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Rehabilitation Psychology

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Factor Structure and Invariance of the Pain Catastrophizing Scale in Patients With Chronic Pain and Their Spouses

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Purpose: This study was designed to investigate the equivalency and factor structure of the patients and significant others' version of pain catastrophizing scales in patients with chronic pain and their spouses who are not in pain. **Method:** Participants were 142 married couples in which 1 spouse reported chronic musculoskeletal pain. Confirmatory factor analyses were used to compare 4 models of pain catastrophizing, and to examine the invariance of the factor structure of the PCS-Patient version and the PCS-Significant other version in patients with chronic pain and their spouses. **Results:** The results indicated that the 2-factor oblique model provided an adequate fit to the data of both patients with chronic pain and their spouses who are not in pain. Moreover, it was found that when gender was controlled, the hypothesized factor structures of the PCS-patient version and the PCS-Significant other version were invariant. Indeed, it was revealed that the PCS-Patient version and the PCS-Significant other version measure the same factors in couples in which 1 of them have a chronic pain condition. **Conclusions:** The findings of the current study showed that the 2-factor oblique model is the best fit in both samples (i.e., patients with chronic pain and their spouses). Therefore, it can be suggested that these versions can be used among patients and their spouses and the findings regarding them can be compared.

Impact and Implications

The current study is the first to examine the factor structure of both the PCS-P and the PCS-S in a sample of Persian-speaking patients with chronic pain and their spouses. Results demonstrate that the PCS-P and the PCS-S is a valid measure of pain catastrophizing in patients and spouses which can be used in a Persian-speaking population. This study adds to the state of knowledge that the pain catastrophizing scale measures the same content across patients with chronic pain and their spouses. Findings of the current study place emphasis on the notion that both patients and their spouses may share similar negative cognitions about pain.

Keywords: chronic pain, musculoskeletal, pain catastrophizing, patients, spouses

Introduction

Pain catastrophizing is defined as a tendency to exaggerate and interpret pain-related experiences in a negative way, and it is associated with the expectation of negative outcomes in ambig-

uous situations (Parkerson et al., 2013; Severeijns, Vlaeyen, & Van Den Hout, 2004; Sharpe & Johnson, 2012; Sharpe, Johnson, & Dear, 2014; Sullivan, Rodgers, & Kirsch, 2001). Expecting a negative outcome may contribute to the development of pain-related fear in patients, and thus can contribute to the development

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national

research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. We thank the management and the staff of Atieh Hospital and Rasa pain clinic for their kind support during data collection. We would also like to thank all the patients who participated in this study. The authors declare that they have no conflict of interest.

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and maintenance of chronic pain (Khatibi, Schrooten, Vancleef, & Vlaeyen, 2014). Pain catastrophizing is associated with disability and other adverse outcomes in patients with pain (McCracken, Gross, Aikens, & Carnrike, 1996; McCracken, Zayfert, & Gross, 1992; Peters, Vlaeyen, & Weber, 2005; Sullivan, Thorn, et al., 2001). In addition, pain catastrophizing may have a communal coping function, that is patients with chronic pain may catastrophize their pain to elicit more support from their significant others, for instance, their spouses (Sullivan, Thorn, et al., 2001).

Recent research suggests that not only may the patients with chronic pain catastrophize their pain, but their significant others (e.g., their spouses) are also prone to expressing pain catastrophizing thoughts about the pain of their family members (Cano, Johansen, & Franz, 2005; Cano & Leonard, 2006; Mohammadi et al., 2012). The existence of pain catastrophizing thoughts among patients' significant others has been shown to be related to their higher level of attentional bias to pain-related information (Mohammadi et al., 2012). In addition, significant others who catastrophize more about the pain of their patients are more likely to report a higher estimation of pain in their patients and express more pain-related fear (Vervoort et al., 2011). Significant others who catastrophize more about the patients' pain condition are more likely to get involved in pain-attending behaviors (Caes, Vervoort, Trost, & Goubert, 2012) and are more likely to express solicitous responses to patients' pain (Romano et al., 1995), which are related to higher disability among patients with chronic pain (Lousberg, Schmidt, & Groenman, 1992).

Considering the interactions between patients and their significant others, especially their spouses, it can be suggested that the assessment of pain catastrophizing in patients with chronic pain and their spouses can aid researchers to create a comprehensive image of the situation and help them take the interpersonal aspects of the condition into account (Abbasi et al., 2012; Cano, Johansen, et al., 2005; Cano & Leonard, 2006; Leonard, Cano, & Johansen, 2006). This would help the practitioners attend to the cognitions that require intervention in both patients with chronic pain and their spouses.

The most widely used measure to investigate pain catastrophizing thoughts is the Pain Catastrophizing Scale (the PCS-13; Sullivan, Bishop, & Pivik, 1995). The PCS-Patient version is a 13-item self-report measure, which measures three components of pain catastrophizing (i.e., rumination, magnification, and helplessness). The PCS-Patient version has been extensively used in research in different cultures, languages, and settings (Crombez et al., 2003; Osman et al., 2000; Sullivan et al., 1995). However, the factor structure of the PCS-Patient version is not robust across different studies. For example, Osman et al. (1997) in a sample of undergraduate students and Raeissadat, Sadeghi, and Montazeri (2013) in a sample of patients with musculoskeletal pain suggested a two-factor solution for the PCS, while Sullivan et al. (1995) stated that the three-factor model would provide the best fit. It is also noteworthy that most of the research in this area has been conducted in nonclinical samples (e.g., students; Osman et al., 1997) which limits the generalization of the results to clinical populations.

In addition to the PCS-Patient version, Cano, Leonard, and Franz (2005) developed a significant other version of the PCS to assess the catastrophizing of the pain of the patients as reported by their spouses (Cano, Leonard, & Franz, 2005; Cano, Leong,

Heller, & Lutz, 2009). While this measure has also been used in different studies and different cultural backgrounds (e.g., Mohammadi et al., 2012), the equivalency of this measure with the PCS-Patient version has not been addressed in the literature. Furthermore, the factor structure of the significant other version of the PCS is not examined in the Persian-speaking population. Thus, the main objectives of the current study are first to investigate the factor structure of the PCS-Patient and the PCS-Significant other versions in patients with chronic pain and their spouses, and second, to determine whether the two versions of the PCS measure have the same content across patients with chronic pain and their spouses, especially in a nonwestern population.

Materials and Method

Participants and Procedures

Participants were recruited from two large clinical centers, including the general hospital of Atieh and Rasa pain clinic, both located in Tehran, Iran. The study was approved by the university research ethics committee and the mental health center of the hospital. Eligible participants were couples that were referred to the pain centers, and of the participants, only one had chronic musculoskeletal pain for at least 3 months. Couples were also required to be married and live together. Exclusion criteria included the presence of a brain injury or a major cognitive dysfunction. Dyads were excluded if both of them had chronic pain. Patients and spouses were approached while waiting for an appointment with their orthopedist. The secretaries of the pain clinic of the hospital and the physiotherapist in the pain clinic, who were previously informed of the inclusion/exclusion criteria, helped out to identify eligible patients and spouses while registering the patients and completing their medical records. Thereafter, the researcher reevaluated the inclusion/exclusion criteria and after shortly describing the study, invited the eligible participants to take part in the study. All participants provided informed consent before filling the questionnaires. Patients with chronic pain were predominantly female ($n = 96$, 67.6%) with an age average of 45.89 years ($SD = 11.90$). Their spouses were on average 47.51 years old ($SD = 12.25$). The mean marriage duration was 22.99 years ($SD = 13.42$). Patients with chronic pain reported a mean pain duration of 46.33 ($SD = 65.69$) months. Most participants reported multiple pain locations (48.6%) including pain in their back (14.8%), knee (14.8%), and feet (12%).

Measures

A battery of questionnaires was used to assess pain catastrophizing, fear of movement, and depression in patients with chronic pain and their spouses.

Pain catastrophizing. To assess pain catastrophizing in the current study, we used the PCS-Patient version (PCS-P) for the patients with chronic pain and the PCS-Significant other version (PCS-S) for the spouses. Both scales consisted of 13 items that measured three dimensions of pain catastrophizing: rumination (four items; e.g., patient version: "I keep thinking about how much it hurts"; significant other version: "I keep thinking about how much it hurts for him/her"), magnification (three items; e.g., patient version: "I become afraid that the pain may get worse";

significant other version: “I become afraid that his/her pain may get worse”), and helplessness (six items; e.g., patient version: “There is nothing I can do to reduce the intensity of the pain”; significant other version: “There is nothing I can do to reduce the intensity of his/her pain”). Respondents had to rank each statement on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*always*) with respect to the painful experiences and indicated the degree to which they experienced those thoughts and feelings (Sullivan et al., 1995). The final score ranged from 0 to 52. Numerous studies have endorsed the reliability and validity of the PCS-P and the PCS-S versions (Osman et al., 1997; Sullivan et al., 1995; Sullivan, Tripp, & Santor, 2000). In the current study, the Persian versions of the PCS-P and the PCS-S were used. These versions have been previously used in different studies among Iranian populations and both scales have shown acceptable reliability (Mohammadi et al., 2012; Raeis-sadat et al., 2013).

Patients with chronic pain completed the PCS-P (Sullivan et al., 1995), and their spouses completed the PCS-S version to assess the extent to which they catastrophize the patients' pain (Cano et al., 2005). In the PCS-S version, the opening sentence of the measure was changed from “When I feel pain . . .” to “When my spouse has pain . . .” to reflect the spouse's catastrophizing thoughts about patient's pain. In the present sample, internal consistency (Cronbach's alpha) for the PCS-S was .86 for the 13-item total score, .71 for rumination, .66 for magnification, and .78 for helplessness. Also, internal consistency (Cronbach's alpha) for the PCS-P was .80 for the 13-item total score, .71 for rumination, .64 for magnification, and .73 for helplessness.

Depression. To investigate depression in patients with chronic pain and their spouses, a subscale of the Depression, Anxiety, and Stress Scale (DASS-42; Lovibond & Lovibond, 1995) was used, which consisted of 14 items. Both patients and their spouses were asked to focus on the past week and report the extent they have experienced each symptom on a Likert-type scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). Interitem reliability of this subscale was excellent for both patients with chronic pain (i.e., $\alpha = .94$) and their spouses (i.e., $\alpha = .91$). This measure has been translated into Persian and it showed acceptable psychometric properties (Khatibi, Dehghani, Sharpe, Asmundson, & Pouretmad, 2009; Mohammadi et al., 2012).

Fear of movement. Fear of movement was assessed with the Tampa Scale of Kinesiophobia (Swinkels-Meewisse, Swinkels, Verbeek, Vlaeyen, & Oostendorp, 2003; Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). It is a self-report scale, including 17 items, each rated on a 4-point Likert-type scale (1 = *extremely disagree* to 4 = *extremely agree*). The total score was calculated after reversing four items (Item numbers: 4, 8, 12, 16). Higher scores reflected greater fear of movement. To assess fear of movement among spouses regarding their patients' condition, some changes in the wording of each item were made (i.e., “My accident has put my body at risk for the rest of my life” was changed to “His/her accident has put his/her body at risk for the rest of his/her life”). It has been shown that this scale has good reliability and validity (Vlaeyen et al., 1995). This measure has been translated into Persian and its psychometric properties were acceptable in previous studies (Khatibi et al., 2009; Mohammadi et al., 2012). Interitem reliability of this scale was good for both partners in the

current study (patients with chronic pain: $\alpha = .80$ and their spouses: $\alpha = .70$).

Statistical Analysis

Several confirmatory factor analyses (CFA) were performed using Amos 20.0, to examine the factor structure of the PCS-P and PCS-S versions. Maximum likelihood estimation was used for all models. The CFA analysis provides a number of indices to evaluate the “goodness of fit” for specified models (Mulaik et al., 1989). In line with the recommendations of Byrne (2001), several fit indices were utilized to examine the goodness-of-fit: the normal chi-square ($3 > \chi^2/df < 2$), which is very sensitive to sample size with a nonsignificant χ^2 , implying the goodness-of-fit of the model to the data. In a small sample size, a poor fit may nevertheless result in a nonsignificant χ^2 . It is also possible that in a large sample size a good fit results in a statistically significant χ^2 (Marsh, Balla, & McDonald, 1988); normed fit index (NFI $> .90$); comparative fit index (CFI $> .90$); Tucker–Lewis Index (TLI); the root mean square error of approximation (RMSEA) and its 90% confidence interval. RMSEA values of .08 or less were considered as evidence of adequate fit.

Based on previous research, four models of pain catastrophizing were tested in order to assess the factor structure of the PCS-P and the PCS-S. For each of these versions, a one-factor model was first investigated, in which the 13 items were hypothesized to measure a single latent factor (i.e., pain catastrophizing). Second, the oblique two-factor model, suggested by Osman et al. (1997), in which the seven magnification–helplessness items and the six rumination items are assumed to be indicators of two correlated dimensions. Third, the oblique two-factor model, suggested by Chibnall and Tait (2005) in which nine magnification–helplessness items and four rumination items are assumed to be indicators of two correlated dimensions. Fourth, the oblique three-factor model, proposed by Sullivan et al. (1995), in which the four rumination items, three magnification items, and six helplessness items were hypothesized to measure three correlated dimensions. Furthermore, the invariance in the factor structure of the best fitting model was examined across patients with chronic pain and their spouses.

To examine whether the selected model of pain catastrophizing scales is equivalent across patients and spouses, a multigroup analysis was conducted. Invariance multigroup analysis provided this possibility to examine the factor structure across two different samples simultaneously based on a baseline model and provided baseline values that all other invariant models were compared against it. The factor loadings and intercorrelations were constrained to be equal across the two groups.

Results

Confirmatory Factor Analyses

Based on the multiple fit statistics displayed in Table 1, it can be concluded that the two-factor model (9 + 4 items) provided the best fit for the data in both patients and spouses (i.e., patients' sample: CFI $> .95$, NFI $> .91$, and RMSEA $< .06$; spouses' sample: CFI $> .91$, NFI $> .90$, and RMSEA $< .07$),

Table 1
Goodness-of-Fit Summary for Different Models Tested

Model	χ^2/df	RMSEA*	CFI†	NFI‡	TLI§
Patient sample					
Model 1: One factor (13 items)	208.16/65	.13	.76	.69	.71
Model 2: Two oblique factors (7 + 6 items)	195.14/65	.12	.78	.72	.74
Model 3: Two oblique factors (9 + 4 items)	90.84/60	.06	.95	.91	.93
Model 4: Three oblique (3 + 4+6 items)	148.94/62	.10	.86	.78	.82
Spouse sample					
Model 1: One factor (13 items)	262.61/65	.15	.61	.55	.53
Model 2: Two oblique factors (7 + 6 items)	236.15/65	.14	.66	.59	.59
Model 3: Two oblique factors (9 + 4 items)	123.16/58	.07	.91	.90	.88
Model 4: Three oblique (3 + 4+6 items)	176.26/62	.11	.77	.70	.71

§ Tucker-Lewis Index. ‡ normed fit index. † comparative fit index. * root-mean-square-error of approximation.

while the one-factor model provides the poorest fit. These results indicate that the pain catastrophizing scale can be represented by two correlated latent dimensions, namely rumination and magnification–helplessness. The standardized factor loadings in both samples are presented in Figure 1.

Invariance of the Oblique Two-Factor Model Across Patients With Chronic Pain and Their Spouses

The results of multigroup analysis revealed that the specified model adequately fits the data for both patient and spouse samples, $\chi^2(126) = 231.22, p < .001$; CFI = .90; NFI = .84, RMSEA =

.05, meaning that the two-factor model was invariant across patients with chronic pain and their spouses. Moreover, the intercorrelation between the latent rumination, and magnification–helplessness dimensions did not differ significantly across patients with chronic pain and their spouses.

Internal Consistency

The internal consistency coefficients, means, and SDs for the catastrophizing scales (i.e., PCS-P and the PCS-S versions) are presented for patients and spouses in Table 2. As shown in Table 2, the internal consistency reliability was .71 for rumination and .84 for magnification–helplessness in patients with chronic pain's sample. In the spouses' sample, the internal consistency reliability was .71 for rumination subscales and .80 for magnification–helplessness subscales. These findings suggest that these subscales have adequate internal consistency.

Convergent Validity

Convergent validity was examined by investigating the correlation between the PCS and other pain-related measures such as depression and fear of movement. Correlation coefficients between rumination and magnification–helplessness with depression and fear of movement were calculated in each sample. Among patients with chronic pain, there were significant positive correlations between rumination and magnification–helplessness, $r = .49, p <$

Figure 1. Oblique two-factor model of the PCS displaying standardized regression coefficients (i.e. factor loadings). Patients' coefficients are presented first. Spouses' coefficients are presented within parentheses. PCS = Pain Catastrophizing Scale.

Table 2
Psychometric Properties of the Pain Catastrophizing Scale for Patients and Their Spouses

Group	Rumination	Magnification–helplessness	PCS*
Patients			
$\alpha^\dagger$	.71	.84	.86
Mean	12.35	15.52	27.87
SD‡	3.12	7.72	9.63
Spouses			
α	.71	.80	.84
Mean	13.30	15.70	29
SD	2.72	6.76	7.97

* standard deviation. † internal consistency reliability. * Pain Catastrophizing Scale.

.001. All the other correlations among rumination, magnification–helplessness, depression, and fear of movement were also significant in the patients' sample.

Among spouses, the correlation between rumination and magnification–helplessness was also significant, $r = .29$, $p = .001$. In addition, all the other correlations among the main variables were significant in the spouses' sample, except for the correlation between rumination and depression ($r = .13$; $p = .13$). A multivariate analysis of variance (MANOVA) with gender as between-groups and two subscales as within-group variables showed no significant group differences. Thus, no more results were reported. Table 3 shows the correlations among the main variables in the study in each sample.

Discussion

The primary objective of this study was to investigate the factor structure of the PCS-P and the PCS-S using CFA in patients with chronic pain and their spouses. In addition, we examined the invariance of the factor structure of the PCS-P and the PCS-S among patients with chronic pain and their spouses using multi-group analysis. Results showed that the two-factor model (9 [magnification–rumination] + 4 [helplessness] items) of the pain catastrophizing scale demonstrated the best fit across the patients and their spouses. All items of the two-factor model loaded on their original factors, supporting previous research that the PCS assesses two related, yet different dimensions of catastrophizing (magnification–helplessness and rumination) in patients with chronic pain and their spouses (Chibnall & Tait, 2005). The results of this study are alongside with previous studies conducted by Chibnall and Tait (2005) on a sample of patients with low back injuries. They indicated that the two-factor model of the PCS (magnification–helplessness and rumination) was the most parsimonious model to their data. However, the results are in contrast with previous studies, which found a three-factor model of the PCS (Cano et al., 2005; Van Damme, Crombez, Bijttebier, Goubert, & Van Houdenhove, 2002). This inconsistency indicates that the questionnaire score does not have the same meaning for all groups. Such discrepancies might be related to the different samples used in these studies. For example, in the study conducted by Van Damme et al. (2002), students were used as the pain-free sample, and the patient sample included patients with fibromyalgia and chronic lower back pain. It is also possible that cultural differences explain such discrepancies as the current study was conducted in a

nonwestern population. In addition, interitem consistency for the PCS-P and PCS-S subscales were adequate for both patients with chronic pain and their pain-free spouses and nearly close to the results of the interitem consistency of the original PCS (with the exception of the rumination subscale; Sullivan et al., 1995). Consistent with the findings of previous studies (Meyer, Spratt, & Mannion, 2008; Osman et al., 2000) and for both patients with chronic pain and their spouses, the lowest values were for the internal consistency of the magnification subscale. This is most likely due to the fewer number of items in this subscale since the internal consistency is particularly sensitive to the number of items in the scale (Osburn, 2000). Previous studies, which found a three-factor model of pain catastrophizing, questioned whether magnification could be reliably used as an independent subscale because of its low value of Cronbach's alpha (Meyer et al., 2008). Combining helplessness and magnification into a single factor, as suggested in the current study, would significantly increase the internal consistency of this subscale, and therefore resolve the reliability problem for this subscale.

Results also indicated that our model was invariant across heterogeneous couples. These findings suggest that patients with chronic pain and their spouses are likely to share similar patterns of catastrophizing. While the data in the current study is cross-sectional, sharing a similar pattern of catastrophizing among patients and their spouses might be a result of living together. This finding is not unexpected due to similarities of cognitive processing patterns between patients with chronic pain and their spouses (Mohammadi et al., 2012).

Additionally, convergent validity was examined by investigating the strength of the relationship between the PCS-P and the PCS-S scores and the scores for other constructs such as fear of movement and depression that are theoretically related to pain catastrophizing. The associations between catastrophizing, fear of movement, and depression were at a moderate level suggesting that pain catastrophizing measures a different construct, but related to the mentioned constructs. However, the association between catastrophizing, fear of movement, and depression was weaker in spouses than in patients. Such findings suggest that catastrophizing and depression might be more distinct constructs in spouses than in patients with chronic pain.

The results of our study have a number of implications. In sum, the present study is the first to evaluate the factor structure of both the PCS-P and the PCS-S in a sample of Persian-speaking patient with chronic pain and their spouses. Findings of the current study suggest that the two-factor model comprising of magnification–helplessness and rumination would better measure pain catastrophizing thoughts among Persian-speaking population. Due to the extensive use of the PCS-P and the PCS-S in pain research, as well as the recent focus on the role of family caregivers in the development and maintenance of pain, examination of the factor structure and invariance of the PCS-P and the PCS-S in patients and spouses contributes to the understanding of pain-related factors in the context of couples and families as posited in the biopsychosocial model. The findings of the present study support the idea that the PCS-P and the PCS-S can be used for both patients with chronic pain and their spouses to measure this cognitive factor in both research and clinical practice. Particularly, the PCS seems to evaluate the same processes of catastrophizing in patients with chronic pain and their

Table 3
The Correlation Among All the Outcome Measures

Measures	1	2	3	4	5	6	7
1. Rumination-patient	1						
2. Rumination-spouse	.007						
3. Magni-help [†] -patient	.49**	-.005					
4. Magni-help [†] -spouse	.02	.29**	.27**				
5. Depression-patient	.36**	-.11	.64**	.22**			
6. Depression-spouse	.15	.13	.33**	.39**	.32**		
7. TSK [‡] -patient	.35**	-.02	.47**	.24**	.41**	.17*	
8. TSK [‡] -spouse	.04	.20*	.11	.37**	.13	.28**	.34**

[‡] Tampa Scale of Kinesiophobia. [†] magnification–helplessness. * $p < .05$. ** $p < .01$.

spouses, although they are different in experiencing pain. That is, patients who are suffering from chronic pain and their spouses with no pain, have a similar understanding of the meaning of the items. This finding might indicate that they have the same understanding of the pain and its implications. Therefore, partners could be a valuable source for evaluating patients' conditions. Our findings imply that patients with chronic pain and their spouses share similar cognitive patterns (i.e., pain catastrophizing). This similarity facilitates the generalization and comparison of findings from both patients and spouses using the PCS. Furthermore, our findings indicate the importance of including partners in the treatment given that catastrophizing spouses increase the likelihood that both spouses concentrate on the patient's pain, thereby leading to more distress and disability. Particularly, clinicians should be aware of the sources that reinforce the maladaptive cognitions (e.g., partners), identify patients and partners' cognitions using the same measures, and help them to change those cognitions. This study is limited also in terms of including only dyads of male-female married couples. There are different combinations of dyads referring to the clinical setting that the findings of this study may not be applied to. Although previous studies (e.g., Mohammadi et al., 2012) reported cognitive similarities in different dyads, this remains as a question to be investigated that similarities on responding to the PCS-P and the PCS-S are the same across different dyads. Future studies would benefit from including patient-spouse interaction measures (i.e., solicitous responding, marital satisfaction) to explore the relationship between patients and their spouses more extensively and the impact of these interactions on the catastrophizing patterns in patients with chronic pain and their spouses.

The results of this study might be a promising pathway toward the application of the PCS for the assessment of catastrophizing in spouses, which would enhance the theoretical understanding of the social context of pain. Our results not only suggest invariance of the factor structure of the PCS between couples, but also provide a cross-cultural invariance of this scale, as we replicated the same factor structure using a translated version of the PCS-P and the PCS-S in a nonwestern sample. The current study contributes to the literature in terms of introducing Middle-Eastern samples in the pain literature that are not well represented.

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