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ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

Psychometric properties of the Greek version of the Pain Catastrophizing Scale in patients with chronic neck pain

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ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2022, 39(6):760–766

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OBJECTIVE **Examination of the construct validity and internal consistency of the Greek version of the Pain Catastrophizing Scale (PCS) in patients with chronic neck pain.** METHOD **Data from 45 patients with chronic neck pain, who completed the Greek version of the PCS, were used. The patients were aged 35.9±14.5 years and had experienced neck pain for longer than 6 months, at least once per week.** RESULTS **The Greek version of the PCS was found to have very good internal consistency (α=0.78–0.95). Confirmatory factor analysis showed that the data had a very good fit to the model (x^2=77.71, p=0.09). The loadings of the items to their corresponding subscale were 0.75–0.92 for the rumination subscale, 0.58–0.91 for the magnification subscale and 0.38–0.93 for the helplessness subscale. The scale showed good convergent validity (average variance extracted: 0.63–0.68), but its subscales had questionable divergent validity. The scale can discriminate well between patients with different levels of catastrophizing (male versus female, M_{diff}=8.43, p=0.03). No ceiling or floor effects were observed.** CONCLUSIONS **The Greek version of the PCS has very good construct validity and internal consistency for the assessment of pain catastrophizing in patients with idiopathic chronic neck pain. With the PCS, health professionals, including physicians, psychiatrists, psychologists, and physiotherapists are provided with a valid and reliable tool for monitoring catastrophizing and estimating the effectiveness of their therapeutic interventions in patients with chronic neck pain.**

Ψυχομετρικά χαρακτηριστικά της ελληνικής έκδοσης της κλίμακας καταστροφολογίας του πόνου σε ασθενείς με χρόνιο αυχενικό πόνο

Περίληψη στο τέλος του άρθρου

Key words

Catastrophizing
Helplessness
Magnification
Neck pain
Rumination

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Neck pain is one of the most common musculoskeletal complaints, and it is associated with a number of accompanying manifestations, including limitation in muscle efficiency and range of movement,[1–3] impaired proprioception,[4] postural adaptations,[5] respiratory dysfunction[6] and psychological compromise.[7] The psychological manifestations of neck pain may include impaired mood states, such as anxiety, depression, kinesiophobia and catastrophizing.[7]

Catastrophizing has been described as a negative mental predisposition towards actual or anticipated pain experience.[8] Catastrophizing is a psychological state that is apparent in patients with chronic neck pain[7] and plays an important role in the prediction of recovery of patients after rehabilitation.[9] Catastrophizing may lead to a more intense experience of pain and increased emotional distress. The reason for catastrophizing is not understood, and it is mainly regarded as a belief, cognitive distortion, appraisal process, attentional process or coping strategy. Catastrophizing is a psychological state that is closely connected to kinesiophobia, as patients who catastrophize may restrain from movements and activities and it is frequently believed that an indirect effect of this is the basis for its contribution to prolongation of pain and disability.[8]

The assessment of pain catastrophizing necessitates

scales with acceptable psychometric properties in order to provide valid and reliable evaluation. Such a scale would contribute not only to more accurate description and understanding of the phenomenon, but also to the assessment of the appropriateness of different therapeutic strategies for its management. The Pain Catastrophizing Scale (PCS) is the most frequently used scale for assessing pain catastrophizing, with very good psychometric properties.[10,11] The PCS has been partially validated in patients with neck pain[12] and has been cross-culturally validated in the Greek language,[13,14] but according to the authors' knowledge no information has yet been published on its psychometric properties in Greek patients with chronic neck pain.

The aim of this study was to evaluate the internal consistency and structural validity of the PCS in Greek patients with chronic neck pain.

MATERIAL AND METHOD

Participants

The study sample was 45 patients with idiopathic chronic neck pain (pain chronicity >6 months, at least once per week) who had participated in a previously published study.[15] The eligibility criteria have been described elsewere.[15] Data collection was performed at the Cardiorespiratory Laboratory of the Department of Physiotherapy of the Technological Educational Institute (TEI) Lamia (Lamia, Greece) 2009–2010. The study had been approved by the Ethics Committee of the University of Manchester (Manchester, UK) and the Ethics Committee of the TEI of Lamia (Lamia, Greece).

Pain Catastrophizing Scale

PCS is a 13-item instrument that reflects three aspects of catastrophizing,[10] "rumination" (4 items), "magnification" (3 items) and "helplessness" (6 items). Each item is scored on an ordinal scale ranging from 0 (not at all) to 4 (all the time), giving a total score from 0 to 52. High scores correspond to high levels of catastrophizing. The questionnaire has been cross-culturally validated in the Greek language.[13,14]

Data analysis

Internal consistency of the scale was established with item-to-total, subscale-to-total and item-to-subscale analyses and calculation of the corresponding Cronbach's α values. Depending on Cronbach's α, internal consistency can be considered unacceptable (Cronbach's α <0.5), poor (Cronbach's α=0.5–0.6), questionable (Cronbach's α=0.6–0.7), acceptable (Cronbach's α=0.7–0.8), good (Cronbach's α=0.8–0.9) and excellent (Cronbach's α >0.9).[16] However, a Cronbach's α >0.95 is not necessarily desirable as this may indicate redundancy.[17]

Ceiling and floor effects were examined by calculating the percentage of patients whose scores were in the highest and lowest 10% of the range of the instrument. If more than 15% of the patients' ratings are found at the top or bottom 10% of the range, then the instrument is believed to have considerable ceiling or floor effects, respectively.[18]

Construct validity was examined by using the known groups method and confirmatory factor analysis. For the known groups method the pain catastrophizing scores were compared between the men and the women of the sample, with the expectance that the women would have significantly higher scores.[19] The comparison was performed with an independent t-test.

Confirmatory factor analysis was performed for examining the fit of the data into the predetermined structure of the instrument, using maximum likelihood estimates. Standardized regression weights for each item and subscale were calculated. The fit of the data into the model was examined by using the x^2 test, the comparative fit index (CFI), the Tucker-Lewis index (TLI), the goodness of fit statistic (GFI) and the root mean square error of approximation (RMSEA). CFI, TLI and GFI values of >0.9 indicate a good fit. An RMSEA of <0.05 indicates a good fit and an RMSEA of <0.08 an acceptable fit. A non-significant test of the RMSEA (PCLOSE >0.05) is also indicative of an acceptable fit.[20]

Convergent and discriminant validity of the model were explored by calculating the average variance extracted (AVE) and the √AVE for each subscale. AVE was calculated as the sum of the squared standardized loadings divided by the number of items on each subscale. For establishing convergent validity an AVE ≥0.5 was required for each subscale. For establishing discriminant validity √AVE was required to be higher than the correlations between the latent variables.[21,22]

Significance level was set at p=0.05. IBM SPSS Amos versus 21.0 software was used for the confirmatory factor analysis. All the other analyses were performed with the Statistical Package for Social Sciences (IBM, SPSS), version 26.0.

RESULTS

The demographic characteristics of the participants were presented in earlier publication.[15] The sample included 13 male and 32 female patients with idiopathic chronic neck pain, with a mean age of 35.9±14.5 years, pain chronicity of 69.6±57.6 months and pain intensity of 45.5±18.8 mm, as recorded on a visual analog scale.

Internal consistency

Item-to-total analysis revealed a high internal consistency of the scale (Cronbach's α=0.95). Subscale-to-total analysis also revealed high internal consistency (Cronbach's α=0.86). The internal consistency from the item-to-subscale

analyses ranged from acceptable to excellent (Cronbach's α=0.78–0.91). The findings of these analyses are presented in table 1.

Ceiling and floor effects

Only 3 patients provided pain catastrophizing ratings in the lowest 10% of the scale, and none in the highest 10%. The distribution of patients across the PCS scores is presented graphically in figure 1.

Known group validity

Female patients with idiopathic chronic neck pain were found to have significantly lower PCS scores ($p<0.05$) than male patients with idiopathic chronic neck pain. The details of this comparison are presented in table 2.

Factorial validity

Confirmatory factor analysis revealed a statistically non-significant x^2 ($x^2=77.71$, df=62, $p=0.09$). Other find-

Table 1. Item-to-total, item-to-subscale and subscale-to-total analysis for the Pain Catastrophizing Scale (PCS) in patients with idiopathic chronic neck pain (n=45).

Type of analysis	Domain/item PCS	Corrected subscale/item-to-total r	Cronbach's α if item deleted	Cronbach's α
Subscale-to-total	PCS rumination	0.84	0.69	0.86
	PCS magnification	0.74	0.88	
	PCS helplessness	0.83	0.76	
Item-to-total	Item 1	0.78	0.94	0.95
	Item 2	0.79	0.94	
	Item 3	0.78	0.94	
	Item 4	0.87	0.94	
	Item 5	0.87	0.94	
	Item 6	0.83	0.94	
	Item 7	0.57	0.95	
	Item 8	0.70	0.94	
	Item 9	0.83	0.94	
	Item 10	0.82	0.94	
	Item 11	0.83	0.94	
	Item 12	0.42	0.95	
	Item 13	0.55	0.95	
Item-to-subscale rumination	Item 8	0.71	0.92	0.91
	Item 9	0.89	0.86	
	Item 10	0.77	0.90	
	Item 11	0.85	0.87	
Item-to-subscale magnification	Item 6	0.62	0.70	0.78
	Item 7	0.65	0.67	
	Item 13	0.59	0.74	
Item-to-subscale helplessness	Item 1	0.79	0.89	0.91
	Item 2	0.84	0.88	
	Item 3	0.83	0.88	
	Item 4	0.87	0.88	
	Item 5	0.88	0.88	
	Item 12	0.36	0.95	

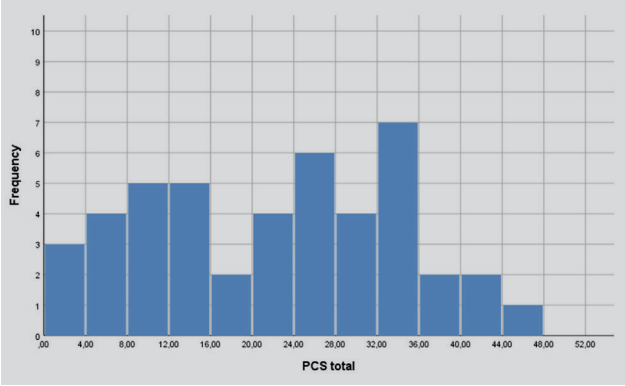

Figure 1. Distribution of total scores on the Pain Catastrophizing Scale (PCS) of patients with idiopathic chronic neck pain (n=45).

Table 2. Scores on the Pain Catastrophizing Scale (PCS) of male (n=13) and female (n=32) patients with idiopathic chronic neck pain.

Group	M (SD)	M_{diff}	95% CI	p
Male	15.38 (11.81)	8.43	0.85, 16.00	0.03
Female	23.81 (11.26)			

M (SD): Mean (standard deviation), M_{diff}: Mean difference, 95% CI: 95% confidence intervals

ings about the fit of the model were TLI=0.96, CFI=0.97, GFI=0.83. Additionally, RMSEA was not statistically significant (RMSEA=0.08, PCLOSE=0.23). The loading of items on their corresponding subscales and of each subscale to the total score were all statistically significant ($p<0.05$), specifically 0.75–0.92 for the rumination items, 0.58–0.91 for the magnification items, 0.38–0.93 for the helplessness items and 0.92–0.93 for the subscales. The standardized values are presented in table 3 and figure 2.

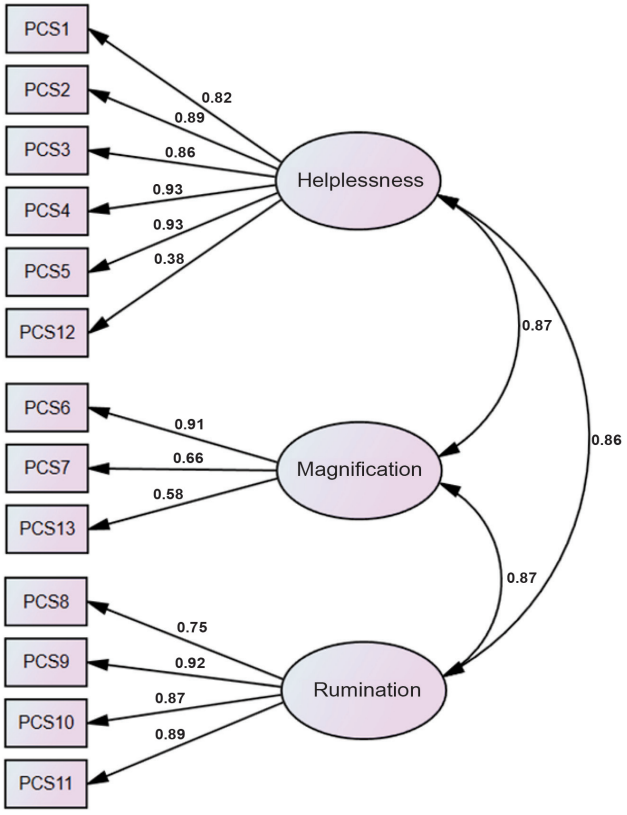

Figure 2. Standardized estimates of Pain Catastrophizing Scale (PCS) items loadings.

Table 3. Convergent and discriminant validity of the Pain Catastrophizing Scale (PCS).

Subscale	Item	Standardized loading	AVE	√AVE	Latent variables correlations (r)
Rumination	Item 8	0.75	0.74	0.63	Rumination with magnification (0.87)
	Item 9	0.92			Magnification with helplessness (0.87)
	Item 10	0.87			Rumination with helplessness (0.86)
	Item 11	0.89			
Magnification	Item 6	0.91	0.54	0.73	
	Item 7	0.66			
	Item 13	0.58			
Helplessness	Item 1	0.83	0.68	0.82	
	Item 2	0.89			
	Item 3	0.86			
	Item 4	0.93			
	Item 5	0.93			
	Item 12	0.38			

AVE: Average variance extracted

Convergent and discriminant validity

The AVEs of the subscales were found to be greater than 0.5 (AVE: 0.63–0.68). √AVEs were found to be lower (0.63–0.82) than the latent variables correlations (r 0.86–0.87) (tab. 3).

DISCUSSION

The Greek version of the PCS was found to be a valid and reliable instrument for the assessment of catastrophizing in patients with idiopathic chronic neck pain. The instrument was found to have excellent internal consistency, very good factorial validity, no floor and ceiling effects, and to be able to discriminate between patients with different level of catastrophizing.

The internal consistency of the instrument was found to be excellent. Item-to-total analysis revealed excellent internal consistency. Item-to-subscale analysis also revealed acceptable to excellent internal consistency. These findings are in agreement with a study[14] which examined the internal consistency of the scale in Greek patients with degenerative disc disease and found good internal consistency for all the subscales (rumination subscale α=0.91, magnification subscale α=0.92, helplessness subscale α=0.94, PCS total α=0.94). The findings from a non-Greek version of the PCS in patients with whiplash[12] lead to similar conclusions, although the internal consistency was slightly worse than that of the current study (rumination subscale α=0.82, magnification subscale α=0.63, helplessness subscale α=0.79, PCS total α=0.89), which may be attributed to the different causes and characteristics of chronic neck pain. Both versions presented their worst internal consistency for the magnification subscale of the instrument.

The factorial validity of the instrument was also very good. TLI, CFI and x^2 revealed a good fit of the model, and GFI was also acceptable. RMSEA with a non-statistically significant PCLOSE also leads towards the same conclusion. The loadings of items on their corresponding subscales were also good, with the exception of item 12 on the helplessness subscale. Similar conclusions about the fit of the model derive from the confirmatory factor analysis of the Catalan version of PCS in whiplash patients,[12] although the loadings of items into their corresponding subscales were somewhat worse (helplessness subscale 0.42–0.71, magnification subscale 0.42–0.78, rumination subscale 0.66–0.80). Similarly to the current study, in the Catalan version of the instrument[12] it was also found that the item 12 had the worst loading into its corresponding subscale.

The PCS was also found to have very good convergent validity, but its discriminant validity was not satisfactory, as the √AVEs were found to be lower than the latent variables correlations.[21] Based on the known-groups method, however, the instrument was found to be able to discriminate well between groups with different levels of catastrophizing, such as males and females.[19] These findings lead to the conclusion that the Greek version of PCS can, in general, be considered as an instrument with satisfactory construct validity.

The PCS was also found not to suffer from ceiling or bottom effects. The percentage of scores in the lowest or highest 10% of the potential scale scores was much less than 15%.[18] In addition, the scores were variably dispersed across the range of the scale. These findings reveal that the PCS can offer responders a satisfactory range of potential ratings, in order for their different levels of catastrophizing to be distinguishable.

The major limitation of the current study was the small number of participants for performing factorial analysis. The sample size requirements for a factorial analysis are not absolutely agreed.[23] Some researchers suggest that the sample size should be based on absolute values, others on patients/variables ratios and others on the number of variables, factors, variables per factor and the size of communalities.[23] The problem of appropriate sample size is aggravated by the inconsistency among recommendations of the sample size estimation rationale.[23] Some recommendations suggest a ratio of 3–6 times the number of variables.[24] Based on such a recommendation the sample size of the current study would be adequate, but based on other suggestions[25] for a ratio of 10 times the number of variables, the sample size of the current study was smaller than required. It appears that the sample size of the current study might be satisfactory for providing evidence of its factorial validity, but a larger sample would provide still more accurate indices.

The findings of the current study have important clinical implications for the everyday practice of health professionals, including physicians, psychiatrists, psychologists and physiotherapists. Catastrophizing is a psychological state that is closely associated with the experience of increased neck pain and disability.[7] Management of catastrophizing in patients with neck pain is an important part of rehabilitation, and it requires an interdisciplinary approach. A valid and reliable instrument for assessing catastrophizing is invaluable for evaluation and treatment. Such an instrument enables the valid monitoring of catastrophizing and the effectiveness of cognitive/behavioral or other interventions for its management.

ΠΕΡΙΛΗΨΗ

Ψυχομετρικά χαρακτηριστικά της ελληνικής έκδοσης της κλίμακας καταστροφολογίας του πόνου σε ασθενείς με χρόνιο αυχενικό πόνο

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ΣΚΟΠΟΣ Η διερεύνηση της δομικής εγκυρότητας και της εσωτερικής συνοχής της ελληνικής εκδοχής της κλίμακας καταστροφολογίας του πόνου (ΚΚΠ) σε ασθενείς με χρόνιο αυχενικό πόνο. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Χρησιμοποιήθηκαν δεδομένα από 45 ασθενείς με χρόνιο αυχενικό πόνο (χρονιότητα πόνου >6 μήνες, πόνος τουλάχιστον μία φορά ανά εβδομάδα, ηλικία 35,9±14,5 ετών). Οι ασθενείς είχαν συμπληρώσει την ελληνική εκδοχή της ΚΚΠ. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Η κλίμακα βρέθηκε να έχει πολύ καλή εσωτερική συνοχή (α=0,95). Η επιβεβαιωτική παραγοντική ανάλυση επίσης έδειξε ότι τα δεδομένα προσαρμόζονται πολύ καλά στο μοντέλο (x^2=77,71, p=0,09). Η παραγοντική φόρτιση των ερωτημάτων στις αντίστοιχες υποκλίμακες ήταν 0,75–0,92 για την υποκλίμακα μηρυκασμού, 0,58–0,91 για την υποκλίμακα μεγέθυνσης και 0,38–0,93 για την υποκλίμακα αβοηθησίας. Η κλίμακα είχε καλή συγκλίνουσα εγκυρότητα (μέση εξαχθείσα διακύμανση: 0,63–0,68), αλλά οι υποκλίμακες παρουσίασαν αμφισβητήσιμη αποκλίνουσα εγκυρότητα. Η κλίμακα είχε καλή διακριτική ικανότητα μεταξύ ασθενών με διαφορετικό επίπεδο καταστροφολογίας (άνδρες έναντι γυναικών, M_{diff}=8,43, p=0,03). Δεν παρατηρήθηκαν φαινόμενα οροφής ή δαπέδου. **ΣΥΜΠΕΡΑΣΜΑΤΑ** Η ελληνική εκδοχή της ΚΚΠ έχει πολύ καλή δομική εγκυρότητα και εσωτερική συνοχή για την αξιολόγηση της καταστροφολογίας του πόνου σε ασθενείς με ιδιοπαθή χρόνιο αυχενικό πόνο. Οι επιστήμονες υγείας, περιλαμβανομένων των ψυχιάτρων, των ψυχολόγων και των φυσικοθεραπευτών, έχουν διαθέσιμο ένα έγκυρο και αξιόπιστο εργαλείο για την παρακολούθηση της καταστροφολογίας και την εκτίμηση της αποτελεσματικότητας των θεραπευτικών τους παρεμβάσεων σε ασθενείς με χρόνιο αυχενικό πόνο.

Λέξεις ευρετηρίου: Αβοηθησία, Αυχενικός πόνος, Καταστροφολογία, Μεγέθυνση, Μηρυκασμός

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