Factor structure and internal consistency of a Swedish version of the Pain Catastrophizing Scale

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Background: Pain catastrophizing is highly relevant to assess in the context of long-standing pain. The Pain Catastrophizing Scale (PCS) is a well-established questionnaire used to measure catastrophizing in individuals with long-standing pain. So far, no Swedish translation has been evaluated in regard to validity and reliability. The aims of this study were to translate the PCS questionnaire from English to Swedish, and to investigate its construct validity (face, content, and structural validity) and reliability (internal consistency).

Methods: We translated the original English version of the PCS to Swedish and collected item responses from 194 persons suffering from primarily long-standing musculoskeletal pain. We used confirmatory factor analysis to evaluate structural validity, and tested the model fit of a one-factor model, an oblique two-factor model, and an oblique three-factor model. We evaluated the measure’s reliability in regard to internal consistency calculated with Cronbach’s alpha.

Results: A three-factor model comprising a four-item rumination factor, a three-item magnification factor, and a six-item helplessness factor provided the best fit to the data. Internal consistency was adequate and Cronbach’s α was 0.92 for the entire scale, 0.84 for the rumination subscale; 0.69 for the magnification subscale, and 0.89 for the helplessness subscale.

Conclusions: The results indicated adequacy of a three-factor solution and the questionnaire’s internal consistency, and provide initial support for the structural validity and internal consistency of a Swedish version of the PCS. Future studies should replicate the study in larger samples and extend the current evaluation in regard to validity and reliability.

Keywords
chronic pain, factor analysis, internal consistency, long-standing pain, pain catastrophizing, Pain Catastrophizing Scale, reliability, validity

1 BACKGROUND

Globally musculoskeletal pain is a considerable medical, societal, and economical challenge comprising more than 200 different diagnoses, including soft tissue and skeletal damage and back problems. The prevalence of musculoskeletal pain is consistently high, but varies slightly between studies due to differences in methodology. A large European study illustrated that approximately 20% of the included adults experienced long-standing pain, the most common pain localization being the back (24%) and the most common reported cause was arthritis/osteoarthritis (34%). In a Swedish study, 23.9% of the respondents experienced long-standing regional musculoskeletal pain and 11.4% reported long-standing widespread musculoskeletal pain. In addition to individual suffering
and interference on functioning, substantial costs are associated with this type of pain. In the United States, productivity losses due to musculoskeletal disorders were estimated to cost $45-54 billion in 2001.5 In Sweden, total costs related to low back pain comprised 1860 million EUR in 2001.6

Psychological factors have proved to be of highest relevance in the development and maintenance of long-standing pain.7,8 And, the fear-avoidance model has proved to have high utility in accounting for the role of these factors.9 Broadly, the model highlights how pain is perceived as threatening and intolerable, by means of, what repeatedly has been conceptualized as, a cognitive process labeled catastrophizing.10 Catastrophizing enhances fear to use the painful body part, for example, an injured back, which in turn is followed by avoidance behaviors, and long-term consequences potentially include pain-related disability and reduced quality of life. Catastrophizing, central to the fear-avoidance model, can on a basic level be understood as negative thinking about one’s pain (ie, “I can’t take any more of this pain!”).9 Research has shown that catastrophizing predicts pain intensity following surgery and pain-related disability and general wellbeing in patients with long-standing back pain.11,12 And, that persons with higher degrees of fear-avoidance had up to twice the risk to develop back problems.11

The subjective psychological experiences and accompanying behaviors that constitute catastrophizing are most commonly assessed with self-report measures, and the Pain Catastrophizing Scale (PCS) is one of the most widely used questionnaires. The PCS has been validated in a number of languages and for a number of pain populations for adults.13-16 However, thus far, no study has evaluated the validity and reliability of a Swedish version of the scale. Given its clinical and scientific relevance, a validation of a Swedish version of the PCS appears pertinent. For example, the PCS can be used in future studies to further assess catastrophizing as a potential predictor, moderator or mediator in a number of treatments for long-standing pain, both medical and behavioral, such as surgery for low back pain, cognitive behavior therapy (CBT), and physiotherapy.17,18

1.1 | Aims

Our overarching aim was to perform an initial validation of a Swedish version of the PCS, and more specifically we aimed to: (a) Translate and adapt the original English version of the PCS to Swedish; (b) assess the questionnaire’s construct validity, including face, content, and structural validity; and (c) to evaluate the scale’s reliability in regard to internal consistency.19

2 | METHODS

2.1 | Participants

Adults between 18-85 years with long-standing pain (a pain duration ≥3 months) referred to one orthopedic clinic at a university hospital, one spine clinic, and one primary health care clinic in the southwest of Sweden were eligible for study inclusion. In dialog with the head of each clinic, site specific inclusion procedures were developed. Inclusion was done following first visit and after patients had been given information of the study and had provided written consent to study participation. At one clinic a research assistant handled inclusion and administered questionnaires two days per week and at the other clinics the staff consecutively included patients and administered questionnaires. Persons who could not answer questions relevant for the study and fill out the questionnaire (eg, due to lack of language proficiency) were excluded. The Regional Ethical Review Board in Gothenburg approved the study (registration number: 881-13).

2.2 | The Pain Catastrophizing Scale

The PCS was constructed to assess pain-related catastrophizing.19 In its original format the PCS comprises 13 items that are rated from 0 to 4 with the endpoints 0 (“Never”) to 4 (“All the time”). Repeatedly, results from previous studies illustrate that pain catastrophizing as assessed by the PCS comprise three factors labeled: (a) Helplessness, which pertains to the helplessness felt in situations when pain is present; (b) Rumination, that concerns the tendency to be increasingly vigilant toward pain; and (c) Magnification, which captures the tendency to exaggerate the threat value of pain.14,16,19,20 In the original study by Sullivan, were the oblique three-factor model was proposed, the correlation between the three subscales was moderate, and the internal consistency was adequate as represented by a Cronbach’s α of 0.87 for the total scale. Cronbach’s α was 0.87, 0.60, and 0.79 for the three dimensions, rumination, magnification and helplessness, respectively. Also, test-retest reliability over a six-week period was adequate (r = 0.75, P < 0.001).19 Apart from the three-factor model referred to above, other factor models have been proposed and evaluated. In a study by Osman et al21 an oblique two-factor model (comprising the two subscales magnification/helplessness and rumination) was evaluated and found to have good model fit. In the same study, a one-factor model, in which the 13 items are assumed to be indicators of a single latent factor was also tested, although with poorer model fit.21

Editorial Comment

Understanding and treating pain, in particular chronic pain, involves an assessment of biopsychosocial aspects. An important determining factor has been found to be pain catastrophizing, measured with the Pain Catastrophizing Scale, which exhibits good psychometric properties. This study provides initial support for the structural validity and internal consistency of a Swedish version of the scale.
2.3 | Translation procedure

At study conception, other Swedish translations of the PCS were available, but as there were no studies of the validity and reliability of these translations we deemed it appropriate to systematically redo the validation procedure. We were granted permission by the developer of the PCS to perform a cross-cultural validation and to test its reliability.23 Here, cross-cultural validation refers to an evaluation of the degree to which items and item performance in a translated or culturally adapted self-report questionnaire adequately reflects these aspects in the original version.22 Prior to translation, a project-group was formed including two of the authors (MLU and JLU) and a master’s student in psychology. Also, an expert group was formed including persons with expertise in the field of long-standing pain and pain catastrophizing (Professor Michael Sullivan and a clinical psychologist and PhD-student).

Validation followed seven steps found in guidelines for cross-cultural validation.23 Individual forward translations of the PCS from English to Swedish were done in the project group (step 1) and synthesized to a first consensus-based Swedish version (step 2). The Swedish translation was subsequently back-translated by a professional language editor (step 3). Based on these translations the expert group composed a so called prefinal version (step 4). Following this, brief cognitive interviews with five patients were conducted by a master’s student in psychology to ensure questionnaire intelligibility (step 5).23,24 In step 6, the project group made final adjustments to the item wordings based on previous translations and interview compilations. In step 7, a final assessment of face and content validity and an evaluation of construct validity was done. The overarching purpose of content validation was to assess whether the measurement instrument (PCS) adequately represented the construct under study (pain catastrophizing). We considered face validity to be a prerequisite of content validity, and the forming of an expert group as described in step 4 above, as an essential step in the assessment of content validation.22 Face and content validity was thus assessed by the project group throughout the translation process (step 1-6) as well as more finally toward the end of this process (step 7), by closely considering and discussing the more final phrasings of the individual items. Following principles detailed by the COSMIN group, validity of the cross-culturally translated and adapted measure should be investigated by assessing its construct validity, and structural validity specifically.22,25 We used confirmatory factor analysis (CFA) to assess structural validity, described in more detail below.

2.4 | Data analytic approach

All data were analyzed using IBM SPSS Statistics, version 24.0 and IBM SPSS AMOS, version 24.0.26,27 Descriptive statistics were used to broadly characterize the sample by means, standard deviations, ranges, and frequencies of demographic (age, gender, and civil status) and background (pain onset, pain duration, and level of education) data. We also calculated means, standard deviations, as well as minimum/maximum values for the factors comprising the model with the best fit. We used 95% confidence intervals and a 0.05 level for significance testing. Little’s Missing Completely at Random (MCAR) test was used to assess if data were missing at random or if missingness depended on the variables in the dataset.28 Each item in the PCS has five categories (possible answers). As commonly done in the literature, we treated items as continuous variables, under the assumption that this would not likely practically impact results.29

We decided to include 195 participants, that is, toward the upper end of the resulting interval when including 10-15 participants/item in line with recommendations by Nunnally.30 The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity was used to test the adequacy of the data for factor analysis. Suitability was determined by a KMO value >0.7 and a significant (ie, <0.05) outcome of Bartlett’s test of sphericity.29 Furthermore, a KMO value between 0.5 and 0.7 was considered mediocre, a value between 0.7 and 0.8 good, and a value >0.9 superb.31 Assumptions of univariate and multivariate normality were tested using a macro for SPSS developed by Lawrence DeCarlo, and calculated Mardia’s multivariate skewness and kurtosis estimates and tested them for significance.32 We deemed univariate skewness >2 and kurtosis values >7 as indicative of deviations from univariate normality.33 Parameter estimation was done using maximum likelihood estimation, as this approach has been shown to adequately handle non-normality.34 Also, we used the Bollen-Stine bootstrap approach (5000 samples), robust to deviations from normality, specifically for chi-square estimation.35

Structural validity of the Swedish version of the PCS was analyzed by performing a CFA and factor loadings above 0.5 were considered adequate.36 The focus of this study was to investigate model fit, and we compared the fit of three different first order models, in line with the approach by Van Dame et al.20 The first comprised a one-factor model, in which the 13 items were assumed to be indicators of a single latent factor (pain catastrophizing). The second model was an oblique two-factor model comprising two correlated dimensions magnification-helplessness (items 1, 2, 3, 4, 6, 7, and 13) and rumination (items 5, 8, 9, 10, 11, and 12), originally proposed by Osman et al.21 The third model was the oblique three-factor model originally proposed by Sullivan et al19 including the three correlated dimensions rumination (items 8, 9, 10, 11); magnification (items 6, 7, 13); and helplessness (items 1, 2, 3, 4, 5, 12), that make up the overarching construct of catastrophizing. We tested overall model fit of the three models by means of a chi-square ($\chi^2$) test in which the two- and one-factor solutions were compared with the more complex three-factor model. In line with recommendations by Bollen and Long, several fit indices were used to assess model fit.37 Model fit was assessed with (a) the chi-square ($\chi^2$) test; (b) the Root Mean Square Error of Approximation (RMSEA) test; (c) the Non-Normed Fit Index (NNFI); and (d) the Comparative Fit Index (CFI).

The chi-square ($\chi^2$) test is a commonly used index of absolute goodness-of-fit, and a significant $\chi^2$ result indicates that significant quantity of observed covariance between items remains unexplained by the model, whereas a nonsignificant result indicates adequate fit of the data as represented by the model, if a large enough sample is used.38 We used the RMSEA as an additional absolute fit index. This
measure is based on the population error of approximation, and on the assumption that the model does not hold exactly in the population, an error accounted for by the RMSEA."The NNFI was used as a measure of relative fit and adequate values should range between 0 and 1 and values close to 0.95 or above were considered indications of good model fit.\textsuperscript{40} The CFI is an incremental fit index that is illustrative of the proportionate improvement in model fit by comparing the target model with a baseline model. Values range from 0 to 1 and in line with recommendations by Hu and Bentler we considered a value ≥0.95 an indicator of good model fit.\textsuperscript{40} Internal consistency was assessed by calculating Cronbach’s $\alpha$ and we considered an alpha value >0.8 to be adequate.\textsuperscript{41,42} Construct validity was additionally assessed by correlating the factor solution with the best model fit, with demographic (age, gender, and civil status) and background (pain onset, pain duration, and level of education) variables.

3 | RESULTS

3.1 | Participants, missing data, and assumptions of normality

In total, 199 patients were eligible for study inclusion. Five persons had not rated any items on the PCS, and hence we excluded them from the CFA and based subsequent analyses on data from 194 individuals. In total nine items were missing, for eight of the included individuals. As Little’s MCAR test indicated that data were MCAR ($\chi^2(71) = 70.112$, $P = 0.507$) the nine missing items were imputed using multiple imputation.\textsuperscript{43} The KMO-test resulted in a value of 0.925 and Bartlett’s test of sphericity was statistically significant ($P < 0.0001$), indicating that data were suitable for factor analysis. Univariate skewness and kurtosis values (ranging from $-0.404$ to 2.027 and $-1.105$ to 4.431, respectively) were within the normal range. A significant Mardia’s test of multivariate skewness and kurtosis ($P < 0.0001$) indicated some departure from multivariate normality.

The 194 participants were between 18 to 83 years old. The mean age was 47.4 years ($SD = 17.62$); 106 (55%) of the 194 included persons were women; 173 (89%) were born in Sweden, four (2%) in other Scandinavian countries, and 13 (7.0%) in countries outside of Scandinavia. Fifty-five (28%) were currently not in a relationship, 86 (44%) were married, 37 (19%) co-habited with another person and four (2%) were in a relationship with another person without living together. Pain duration ranged from 3 to 492 months and the mean pain duration was 70 months ($SD = 97.7$). For 63 (33%) individuals pain onset was sudden and for 120 (62%) persons pain onset was gradual. Twenty-two (11%) had completed primary school; 80 (41%) had a high school education, and 88 (45%) had a University degree.

3.2 | Confirmatory factor analysis

In contrast to the significant chi-square test for the one- and two-factor models ($P \leq 0.01$), results from the chi-square test for the three-factor model was nonsignificant ($P = 0.056$), indicating better model fit. Also, assessments of overall fit resulted in statistically significant chi-square values for the one- ($\chi^2(3) = 27.175$, $P < 0.001$) and two-factor solutions ($\chi^2(1) = 65.416$, $P < 0.001$), which indicated that the constraints on the original model resulted in a significant reduction in overall model fit, and that the three-factor model was the one most consistent with the data. Furthermore, the overall pattern of results illustrated that the three-factor solution was the model with the better fit, as indicated by a RMSEA-value of 0.065, closest to the recommended 0.06 value; a NNFI-value of 0.953, that is, above the recommended 0.95 cutoff, and a CFI-value ≥0.95, indicative of good model fit. See Table 1 for specific fit indices for the tested models. Broadly factor loadings for the three-factor model were satisfactory (>0.5). However, loadings for item 12 (Helplessness scale) and item 7 (Magnification scale) were just below 0.5 (0.495 and 0.475, respectively). Please find factor loadings for all items and factors in the three-factor model (Table 2), and means and measures of dispersion for the three factors and the total score for the PCS (Table 3).

3.3 | Correlational analyses

There were small significant negative correlations between age and Helplessness ($r = -0.310$, $P < 0.01$); Rumination ($r = -0.379$, $P < 0.01$) and Magnification ($r = -0.185$, $P < 0.01$); and the PCS total score ($r = -0.346$, $P < 0.01$). See Table 4 for additional correlations.

3.4 | Internal consistency

Cronbach’s $\alpha$ was 0.836 for the rumination subscale; 0.689 for the magnification subscale; and 0.885 for the helplessness subscale. Cronbach’s $\alpha$ for the total scale was 0.918.

4 | DISCUSSION

We evaluated a Swedish version of the PCS in regard to construct validity by assessing face, content, and structural validity. Structural validity was evaluated by performing a CFA. In addition, construct

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$ (df)</th>
<th>P*</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-factor model</td>
<td>140.037 (65)</td>
<td>0.013</td>
<td>0.944</td>
<td>0.933</td>
<td>0.077</td>
</tr>
<tr>
<td>Two-factor model</td>
<td>178.278 (63)</td>
<td>0.001</td>
<td>0.915</td>
<td>0.894</td>
<td>0.097</td>
</tr>
<tr>
<td>Three-factor model</td>
<td>112.862 (62)</td>
<td>0.056</td>
<td>0.962</td>
<td>0.953</td>
<td>0.065</td>
</tr>
</tbody>
</table>

*Only the P-values are based on the Bollen-Stine bootstrapped chi-square estimation.
validity was further assessed by correlating the factor solution with the best model fit with demographic and background variables. Reliability was addressed by evaluating internal consistency. Overall, findings align with previous research and specific results from the CFA support an oblique three-factor solution that further underpins the three-factor structure of the PCS, distinguishing rumination, magnification, and helplessness as independent, but related, dimensions of pain catastrophizing.19,20

In discussing internal consistency, acceptable to very good Cronbach’s α values range from 0.70 to 0.95. And, values closer to the upper end of the range are recommended for clinical application.42,44 Results in this study showed that internal consistency of the rumination and helplessness subscales were good, but questionable for the magnification subscale (α = 0.69). These values are in line with previous analyses of internal consistency.19-21,45 In regard to the magnification subscale, similar results have been seen in previous studies, for example, the study by Van Damme et al20 report alpha values ranging from 0.59-0.72. Similarly, Sullivan et al19 in their original evaluation of the PCS report an alpha value 0.60 in a student sample, and reason that the lower alpha value for the magnification subscale may reflect differences in how individuals appraise the questions dependent on the diversity of pain situations that individuals historically have encountered and taken into consideration in completing the questionnaire. And,

### TABLE 2  Factor loadings for the three-factor solution

<table>
<thead>
<tr>
<th>Item</th>
<th>English original (Swedish translation)</th>
<th>Helplessness Factor loadings</th>
<th>Rumination Factor loadings</th>
<th>Magnification Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I worry all the time about whether the pain will end. (Oroar jag mig för om smärtan aldrig kommer att gå över.)</td>
<td>0.665</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I feel I can't go on. (Känner jag att jag inte orkar fortsätta.)</td>
<td>0.789</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>It's terrible and I think it's never going to get any better. (Är det fruktansvärt och jag tänker att det aldrig kommer att bli bättre.)</td>
<td>0.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>It's awful and I feel that it overwhelms me. (Är det hemskt och jag känner att det överväldigar mig.)</td>
<td>0.858</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I feel I can't stand it anymore. (Känns det som att jag inte kan stå ut längre.)</td>
<td>0.892</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I become afraid that the pain will get worse. (Blir jag rädd att smärtan ska förvärvas.)</td>
<td>0.754</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I keep thinking of other painful events. (Tänker jag på andra smärtsamma händelser.)</td>
<td>0.475</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I anxiously want the pain to go away. (Väntar jag otåligen på att smärtan ska försvinna.)</td>
<td>0.666</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I can't seem to get it out of my mind. (Har jag svårt att låta bli att tänka på den.)</td>
<td>0.786</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I keep thinking about how much it hurts. (Tänker jag på hur ont det gör.)</td>
<td>0.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I keep thinking about how badly I want the pain to stop. (Tänker jag på hur gärna jag vill att smärtan ska gå över.)</td>
<td>0.751</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>There’s nothing I can do to reduce the intensity of the pain. (Finns det ingenting jag kan göra för att minska smärtsens intensitet.)</td>
<td>0.495</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I wonder whether something serious may happen. (Undrar jag om något allvarligt kommer att hända.)</td>
<td>0.739</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 194.

### TABLE 3  Means and dispersion measures for the three-factor solution

<table>
<thead>
<tr>
<th></th>
<th>Means</th>
<th>Standard deviations</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helplessness (0-24)</td>
<td>8.00</td>
<td>5.64</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Rumination (0-16)</td>
<td>7.61</td>
<td>3.99</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Magnification (0-12)</td>
<td>2.96</td>
<td>2.37</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>PCS total score (0-52)</td>
<td>18.57</td>
<td>10.67</td>
<td>0</td>
<td>49</td>
</tr>
</tbody>
</table>

PCS, Pain Catastrophizing Scale.  
*N = 194.

validity was further assessed by correlating the factor solution with the best model fit with demographic and background variables. Reliability was addressed by evaluating internal consistency. Overall, findings align with previous research and specific results from the CFA support an oblique three-factor solution that further underpins the three-factor structure of the PCS, distinguishing rumination, magnification, and helplessness as independent, but related, dimensions of pain catastrophizing.19,20

### TABLE 4  Correlations between factors, background, and clinical variables

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Age</th>
<th>Level of education</th>
<th>Civil status</th>
<th>Pain duration</th>
<th>Pain debut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helplessness</td>
<td>-0.019</td>
<td>-0.310**</td>
<td>-0.126</td>
<td>0.099</td>
<td>0.015</td>
<td>-0.024</td>
</tr>
<tr>
<td>Rumination</td>
<td>0.001</td>
<td>-0.379**</td>
<td>-0.114</td>
<td>0.093</td>
<td>-0.075</td>
<td>0.034</td>
</tr>
<tr>
<td>Magnification</td>
<td>-0.039</td>
<td>-0.185**</td>
<td>0.041</td>
<td>0.043</td>
<td>-0.026</td>
<td>0.037</td>
</tr>
<tr>
<td>PCS total score</td>
<td>-0.018</td>
<td>-0.346**</td>
<td>-0.100</td>
<td>0.097</td>
<td>-0.026</td>
<td>0.008</td>
</tr>
</tbody>
</table>

PCS, Pain Catastrophizing Scale.  
*N = 193.  
**Correlation is significant at the 0.01 level (2-tailed).
even if the assumption that pain situations share sufficient com-
monality across individuals to elicit similar cognitive and emotional
responses appears valid, it may hold more strongly for the rumina-
tion and helplessness subscales.\textsuperscript{19} In addition, statistically the com-
paratively low alpha value for the magnification subscale may be a
consequence of the small number of items (three) in that specific
subscale. In an evaluation of a Brazilian Portuguese version of the
PCS in a sample of 384 persons experiencing chronic nonmalign-
ant pain an alpha value of 0.88 is reported for this subscale,
indicating that the value may also be a consequence of sample
size.

Notably, an extended conceptual discussion of catastrophizing is
beyond the scope of this article. However, in relation to the magnifi-
cation factor, which captures the tendency to exaggerate the threat
value of pain (eg, “I become afraid that the pain will get worse”),
there may be conceptual reasons that warrant a role for this facet of
catastrophizing.

The appraisal model, situated within a transactional model of
stress and coping, describes pain catastrophizing as occurring when
primary appraisals (ie, evaluations of the situation) gains the upper
hand over secondary appraisals (ie, evaluations of personal coping
abilities in the situation).\textsuperscript{10,46} According to Severijns and co-authors,
magnification and rumination may reflect a cognitive focus on, and
evaluation of, an extremely threatening painful stimulus (primary
appraisal). In this view, helplessness may reflect secondary appraisals
of incapacity to cope.\textsuperscript{10} Having said that, more work is needed to
pin down a conceptualization of catastrophizing, including a potential
role for the aspect of magnification, with adequate utility to predict
behavior in a systematic fashion.\textsuperscript{47}

Some limitations should be considered when interpreting the
results in this study. First, deviations from normal distribution of data
were indicated, which may result in misleading estimates of standard
errors, chi-square- and other fit-indices. For example, under these
circumstances chi-square estimates may be overly large and lead to
subsequent over-rejection of models. That being said, maximum like-
lihood estimation has been shown to produce fairly robust estimation
also in situations of non-normality.\textsuperscript{34} In addition, the Bollen-
Stine bootstrap approach, robust to non-normality, was used for chi-
square estimation.\textsuperscript{34,35} Second, the study population comprised
patients with primarily musculoskeletal pain from three pain clinics,
but the lack of more specific background and clinical information is a
limitation. This was due to the chosen inclusion procedures in which
we heavily had to limit the assessment of additional background and
clinical information in order to fit nonreimbursed questionnaire
administration into the busy schedules of the clinics. However, we
would argue that we have enough information to evaluate factor
structure, model fit, and internal consistency.

Additional studies are needed to cover of the broad range of
issues regarding validity and reliability. In this study, the PCS was
tested in a sample of patients experiencing primarily musculoskeletal
pain, which, given how common this type of pain is, speaks
for the utility of the questionnaire. We based our analytical strat-
egy on the approach of Van Damme and co-authors, and in that
study results illustrated that the three-factor oblique model pro-
vided the best fit across three different samples (pain free stu-
dents, patients with low back pain and patients with fibromyalgia),
which lends credibility to the stability of the findings in this
study.\textsuperscript{20} However, the evaluation of the consistency of the results
in this study across samples should be considered in future stud-
ies, for example, in potentially more heterogeneous samples (eg,
nonspecific long-standing pain), or for persons with a more speci-
fic and/or qualitatively different pain experience (eg, peripheral
neuropathic pain).\textsuperscript{20}

Future studies should also evaluate other aspects of validity
(eg, concurrent and predictive validity), for example, using longitudi-
dinal designs in which baseline levels of catastrophizing are used
as predictors of changes in pain symptoms and pain-related func-
tioning over time. Relatedly, to add further knowledge of the
questionnaire’s reliability, efforts should be made to determine its
test-retest stability as a gauge of its stability over time. Also,
given that the questionnaire should be used in clinical evaluations,
the questionnaire’s sensitivity to change also needs to be investi-
gated systematically.

In sum, several studies highlight pain catastrophizing in the
development and maintenance of pain-related disability, underlining
the importance to assess and address catastrophizing in caring for
persons with long-standing pain. In this regard, the PCS is a relatively
brief questionnaire for use in clinical and scientific contexts. This
study provides initial support for the structural validity and internal
consistency of a Swedish version of the PCS. Future studies should
replicate the study in larger samples and extend the current evalua-
tion in regard to reliability and validity.

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CONFLICTS OF INTEREST

There are no conflicts of interest, that is, financial or personal rela-
tionships between authors and other persons that bias this study.

AUTHORS’ CONTRIBUTIONS

MLU, JLU and MSU conceived the study and overall directed and
planned the course of the study. They were directly involved in the
translation and initial validation procedure and also provided impor-
tant feedback on the manuscript in its different iterations. MKKE
(corresponding author) drafted the manuscript and was responsible
for the continued development of the manuscript, selecting the data
analytic strategy as well as analyzing the data. Data analysis was
done in collaboration with AGR-EK, who also provided continuous feedback on the manuscript.

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REFERENCES


19. Arbuckle JL. Amos (Version 24.0) [Computer Program]. Chicago, IL, USA: IBM SPSS; 2016.


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