solutions (8, 19–21, 23, 24). Our findings reaffirm this, showing that excluding the 4 reverse-scored items significantly enhanced the TSK's psychometric

Table VII. *Correlation coefficients of the 4-item version of Tampa Scale for Kinesiophobia (TSK4), pain intensity, pain interference, and Hospital Anxiety and Depression Scale (HADS) scores for the pain clinic sample (n = 109)*

	1	2	3	4	5	6	7	8	9
1. TSK4	–								
2. Pain intensity-Present Pain	0.20*								
3. Pain intensity-Average Pain	0.27*	0.69*							
4. Pain intensity-Worst Pain	0.20*	0.44*	0.70*						
5. Pain interference-Daily activities	0.25*	0.44*	0.45*	0.46*					
6. Pain interference-Social activities	0.25*	0.37*	0.44*	0.46*	0.66*				
7. Pain interference-Working abilities	0.25*	0.35*	0.44*	0.47*	0.53*	0.49*			
8. HADS-Depression	0.28*	0.30*	0.36*	0.33*	0.29*	0.31*	0.38*		
9. HADS-Anxiety	0.35*	0.39*	0.47*	0.40*	0.30*	0.30*	0.33*	0.71*	
10. HADS-Total	0.35*	0.38*	0.46*	0.40*	0.32*	0.33*	0.32*	0.92*	0.93*

*$p < 0.01$.
The upper horizontal row of numbers indicates the different instruments in the first column. The pain intensity and pain interference scores were drawn from individual items of the Chronic Pain Grade questionnaire.

properties. Furthermore, the orthopaedics sample data showed that the psychometric properties of the TSK are improved by removing 2 additional items, item 9 ("I am afraid that I might injure myself accidently") and item 14 ("It's really not safe for a person with a condition like mine to be physically active") as previously suggested (23). Unlike other AA items, the 2 deleted items do not clearly address avoidance of movement and/or fear in relation to pain. This could explain their weak relationship with other items comprising the AA subscale and the poor CFA fit statistics when the items were included. The 4 TSK4 items were originally loaded on the SF factor of Clark et al.'s (19) model and on the Harm factor of Goubert et al.'s (21) model. However, as pointed out by Burwinkle et al. (28), the content of these 4 items (items 3, 6, 7 and 11) addressed a general sense of vulnerability or a tendency to catastrophize a painful problem, rather than a specific fear of movement. The uncertain TSK content validity may therefore contribute to the inconsistencies in reported scale factor structures. A closer examination of content validity is warranted.

The TSK factor structure differences between the 2 samples probably reflect sample heterogeneity in terms of socio-demographic and pain characteristics. Not only were they older and of lower socio-economic status than the orthopaedics sample (62.2% fell into the lowest income group and only 28% had full-time employment), but the pain clinic sample also had more pain for longer duration and more pain-related disability. Pain location also differed; more pain clinic participants reported facial pain, whereas more orthopaedics participants reported shoulder, arm and muscle pain. Although pain clinic participants did not differ statistically in their TSK11 and TSK4 scores from their orthopaedics counterparts, they did report higher HADS anxiety and total scores that met the psychiatric case criterion for Chinese people (35). These differences suggest that different factors may be at play in determining fear of movement/(re)injury for the 2 groups of patients with chronic pain. Moreover, type and availability of pain services and treatment contexts may also impact patients' pain-related fear. Within a multidisciplinary setting, patients with chronic pain attending pain clinic services are managed by specialist pain physicians, clinical psychologists, occupational therapists and physiotherapists with special training in pain management. Patients with chronic pain attending orthopaedics SOPCs may, if necessary, also be referred by orthopaedics specialists to other clinical psychology, physiotherapy and occupational therapy services, but these tend not to specialize in chronic pain and, due to limited resources, pain patients must compete with patients from other departments for these services. Both clinics apparently serve different populations, and our samples reflect this.

The weak correlation between TSK11-AA and TSK11-SF ($r=0.37$) in the orthopaedics sample is consistent with previous studies (20, 24, 26). This has been the basis of previous recommendation for using subscale rather than total TSK scores. Yet, no studies have tested whether a second, higher-order latent factor might possibly underlie the presumed first-order factors. The better fit of correlated over hierarchical models on all factor solutions (except Models 9 and 18) tested is inconsistent with a higher, general factor of kinesiophobia. In particular, while the TSK11's 2 first-order factors were correlated, they were not explained by a higher-order factor of general kinesiophobia, and are not readily subsumed under the kinesiophobia/fear of movement/(re)injury construct. Compared with the somatic focus factors, previous studies generally demonstrated a stronger association between the activity avoidance factor and disability (4, 9, 14, 16, 45, 46). These data offer further support for the better utility of the two-factor scale than the one-factor scale. The use of subscale scores, instead of total score, would provide a more accurate account of how the 2 dimensions associate with other parameters and pain adjustment outcomes. A single generalized concept of kinesiophobia may be unwarranted, inaccurate and conceptually misleading as a result.

Importantly, results of post-hoc *t*-test analyses showed that mean scores of the TSK11-SF (orthopaedics: mean = 13.73; pain clinic: mean = 13.49) and TSK11-AA (orthopaedics: mean = 16.42; pain clinic: mean = 15.96) among the present Chinese sample were significantly higher than those reported in Roelofs et al. (24) whose 3 Western samples obtained means of 11.3 and 14.3 for the TSK11-SF and TSK11-AA, respectively (all $p<0.001$). These differences in TSK scores may reflect cross-cultural differences in emotional response to pain between Western and Chinese populations. Chinese culture encourages the adoption of a sick role, in which case family care-taking becomes mandatory. This might contribute both to greater immobility, with more sensory activity on limited movement, and/or inflated pain ratings from sick role nocebo influences. These factors await further elucidation in future cross-cultural research.

The TSK11, TSK11-AA and TSK4 demonstrated marginally-acceptable Cronbach αs ~0.60, reflecting poor scalability of items and weak internal consistency. The standardized factor loadings of item 11 on both the TSK11 (0.16) and TSK4 (0.13) were low, partly explaining the TSK11-SF's marginal internal consistency ($\alpha=0.60$). Removal of this item should improve item scalability. Correlations of the TSK11 subscales and the TSK4 with other measures were all in the expected direction, but generally weak, suggesting higher pain-related fear is only weakly associated with higher pain intensity and interference, and greater psychological distress. The low correlations between TSK4 and other measures (*rs* ranging from 0.20 to 0.35) were generally higher than those with the TSK11, some of which were very low (*rs* ranging from 0.08 to 0.31). Nonetheless, the present study generated *rs* for the TSK11 and TSK4 comparable with other studies (24, 26). The low correlations of TSK scores with pain intensity, interference and psychological distress might be due to the possibility that fear of pain may sometimes be adaptive and sometimes maladaptive. Moreover, pain-related fear is likely to be labile and associated with pain desynchrony, whereby the different components of pain (sensory, emotional, cognitive, motivational and communicative) become disintegrated, resulting in, for example, a declining sensory component but increasing emotional components, or greater catastrophizing resulting in pain sensitivity thresholds being repeatedly re-set downwards. Some persons will live adaptively with their pain and not have high emotional components, whereas others may continue to react negatively to low levels of sensory activity. This individual variability will result in the low correlations seen. Longitudinal and experimental research to determine how different clinical and psychological variables influence the differential effects of pain-related fear on adjustment outcomes is therefore warranted.

This study is limited, in having been conducted with Cantonese-speaking Chinese people only, and the multidisciplinary specialist pain services sample is rather small, which might have compromised the findings on the CFAs for that particular group. The recommended minimum sample size for structural equation modelling ranges widely from 100 (47) or 5 times the number of variables examined (48) to 200 (49) or 20 times of the number of variables (50). Generally speaking, a minimum of 10 subjects per variable, plus 50 extra is considered acceptable and 20 desirable (51). The pain clinic sample CFA should be considered with caution. Replication in other Chinese and Asian populations using a bigger pain services sample is desirable.

In conclusion, the present study demonstrated inequality in the TSK factor structure between patients with chronic pain recruited from orthopaedics SOPC and a specialist pain clinic. A two-factor correlated structure, as reported by Roelofs et al. (24), best represented the underlying dimensions of the TSK11 in a sample of Chinese patients with chronic pain using orthopaedics pain services, whereas a one-factor structure, as reported by Burwinkle et al. (28), best represents the underlying dimension of the TSK4 in a sample of patients with chronic pain attending pain clinic services. No evidence was found for a single overarching construct of kinesiophobia.

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REFERENCES

1. Asmundson GJG, Norton PJ, Norton GR. Beyond pain: the role of fear and avoidance in chronicity. Clin Psychol Rev 1999; 19: 97–119.
2. Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain 2000; 85: 317–332.
3. Roelofs J, Peters ML, Patijn J, Schouten EGW, Vlaeyen JWS. Electronic diary assessment of pain-related fear, attention to pain, and pain intensity in chronic low back pain patients. Pain 2004; 112: 335–342.
4. Vlaeyen JWS, Kole-Snijders AMJ, Rotteveel AM, Ruesink R, et al. The role of fear of movement/(re)injury in pain disability. J Occup Rehabil 1995; 5: 235–252.
5. Grotle M, Vollestad NK, Veierod MB, Brox JI. Fear-avoidance beliefs and distress in relation to disability in acute and chronic low back pain. Pain 2004; 112: 343–352.
6. Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A fear-avoidance beliefs questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. Pain 1993; 52: 157–168.
7. Woby SR, Watson PJ, Roach NK, Urmston M. Adjustment to chronic low back pain – the relative influence of fear-avoidance beliefs, catastrophizing, and appraisals of control. Behav Res Ther 2004; 42: 761–774.
8. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. Pain 1995; 62: 363–372.
9. Crombez G, Vlaeyen JW, Heuts PH, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. Pain 1999; 80: 329–339.
10. Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. Pain 2001; 94: 7–15.
11. Swinkels-Meewisse EJCM, Swinkels RAHM, Verbeek ALM, Vlaeyen JWS, Oostendorp RAB. Psychometric properties of the Tampa Scale for kinesiophobia and the fear-avoidance beliefs questionnaire in acute low back pain. Manual Ther 2003; 8: 29–36.
12. Symonds TL, Burton AK, Tillotson KM, Main CJ. Absence resulting from low back trouble can be reduced by psychosocial intervention at the work place. Spine 1995; 20: 2738–2745.
13. Buchbinder R, Jolley D, Wyatt M. Population based intervention to change back pain beliefs and disability: three part evaluation. BMJ 2001; 322: 1516–1520.
14. Vlaeyen JW, de Jong J, Geilen M, Heuts PH, van Breukelen G. Graded exposure in vivo in the treatment of pain-related fear: a replicated single-case experimental design in four patients with chronic low back pain. Behav Res Ther 2001; 39: 151–166.
15. Vlaeyen JWS, De Jong JR, Onghena P, Kerckhoffs-Hanssen M, Kole-Snijders AMJ. Can pain-related fear be reduced? The application of cognitive-behavioural exposure in vivo. Pain Res Manage 2002; 7: 144–153.
16. Vlaeyen JWS, de Jong J, Geilen M, Heuts PHTG, van Breukelen G. The treatment of fear of movement/(re)injury in chronic low back pain: further evidence on the effectiveness of exposure in vivo. Clin J Pain 2002; 18: 251–261.
17. Kori SH, Miller RP, Todd DD. Kinesiophobia: a new view of chronic pain behavior. Pain Manage 1990; Jan/Feb: 35–43.
18. Miller RP, Kori SH, Todd DD. Tampa Scale. Tampa, FL, 1991.
19. Clark ME, Kori SH, Brockel J. Kinesiophobia and chronic pain: psychometric characteristics and factor analysis of the Tampa Scale. Amer Pain Soc Abstr 1996.
20. Geisser ME, Haig AJ, Theisen ME. Activity avoidance and function in persons with chronic back pain. J Occup Rehabil 2000; 10: 215–227.
21. Goubert L, Crombez G, Van Damme S, Vlaeyen JWS, Bijttebier P, Roelofs J. Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: invariant two-factor model across low back pain patients and fibromyalgia patients. Clin J Pain 2004; 20: 103–110.
22. Lundberg MKE, Styf J, Carlsson SG. A psychometric evaluation of the Tampa Scale for Kinesiophobia – from a physiotherapeutic perspective. Physiother Theory Pract 2004; 20: 121–133.
23. Woby SR, Roach NK, Urmston M, Watson PJ. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. Pain 2005; 117: 137–144.
24. Roelofs J, Sluiter JK, Frings-Dresen MHW, Goossens M, Thibault P, Boersma K, et al. Fear of movement and (re)injury in chronic musculoskeletal pain: evidence for an invariant two-factor model of the Tampa Scale for Kinesiophobia across pain diagnoses and Dutch, Swedish, and Canadian samples. Pain 2007; 131: 181–190.
25. Haugen AJ, Grevle L, Keller A, Grotle M. Cross-cultural adaptation and validation of the Norwegian version of the Tampa scale for kinesiophobia. Spine 2008; 33: E595–601.
26. Swinkels-Meewisse IEJ, Roelofs J, Verbeek ALM, Oostendorp RAB, Vlaeyen JWS. Fear of movement/(re)injury, disability and participation in acute low back pain. Pain 2003; 105: 371–379.
27. French DJ, France CR, Vigneau F, French JA, Evans RT. Fear of

movement/(re)injury in chronic pain: a psychometric assessment of the original English version of the Tampa scale for kinesiophobia (TSK). Pain 2007; 127: 42–51.
28. Burwinkle T, Robinson JP, Turk DC. Fear of movement: factor structure of the Tampa Scale of Kinesiophobia in patients with fibromyalgia syndrome. J Pain 2005; 6: 384–391.
29. Fielding R, Wong WS. The prevalence of chronic pain, fatigue, and insomnia in the general population of Hong Kong. Final report to the Health, Welfare and Food Bureau, Government of the Hong Kong Special Administrative Region, China Hong Kong: School of Public Health, The University of Hong Kong, 2008.
30. IASP. Classification of chronic pain. Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the International Association for the Study of Pain, Subcommittee on Taxonomy. Pain Suppl 1986; 3: S1–226.
31. Von Korff M, Dworkin SF, Le Resche L. Graded chronic pain status: an epidemiologic evaluation. Pain 1990; 40: 279–291.
32. Smith BH, Penny KI, Purves AM, Munro C, Wilson B, Grimshaw J, et al. The Chronic Pain Grade questionnaire: validation and reliability in postal research. Pain 1997; 71: 141–147.
33. Elliott AM, Smith BH, Smith WC, Chambers WA. Changes in chronic pain severity over time: the Chronic Pain Grade as a valid measure. Pain 2000; 88: 303–308.
34. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. Acta Psychiatr Scand 1983; 67: 361–370.
35. Snaith R, Zigmond A. The Hospital Anxiety and Depression Scale: manual. Windsor: NFER-Nelson; 1994.
36. Leung CM, Ho S, Kan CS, Hung CH, Chen CN. Evaluation of the Chinese version of the Hospital Anxiety and Depression Scale. A cross-cultural perspective. Int J Psychosomat 1993; 40: 29–34.
37. Leung CM, Wing YK, Kwong PK, Lo A, Shum K. Validation of the Chinese-Cantonese version of the hospital anxiety and depression scale and comparison with the Hamilton Rating Scale of Depression. Acta Psychiatr Scand 1999; 100: 456–461.
38. SPSS Inc. Statistical Package for the Social Sciences. Chicago: SPSS Inc; 2002.
39. Mardia K. Measures of multivariate skewness and kurtosis with application. Biometrika 1970; 57: 519–530.
40. Bentler PM, Wu EJC. EQS/Windows: user's guide. Los Angeles: BMDP Statistical Software; 1993.
41. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equat Modeling 1999; 6: 1–55.
42. Bentler P, Bonett D. Significance tests and goodness of fit in the analysis of covariance structures. Psychol Bull 1980; 88: 588–606.
43. Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, editors. Testing structural equation models. Newbury Park, CA: Sage; 1993.
44. Satorra A, Bentler P. Corrections to test statistics and standard errors in covariance structure analysis. In: Von Eye A, Clogg C, editors. Latent variable analysis: Applications for developmental research. Thousand Oaks, CA: Sage; 1994.
45. Crombez G, Eccleston C, Van den Broeck A, Van Houdenhove B, Goubert L. The effects of catastrophic thinking about pain on attentional interference by pain: no mediation of negative affectivity in healthy volunteers and in patients with low back pain. Pain Res Manage 2002; 7: 31–39.
46. Roelofs J, Goubert L, Peters ML, Vlaeyen JWS, Crombez G. The Tampa Scale for Kinesiophobia: further examination of psychometric properties in patients with chronic low back pain and fibromyalgia. Eur J Pain 2004; 8: 495–502.
47. Loehlin JC. Latent variable models: an introduction to factor, path, and structural analysis. 4th edn. NJ: Hillsdale: Lawrence Erlbaum, 2004.
48. Bentler PM, Chou CP. Practical issues in structural modeling. Sociol Methods Res 1987; 16: 78–117.
49. Kline RB. Software programs for structural equation modeling: AMOS, EQS, and LISREL. J Psychoeducat Assess 1998; 16: 343–364.
50. Mitchell RJ. Path analysis: Pollination. In: Schneider SM, Gurevitch J, editors. Design and analysis of ecological experiments. New York, USA: Chapman & Hall; 1993, p. 217–234.
51. van Belle G. Statistical rules of thumb. New York, USA: Wiley; 2002, p. 88.