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Fear of Movement/Injury in the General Population: Factor Structure and Psychometric Properties of an Adapted Version of the Tampa Scale for Kinesiophobia

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In recent years, several studies have pointed out the importance of pain-related fear in the development and maintenance of chronic pain. An important instrument for measuring pain-related fear in the context of low back pain is the Tampa Scale for Kinesiophobia (TSK). Recently, a version of this questionnaire has been developed for administration among the general population (TSK-G). To determine the factor structure of the TSK-G, data from a random sample of the Dutch general population were studied separately for people who had had back complaints in the previous year, and people who had been without back complaints. For both groups the TSK-G appeared to consist of one, internally consistent, factor of 12 items. The one-factor TSK-G also appeared valid after comparison with scores on measures of catastrophizing and general health status.

KEY WORDS: pain-related fear; fear-avoidance beliefs; general population; TSK; psychometric properties.

INTRODUCTION

Ever since the introduction of the term "kinesiophobia" by Kori *et al.* (1990), scientific attention for the concept of pain-related fear in relation to chronic pain has increased. Although not everyone would go so far as to view pain-related fear as a simple phobia, a review article by Vlaeyen and Linton (2000) shows that pain researchers and clinicians alike are convinced of the importance of pain-related fear and fear-avoidance beliefs in explaining disability and the transition from acute to chronic musculoskeletal pain. One of the clinical fields of interest in this respect concerns disability as a consequence of chronic low back pain. Several studies have shown the relevance of fear-avoidance beliefs in this field (Lethem *et al.* 1983; Philips, 1987; Waddell *et al.* 1993). Tying together these findings, an etiological model based on the specific fear that physical activity will cause (re)injury has been presented (Vlaeyen *et al.* 1995b; Vlaeyen and Linton, 2000). This model presents a possible pathway by which injured patients either become mired in a negative spiral leading to disability, or successfully recover. A patient who catastrophizes about pain (i.e. who is convinced that his/her body is extremely vulnerable, weak, and must be carefully protected from overstrain) is likely to be fearful of movement/(re)injury when experiencing pain. These fearful reactions are associated with increased muscular reactivity and avoidance, and in the long run they may lead to disuse, depression, and disability. On the other hand, a patient who does not catastrophize about pain will be more likely to resume daily activities and recover successfully.

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However, from a prevention point of view it would be worthwhile to find out whether the fear of movement/(re)injury also occurs in the general population. If this is the case, the more fearful people might be at greater risk of developing chronic low back pain, when confronted with a low back pain episode. Research indeed showed that the presence of fear-avoidance beliefs about work in the acute state of low back pain predicted disability 4 weeks later (Fritz *et al.* 2001) and that pain catastrophizing and, especiallly, fear-avoidance beliefs are important in the development of low back pain, reflected in a higher risk for pain and lower physical function at 1-year follow-up in previously pain-free people (Linton *et al.* 2000). In addition, a study by Buer and Linton (2002) showed that fear-avoidance beliefs and pain catastrophizing already existed in the general population of nonpatients. Furthermore, results from the nonpatients, mild pain groups, and moderate pain groups suggested a significant contribution of fear-avoidance beliefs and pain catastrophizing towards the transition from acute to chronic pain (Buer and Linton, 2002). Besides fear-avoidance beliefs in the general population, health care providers also tend to hold fear-avoidance beliefs. For example, some health care providers associate back pain with the need to avoid painful activities and view pain reduction as a necessary requirement to return to work (Linton *et al.* 2002).

Reliable and valid tools are now available to measure pain-related fear in patients, including the Tampa Scale for Kinesiophobia (TSK; Kori *et al.* 1990), the Fear Avoidance Beliefs Questionnaire (FABQ; Waddell *et al.* 1993), and the Pain Anxiety Symptoms Scale (PASS; McCracken *et al.* 1992). The TSK has been specifically designed to measure fear of movement/(re)injury in patients with low back pain and consists of 17 statements, which have to be rated on a 4-point scale ranging from "strongly disagree" to "strongly agree." Four items are phrased in reversed key. Psychometric research carried out with the Dutch version of the TSK (Vlaeyen *et al.* 1995a) has shown the TSK to be sufficiently reliable ($\alpha = 0.77$) and having predictive validity. Scores on the TSK were better predictors of disability levels in chronic low back pain patients than were, for example, pain intensity or biomedical findings (Vlaeyen *et al.* 1995b).

With respect to the factor structure of the TSK, Vlaeyen *et al.* (1995b) conducted a principal component analysis with oblique rotation on all 17 items. They found four nonorthogonal factors labeled harm, fear of (re)injury, importance of exercise, and avoidance of activity. This four-factor solution explained 36.2% of the total variance. Five items were excluded from the analysis because their factor loading was smaller than 0.40. Clark *et al.* (1996) performed a principal component analysis with Varimax rotation and found two factors, labeled activity avoidance and pathological somatic focus, explaining 49% of the total variance. All four reversed key items were excluded because item analysis showed that these items had a weak association with the total TSK score (Clark *et al.* 1996). Recently, Goubert *et al.* (2004) compared four-factor models for the TSK using confirmatory factor analysis in chronic low back pain and fibromyalgia patients, namely a one-factor model (17 items), the four-factor model of Vlaeyen *et al.* (1995b), a one-factor model without reversed items, and the two-factor model of Clark *et al.* (1996). The results showed that for both chronic low back pain patients and fibromyalgia patients, the two-factor model of Clark *et al.* (1996) provided a better fit than the four-factor model of Vlaeyen *et al.* (1995b), although it was still not adequate. Moreover, the two-factor model was found to be invariant across both patient groups, indicating that the model is robust in both the samples of patients with pain. These findings were confirmed by Roelofs *et al.* (in press), who also provided evidence for the construct and predictive validity of the adjusted version of the TSK (Roelofs *et al.* in press).

Until now, research with the TSK has been carried out only among patients with pain. As mentioned before, from a prevention point of view it would be interesting to be able to measure pain-related fear in the general population. For this purpose, the TSK has been modified (TSK-G; in which G stands for general population) to enable people without complaints to also complete it (Vlaeyen and Crombez, 1998). A first step before actually using the TSK-G in research would consist of testing it psychometrically, and comparing the results to those of the original TSK. For this purpose, the current study uses data from a large Dutch community sample that completed several questionnaires for the Dutch population-based Musculoskeletal Complaints and Consequences Cohort study (DMC_3-study) (Picavet *et al.* 2000).

The purpose of the current study was (1) to determine the factor structure of the TSK-G, (2) to determine the internal consistency of the TSK-G factors, and (3) to examine the validity of the TSK-G by comparing scores on the TSK-G with data gathered

in the same study on pain catastrophizing and general health status.

METHODS

Sample and Procedure

All participants were recruited through the DMC_3-study, a nationwide study of the prevalence and course of musculoskeletal complaints in the Netherlands in 1998 and 1999 (Picavet *et al.* 2000; Picavet and Schouten, 2003). The study consisted of two parts. First, a booklet of questionnaires was sent to a random sample of 8000 persons aged 25 and above, living in the Netherlands, stratified by 10 years age group and sex. This sample was drawn from the Dutch population register of 1998. People who did not return the booklet received a maximum of two reminders (after 3 and after 6 weeks). In total, 3664 persons returned the questionnaire. As a part of this first booklet, people were also asked to state if they were willing to complete a follow-up questionnaire. Those who agreed received a second booklet 6 months after the first.

For the current study, data only from the first booklet were used. Furthermore, persons only between 25 and 65 years of age were included in the analyses. Subjects who had missing values on the TSK-G in the first booklet were excluded, leaving a total of 2240 persons with valid data. Analyses were carried out separately for people with and without back complaints at the moment of completing the questionnaire or in the year before, because the presence of back pain is assumed to influence the results. Thus, the sample consisted of 1029 persons with back complaints and 1211 persons without back complaints.

Measurements

Musculoskeletal Complaints

The booklet consisted of 28 pages in full color, with items regarding the presence of musculoskeletal complaints, consequences of these complaints, determinants, other physical complaints, and sociodemographic variables. The musculoskeletal complaints were divided into five groups according to their location: (1) neck, shoulders, upper back, (2) elbow, wrist, hand, (3) lower back, (4) hip, knee, and (5) ankle, foot. For these complaints, questions were asked about the duration, seriousness, and course.

Catastrophizing Cognitions

The Pain Catastrophizing Scale (PCS) is a 13-item questionnaire, in which patients reflect upon past experiences of pain and have to indicate on a 5-point scale (ranging from "not at all" to "constantly") to which degree they experienced pain-related thoughts and feelings. A higher score on the PCS points towards a higher degree of pain catastrophizing cognitions. The PCS has been found to be sufficiently reliable and valid (Severeijns *et al.* 2002; Sullivan *et al.* 1995; Van Damme *et al.* 2002).

General Health Status (RAND-36)

The RAND-36 (Zee and Sanderman, 1993) was included in the booklet as a measure of general health status. It is a short version of the RAND Health Insurance Study Questionnaire consisting of 36 items divided over 9 subscales: (1) physical functioning, (2) social functioning, (3) role restrictions due to physical problems, (4) role restrictions due to emotional problems, (5) mental health, (6) vitality, (7) pain, (8) perceived general health, and (9) perceived changes in health status. A higher score on these subscales denotes a better health status. The RAND-36 bears close resemblance to the SF-36. Interesting for this study are the subscales 1, 2, 3, 7, and 8 (physical functioning, social functioning, role restrictions due to physical problems, pain, and perceived general health), because based on previous research fear of movement/(re)injury is expected to be related to limitations in physical as well as social functioning, and possibly even to pain (Vlaeyen and Linton, 2000).

Fear of Movement/(Re)injury (TSK-G)

The TSK has been specifically designed to measure fear of movement/(re)injury (Kori *et al.* 1990) in low back pain patients. The TSK consists of 17 statements, which have to be rated on a 4-point scale ranging from "strongly disagree" to "strongly agree." Four items are phrased in reversed key. The Dutch version of the TSK has been shown to be sufficiently reliable and valid (Goubert *et al.* 2004; Vlaeyen *et al.*

1995a). For the TSK-G, items have been rephrased in such a way that people without low back pain can complete them. For example, the item "If I were to try to overcome it, my pain would increase" was adapted to read "If I had low back pain and I were to try to overcome it, my pain would increase." A higher score on the TSK-G reflects a higher degree of fear of movement/(re)injury.

Statistical Analyses

The sample consisted of persons with and without low back complaints in the previous year. Since a recent experience with low back pain could influence scores on the TSK-G, it was decided to carry out the analyses for the people with and without complaints, separately. Furthermore, since a large sample was available, it was also decided to randomly split each group in half, then first carry out an exploratory factor analysis on the first half of each group, and finally test the factor structure on the second half of each group by means of a confirmatory factor analysis. Exploratory factor analysis was carried out with a Principal Axis Factor Analysis (PAF) with an oblique rotation, using SPSS 11.0.1 (SPSS-Inc., 2001). Factors were extracted until the Eigenvalue dropped below 1 or until the Eigenvalue hardly changed between two subsequent factors, visible as a levelling off in the Scree plot. Items with a factor loading below 0.25 were removed. If an item loaded on more than one factor, the item was removed if the difference in loading was below 0.1. Confirmatory factor analysis was done by means of the LISREL 8.54 statistical package (Joreskog and Sorbom, 2001). Modifications were carried out until changes in Chi-square of the modifications dropped below 4, or until the Non-Normed Fit Index (NNFI) reached the level of 0.90. As a goodness of fit statistic, the NNFI is uniquely used, because of its ability to estimate the goodness of fit, while accounting for large sample sizes and the frugality of a model. The first model and the final model were tested for identification (i.e. whether the estimates found are unique for the data used) by saving the fitted covariances of the respective models and using them as input. An identified model should yield a perfect fit on all parameter estimates.

Internal consistency was determined by calculating Cronbach's alpha. Validity was studied by firstly examining relationships with other variables such as pain catastrophizing and selected subscales referring to general health status using Pearson correlation coefficients. Furthermore, it was examined whether scores on these other variables could be predicted from scores on the TSK-G, when controlling for demographic variables, by means of regression analyses. Because of the considerable size of the sample, all statistical tests were carried out with a 0.01 significance level.

RESULTS

Sociodemographics

As described before, a total of 2240 persons were included in the analyses. Mean age was 45.2 years (SD, 11.3) and 46.3% of the persons included were males. The groups with and without low back complaints in the year prior to completing the questionnaire consisted of 1029 and 1211 persons, respectively.

Data Examination

Before starting with the exploratory factor analysis both samples were randomly split in half. For the exploratory factor analysis a sample of 515 persons with low back complaints and 605 persons without low back complaints was available. Table I shows the descriptive statistics for the 17 TSK-G items for each of the samples. Before factor analysis, inter-item correlations were computed. These showed that the four reversed key items (4, 8, 12, and 16) had generally low intercorrelations with the other TSK-G items. Furthermore, preliminary factor analyses with all 17 TSK-G-items showed that these four items were never included in factors with other items, but always formed separate factors by themselves. When looking at the content of these items, this is unexpected. The same pattern was found in psychometric research with the original TSK (Clark *et al.* 1996; Goubert *et al.* 2004), and since feedback from clinical experience has also shown that patients find these reversed key items confusing, it was decided not to include them in any further analysis.

Exploratory Factor Analysis

A PAF with oblique rotation was carried out on the remaining 13 items for the samples of persons with and without low back complaints, separately. For the sample of persons with back complaints the Kaiser–Meyer–Olkin measure (0.825) and Bartlett's

Table I. Descriptives (Mean, Standard Deviation (SD), Factor Loadings, and Reasons for Exclusion) for TSK-G-Items for People With and Without Back Complaints

		With back complaints ($N = 517$)		Without back complaints ($N = 609$)	
No	Item	Mean (SD)	Factor loadings	Mean (SD)	Factor loadings
1	I'm afraid sometimes that I might injure my back if I exercise	1.9 (1.1)	0.541	1.6 (1.0)	0.388
2	If I had low back pain and I were to try to overcome it, my pain would increase	2.1 (1.2)	0.450	2.0 (1.1)	0.343
3	Back pain means that there is something dangerously wrong with your body	1.8 (1.1)	0.607	1.9 (1.1)	0.638
4	Back pain decreases when a person stays physically active	2.8 (1.1)	A	2.8 (1.0)	A
5	People aren't taking my medical condition seriously enough	1.7 (1.0)	0.403	1.5 (.9)	0.368
6	If I had long-term low back pain, the rest of my life would become endangered	1.7 (1.0)	0.409	1.8 (1.0)	0.542
7	Back pain means the body is injured	2.3 (1.1)	0.436	2.3 (1.1)	0.489
8	If back pain increases through physical activity, that doesn't mean that it is dangerous	2.9 (1.1)	A	2.9 (1.1)	A
9	I am afraid that I might injury myself accidentally	1.7 (1.1)	0.632	1.7 (1.0)	0.536
10	The safest way to prevent back pain from worsening, is being careful not to make any unnecessary movements	2.7 (1.2)	0.296	2.6 (1.2)	0.315
11	There would perhaps be less back pain if there weren't something wrong with the back	3.1 (1.1)	B	3.1 (1.1)	B
12	If I had back pain, I would try to stay physically active	3.4 (.8)	A	3.3 (.9)	A
13	Back pain means a person should stop exercising to prevent injury	1.7 (.9)	0.528	1.9 (1.0)	0.585
14	For a person with back complaints it is not advisable to be physically active	1.5 (.8)	0.537	1.7 (.9)	0.549
15	I can't do all the things normal people do, because I think I can easily get back complaints	1.6 (1.0)	0.554	1.3 (.7)	0.500
16	Even though something would cause me a lot of back pain, I don't immediately think it is dangerous	2.8 (1.1)	A	2.9 (1.1)	A
17	I should not have to exercise if I would have back pain	1.6 (.9)	0.490	1.6 (.9)	0.424
	Total score (17 items)	33.6 (7.8)		32.9 (7.3)	
	Total score (12 items)	22.4 (6.7)		21.7 (6.3)	

Note. Reasons for exclusion: A = Small inter-item correlations, B = Factor loading below 0.25.

Test of Sphericity ($\chi^2 = 1345.3$; $p = 0.000$) both justified continuation of the analysis. Examination of Eigenvalues in combination with the Scree plot pointed towards a one-factor solution. Subsequent factor analysis showed that item 11 had an insufficient factor loading. The remaining 12 items made up one factor. Factor loadings and reasons for exclusion for these items are shown in Table I. Total variance explained was 31.0%. Cronbach's alpha for this factor was 0.79, which is sufficient.

Factor analysis of the sample of persons without low back complaints followed the same pattern. The Kaiser–Meyer–Olkin measure (0.815) and Bartlett's Test of Sphericity ($\chi^2 = 1424.3$; $p = 0.000$) were again both sufficient. Also, Eigenvalues and Scree plot suggested the extraction of one factor, and again item 11 was removed because of not meeting the minimum factor loading criterion. Total variance explained was 29.6%, and Cronbach's alpha was 0.78 in this case.[5] Factor loadings and reasons for exclusion are again shown in Table I.

Confirmatory Factor Analysis

A confirmatory factor analysis was carried out using the LISREL 8.54 statistical software. Since the TSK-G-items are scored on a 4-point scale, and item scores are therefore not normally distributed, polychoric correlations were used as input instead of Pearson correlations. The one-factor model that was described above was tested for the

[5]Cronbach's alpha of the 17-item TSK-G was .75 for the sample with low back complaints and .72 for the sample without low back complaints.

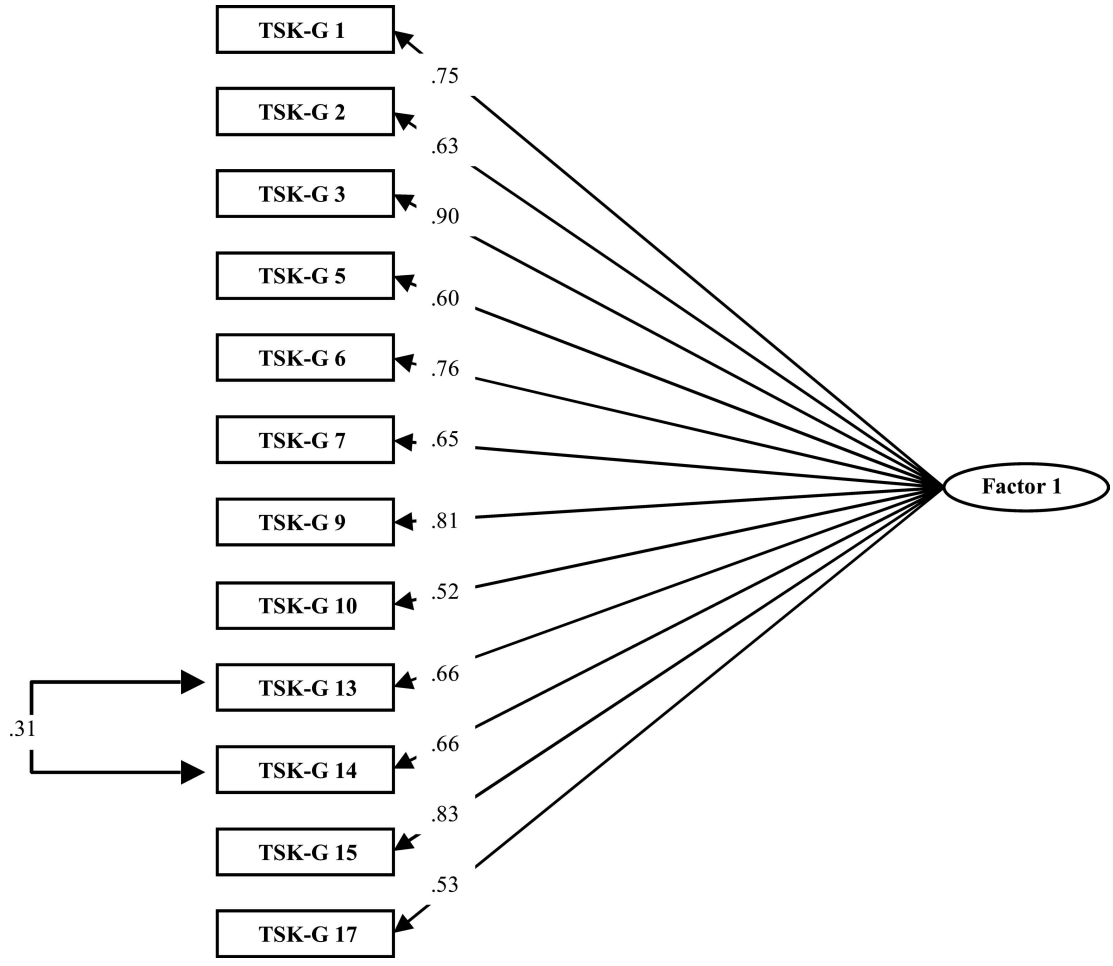

Fig. 1. Final LISREL model for people with low back complaints (factor loadings and error covariances between items).

second half of the people with low back complaints ($N = 514$) and without low back complaints ($N = 606$). For the sample of persons with low back complaints, results provided by LISREL showed that the one-factor model fitted reasonably to the data (Non-Normed Fit Index (NNFI) = 0.88). However, there was still room for improvement suggested by LISREL, through adding error covariances between certain items. After adding an error covariance between items 13 and 14, the NNFI reached the level of 0.91. Chi-square for this model was 161.3 (df = 53; $p < 0.01$), and the check for identification for the first and final model showed that the model was identified. The final model is shown in Fig. 1.

Next, the same procedure was followed for the second half of the sample of persons without low back complaints. The initial fit of the one-factor model was somewhat less for this sample (NNFI = 0.79). However, LISREL provided several suggestions for improvement through adding error covariances. The NNFI reached the level of 0.91 after adding four covariances between items 1 and 9, 3 and 7, 13 and 14, and 14 and 17. Chi-square for the final model was 130.4 (df = 50; $p < 0.01$). Both the first and final models were identified. The final model is shown in Fig. 2.

Validity

To determine the validity of the TSK-G, sum-scores were compared to scores on measures of pain catastrophizing and selected subscales of general health status. The selected subscales from the RAND-36 were physical functioning, social functioning, role restrictions due to physical problems, pain,

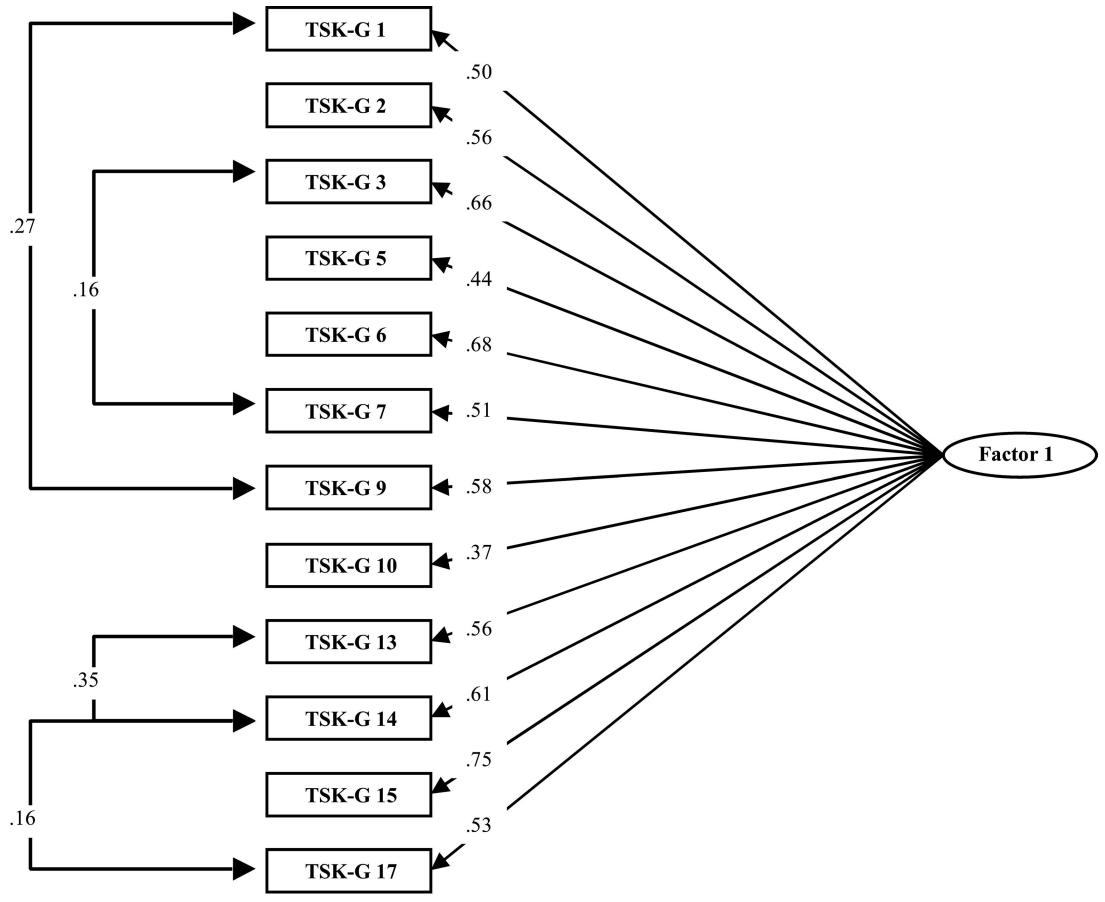

Fig. 2. Final LISREL model for people without low back complaints (factor loadings and error covariances between items).

and perceived general health. As a measure of pain catastrophizing a sumscore on the PCS was calculated. Since both samples with and without low back pain showed the same factor structure, it was decided to join both samples and carry out the following analyses on the group as a whole. However, in the regression analyses, having low back pain or not was added as a covariate. Other covariates in the regression analyses were gender and age.

Pearson correlations are shown in Table II. As can be seen, a higher degree of pain-related fear is associated with a higher degree of pain catastrophizing and lower general health status. Coefficients vary between 0.205 and 0.356 in absolute terms. Regression analyses show that TSK-G-score is a significant predictor in all cases and even the strongest predictor when it comes to pain catastrophizing, physical and social functioning, and perceived general health. Furthermore, whether or not a person has had back pain in the last year was also a significant predictor for general health status, but was hardly predictive of pain catastrophizing. Finally, it appears that being male was associated with less pain catastrophizing and a better general health status. In general however, as can be concluded from the magnitude of the adjusted *R*-squares, relatively little of the variance on the dependent variables was explained by the regression models (Table III).

DISCUSSION

The purpose of the current study was (1) to determine the factor structure of the TSK-G, (2) to determine the internal consistency of the TSK-G factors, and (3) to examine the validity of the TSK-G by comparing scores on the TSK-G with data gathered in the same study on pain catastrophizing and

Table III. Regression Analyses With TSK-G-Scores As a Predictor for Pain Catastrophizing and Subscales of General Health Status

	Pain catastrophizing	Physical functioning	Social functioning	Role restrictions due to physical problem	Pain	Perceived general health
Adjusted *R*-square	0.148	0.181	0.078	0.102	0.165	0.148
Standardized beta's:						
TSK-G	0.375**	−0.258**	−0.225**	−0.208**	−0.215**	−0.270**
Low back pain	0.046	−0.233**	−0.144**	−0.209**	−0.309**	−0.215**
Gender	−0.144**	0.146**	0.082**	0.126**	0.132**	0.060*
Age	−0.013	−0.198**	−0.030	−0.035	−0.066**	−0.137**

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

general health status. Similar to previous psychometric research with the TSK, it appears that the four reversed key items of the TSK-G provide problems for persons completing the questionnaire. It was therefore decided to remove these four items from further analysis. Since this is a consistent finding in studies with the TSK, it might be worthwhile to rephrase these items in the same direction as the other items, and study whether they contribute to the reliability and validity of the TSK. The content of these four items does seem relevant upon the first glance.

From the remaining 13 items of the TSK-G, only one was excluded during exploratory factor analysis because of a factor loading that was too low. This item read "There would perhaps be less back pain if there weren't something wrong with the back," and the corresponding original TSK-item was "I wouldn't have this much pain if there weren't something potentially dangerous going on in my body." In the adapted item from the TSK-G, less emphasis is put on the potential threat of something being wrong with the back. Thus, it might be that this item taps less into the concept of pain-related fear, and because of this is excluded from factor analysis. Furthermore, the TSK-G item contains a double negation, which can be confusing for the person completing the scale. Perhaps a better adaptation for the TSK-G would read "There is back pain, because there is something potentially dangerous wrong with the back." Summing up, exploratory factor analysis showed that the TSK-G consists of one factor, made up out of 12 items, and this structure was the same for people with and without low back complaints in the year before completing the questionnaire. Internal consistency (Cronbach's alpha) was 0.79 for the people with low back complaints and 0.78 for the people without low back complaints.

Table II. Pearson Correlations Between TSK-G-Scores, Pain Catastrophizing, and General Health Status

	N	TSK-G
Pain catastrophizing	2065	0.356
Physical functioning	2165	−0.266
Social funtioning	2223	−0.225
Role restrictions due to physical problem	2178	−0.205
Pain	2221	−0.219
Perceived general health	2176	−0.287

Note. All correlations were highly significant ($p < 0.001$).

Confirmatory factor analysis on the second half of the sample of persons with and without low back complaints showed similar results to the exploratory analysis. For the persons with low back complaints an adequately fitting model was found with the addition of one error covariance. For the people without low back complaints, four error covariances were added before the model fitted sufficiently. The addition of several covariances might be an indication that the factor structure needs adaptation, since it shows that there is variance unexplained by the proposed model. This is especially necessary if these covariances show a distinct pattern. However, no pattern was observed in this case.

The validity of the TSK-G was determined by comparing scores on this measure with scores for pain catastrophizing and scores for the subscales physical functioning, social functioning, role restrictions due to a physical problem, pain, and perceived general health from the RAND-36. Pearson correlation coefficients showed that a higher degree of pain-related fear was associated with a higher degree of catastrophizing cognitions and poorer health as measured on the subscales of the RAND-36. The magnitude of the correlations is not really high, but scores are not compared to a gold standard but to measures of concepts that are expected to be related. Furthermore, the correlation with the PCS is the highest, and this is also the measure that, from a biopsychosocial model, is conceptually the closest (Vlaeyen and Linton, 2000).

Regression analyses also showed TSK-G scores to be consistently associated with scores on pain catastrophizing and general health as measured by the RAND-36 subscales. It was the strongest predictor with regard to pain catastrophizing, physical and social functioning, and perceived general health, when controlling for age, gender, and whether or not a person had had back complaints during the last year. However, the regression models explained only a relatively small amount of the variance on the dependent variables.

Until now, only a few studies with the TSK-G have been carried out. Picavet *et al.* (2002) used the data from the DMC_3-study to determine whether future back complaints could be predicted from scores on the TSK-G. All 17 items were used to calculate a sumscore, which was predictive of low back pain and disability measured with the follow-up questionnaire of the DMC_3-study (Picavet *et al.* 2002). Peters *et al.* also used a sumscore of all 17 TSK-G items in an experiment on the predictive value of pain-related fear with regard to somatosensory hypervigilance in chronic low back pain patients. Patients completed the regular TSK, whereas healthy controls completed the TSK-G. As expected, scores of the healthy controls were found to be in between scores of low-fearful and high-fearful patients (Peters *et al.* 2002). The problem with both these studies is that till that time the psychometric properties of the TSK-G had not been studied. Although not very likely, it is possible that the results would have been different if the conclusions of the current study had been known.

Several studies have shown low back pain to be a medical, social, and economical problem (Waddell, 1998). The largest part of this problem is accounted for by a relatively small group of people with chronic complaints (Nachemson, 1992). Attention of clinicians has therefore shifted towards prevention of chronicity. The TSK-G can be useful in determining people at risk for developing chronic back complaints. The current study gives preliminary data with regard to the TSK-G. More extensive data are needed on the predictive value of the (one factor; 12 item) TSK-G for developing (chronic) low back complaints. Looking at the TSK-G scores from the current study, it seems that they are a few points lower than those of acute (Sieben *et al.* 2002; Swinkels Meewisse *et al.* 2003), as well as chronic (Crombez *et al.* 1999; Peters *et al.* 2002; Vlaeyen *et al.* 1995a,b) low back pain patients. Further research is needed to determine which people might be at risk for developing chronic low back pain problems, but it could be assumed that cut-off points should probably also be a few points lower than those based on the regular TSK. Scores on the TSK-G were normally distributed, were similar for people with and without low back complaints, and varied almost along the full range of the scale. Cut-off points on the 12-item TSK-G (with 17-item TSK-G scores between parentheses) based on the 2240 people included in the current study would be 21 (32) points for a median-split. For a division based on lower and upper tertile the cut-off points would be 18 (29) and 24 (36) points respectively. Another method for determining cut-off points on the TSK-G is the receiver operating characteristic (ROC) method (Hanley and McNiell, 1982). For the use of this method, prospective data are needed on TSK-G scores and whether or not people have developed chronic low back pain. By making a graph of "true positives" versus "false positives" for several cut-off points, the optimal cut-off point can be determined. This method could not be used in the current study, since no data were available on the development of chronic low back pain.

Additionally, it would be interesting to determine whether the regular TSK and the TSK-G can be related to each other. It might be expected that this is the case, since the TSK-G is merely an adaptation of the items from the TSK, and so the scale can be administered to people without complaints. However, it needs to be studied first whether scores gathered on the TSK-G are still useful as a measure of pain-related fear when a person has developed low back complaints, or if the regular TSK should then be administered.

In conclusion, the factor structure of the TSK-G appears to be similar for people with and without low back complaints. The TSK-G consists of one internally consistent factor, made up of 12 items. Similar to the studies by Goubert *et al.* (2004) and Clark *et al.* (1996), it is recommended to use the TSK-G without the reversed key items, or to rephrase these items in the same direction as all the other items. The other item that was excluded during factor analysis might still be used in the questionnaire, if it is phrased differently. However, both adaptations will require the TSK-G to be psychometrically studied again. Preliminary examination of the validity also points in the expected direction. High TSK scores predict pain catastrophizing, pain intensity, and pain-related health indices, even when controlling for the presence of low back pain. It is recommended to use TSK-G as a measure of pain-related fear in general population studies.

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