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RESEARCH ARTICLE

Validation of pain catastrophizing scale on breast cancer survivor

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Abstract

Introduction: Pain catastrophizing scale (PCS) is the most used scale to measure pain catastrophizing. In breast cancer survivors (BCS), pain catastrophizing is related to upper-limbs dysfunction and disability. This study aimed to assess the internal consistency, internal structure, and convergent validity of the Spanish version of the PCS in Spanish BCS.

Material and Methods: Breast cancer survivors were recruited from the service of Medical Oncology of the University Clinical Hospital Virgen de la Victoria, in Málaga (Spain). The psychometric properties were evaluated with analysis factor structure by maximum likelihood extraction (MLE), internal consistency, and construct validity by confirmatory factor analysis (CFA).

Results: Factor structure was three-dimensional, and one item was removed due to cross-loading. The new 12-item PCS showed a high internal consistency for the total score ($\alpha = 0.91$) and a good homogeneity, and CFA revealed a satisfactory fit. PCS showed an acceptable correlation with FACS ($r = 0.53$, $p < 0.01$).

Conclusion: Pain catastrophizing scale is a valid and reliable instrument to evaluate pain catastrophizing in Spanish BCS. This tool may help clinicians in the management of pain by assessing pain and by measuring the effect of interventions.

KEYWORDS
breast cancer, catastrophizing, chronic pain, psychometric properties, validation studies

INTRODUCTION

Breast cancer is the most commonly diagnosed cancer in women, with a high rate of survival.[1] Therefore, a big amount of breast cancer survivors (BCS) must face sequelae of this disease and symptoms which may affect negatively their lives.[2,3] Between them, chronic pain can affect up to 30% of BCS 10 years after treatment,[4] reducing quality of life.[5] Therefore, its management is an important factor in the quality of life and in the rehabilitation treatment in BCS.[2,6] Chronic pain in this population has been widely studied,[7] including contributing psychological factors, such as catastrophizing.[8]

The term catastrophizing refers to an attentional focus on negative aspects of the patient's situation.[9] In the study of chronic pain, pain catastrophizing (PC) is defined as an exaggerated negative mental set brought to bear during actual or anticipated painful experiences.[10] Currently, PC is integrated as part of the Fear-Avoidance Model of Chronic Pain, which states that negative appraisals about pain and its consequences,

such as catastrophic thoughts, can drive into feelings of pain-related fear, avoidance of daily activities, or hypervigilance, resulting in physical deconditioning depression, and disability from work, recreation, and/or family activities.[11] Therefore, PC is a psychological construct that amplifies perceived painful sensations and predisposes to perpetuation of pain, constituting an important variable to be measured in BCS.[12,13]

The Pain Catastrophizing Scale (PCS) is a Patient-Reported Outcome (PRO) developed in 1995 to measure PC,[14] and it has been validated and adapted in different cultures, such as Spanish population.[15,16] The use of this PRO has allowed deep in the role of pain catastrophizing among BCS suffering chronic pain after surgery. In postmastectomy patients, PC is associated with pain severity, whereas other demographic, surgical, medical, and treatment-related variables are not.[17] In the late stage after breast cancer surgery, PC was associated with pain severity, while movement restriction or lymphedema was not.[18] In women suffering post-lumpectomy pain, elevated reports of painful cold after-sensations are explained by higher levels of catastrophizing,[19] and it has also shown a significant correlation with upper-limbs dysfunction.[20]

Besides current literature using PCS in BCS, the psychometric properties of this scale have not been assessed in breast cancer population. Therefore, the aim of the present study was to assess the internal consistency, internal structure, and convergent validity of the Spanish version of the PCS in Spanish BCS.

MATERIALS AND METHODS

Subjects and procedure

Patients were recruited from the service of Medical Oncology of the University Clinical Hospital Virgen de la Victoria, in Málaga (Spain). Data on BCS patients were obtained between May 2017 and February 2020. The inclusion criteria were (1) Spanish-speaking adults; (2) have signed an informed consent; and (3) BCS who had been surgically treated for their primary tumor with no evidence of recurrence at the time of recruitment. Exclusion criteria were (1) a poor Spanish language comprehension; (2) the participant's refusal to take part in the study; and (3) the participant being under 18 years old.

Potential participants who attended a physical medicine and rehabilitation consult from the University Clinical Hospital Virgen de la Victoria were asked by their oncologist to voluntarily participate in the study. Each participant received a detailed explanation of the study and gave written informed consent before participation. The PCS-Sp was self-completed. The University Clinical Hospital gave ethical clearance for the study, following the Declaration of Helsinki.

Measures

The Spanish version of the pain Catastrophizing scale (PCS-Sp)

The PCS was developed to measure pain catastrophizing by assessing the three components of catastrophizing: rumination ("I can't stop thinking about how much it hurts"); magnification ("I worry that something serious may happen"); and helplessness ("There is nothing I can do to reduce the intensity of the pain") patients have about their perceived ability to manage their pain.[14] It comprises 13 item scored from 0 to 4, with a total possible score of 52.[21] A total PCS score of 30 represents clinically relevant level of pain catastrophizing.[22]

The PCS has been adapted for different languages, such as Spanish,[15] Greek,[23] Portuguese,[24] or Bengali,[25] where it has proven to be both a valid and reliable instrument. The Spanish version of the PCS (PCS-Sp) was used in people with migraine[26] and fibromyalgia.[15] The PCS-Sp has demonstrated high internal consistency ($\alpha = 0.79$) and test–retest reliability (ICC = 0.84).[15]

Spanish fear avoidance components scale (FACS-Sp)

FACS-Sp was used for convergent validity. The original version of FACS was developed for assessing cognitive (pain catastrophizing), affective (pain-related fear/anxiety), and behavioral (avoidance) constructs of the current model of fear-avoidance in patients with chronic musculoskeletal pain disorders. In fact, FACS items were developed from the fear-avoidance components represented in PCS.[27]

This instrument consists of 20 items which are scored on a 6-point Likert scale, from 0 "completely disagree" to 5 "completely agree." A total score, which ranges from 0 to 100, can be obtained by adding the ratings of each item.[27]

FACS-Sp has been cross-cultural adapted and validated in Spanish patients with chronic musculoskeletal pain disorders[28] and BCS,[29] showing to be a valid and reliable instrument.[28]

Statistics

A descriptive analysis was applied to estimate the sociodemographic and clinical variables. A statistical psychometric analysis was carried out to evaluate the internal consistency, internal structure, and convergent validity of the PCS-Sp. The Kaiser-Meyer-Olkin (KMO) test was used to measure the sample adequacy, and Bartlett's test of sphericity was used to check for redundancy between variables. KMO >0.8 was considered adequate, together significant values for Bartlett's

test of sphericity. Exploratory factor analysis (EFA) with maximum likelihood extraction and varimax rotation was conducted to determine the internal structure of the questionnaire. To determine the structural validity of the questionnaire, confirmatory factor analysis (CFA) was performed. The model fit indices included chi-square (x^2), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI). For RMSEA, values ≤0.08 indicated a close and reasonable fit.[30] Items whose factor loading in the exploratory factor analysis were <0.40 were retained for subsequent analyses. Items that showed cross-loading were deleted.[31]

Cronbach's α coefficients were used to calculate the internal consistency of the scale.[32] The Pearson correlation coefficient was used to evaluate convergent validity between PCS-Sp and (FACS-Sp). Statistical analyses were performed using the Statistical Package for Social Science (SPSS) for Windows version 21.0 and SPSS AMOS.

RESULTS

Participant characteristics

The participants were 183 breast cancer survivors with a mean age of 51.31 (±9.5) years. Table 1 shows the characteristics of the sample, the received treatment, and the current treatment.

TABLE 1 Participant descriptive and clinical variables ($n = 183$)

Variable	Mean (SD)	Min-max
Age (years)	51.31 (9.35)	32.0–70.0
BMI[a] (Kg/m^2)	27.99 (5.70)	20–47.7
Years from diagnosis	2.36 (2.09)	0–13.0
Function		
30-STS[b]	21.48 (6.55)	3–36
ULFI[c]	70.17 (23.16)	0–100
CSI	34.22 (14.90)	0–73
Surgical intervention	Percentage (%)	
Breast-conserving surgery	70% (128)	
Mastectomy	30% (55)	
Cancer treatment		
Chemotherapy	81% (147)	
Radiotherapy	86% (156)	
Hormone therapy	80% (146)	
Monoclonal antibody	27% (49)	
Current treatment		
None	22% (40)	
Radiotherapy	2.7% (5)	
Monoclonal antibody	5.5% (10)	
Hormone therapy	60% (110)	

Abbreviations: CSI, Central Sensitization Index; SD, Standard Deviation.
[a]Body Mass Index.
[b]30 S Sit to Stand Test.
[c]Upper Limb Functional Index.

Exploratory factor analysis

The Bartlett's sphericity test rejected the null hypothesis of an identity matrix (df:906, sig<0.01) with a Kaiser-Meyer-Olkin (KMO) sample adequacy measure of 0.89 indicating that the sample was adequate.[33] For the extraction of factors were used the following criteria: eigenvalue >1, a value >10% of the variance, and a screen test (Figure 1) (Table 2).[34–36] Following these criteria, three factors were extracted with a variance explained of 70.83%.

The loading of the factors with a cutoff point >0.4 identified the following items in each factor (Table 3): factor 1 (four items) 2, 3, 4, and 5; factor 2 (four items) 8, 9, 10, 11, and factor 3 (four items) 1, 6, 7, 12. Item 12 was deleted due to cross-loading in factor 1, 2, and 3.

Scree plot shows the curve of the factors. The image shows a three-dimensional structure.

Confirmatory factor analysis

After the confirmatory factor analysis, the fit indexes were satisfactory with CFI = 0.95 and RMSEA = 0.08 for the entire questionnaire. The x^2 for the three factors was significant ($x^2 = 123.0$, df = 51, $p < 0.01$) (Figure 2). Figure shows the factor loading in a three-dimensional structure of the questionnaire.

Internal consistency

The mean score of the PCS was 9.83 (±9.51). The internal consistency, Cronbach's alpha, for the PCS, was 0.91 (0.91–0.92) indicating very good internal consistency (Table 4). The homogeneity of the scale was assessed on the basis of the corrected item-total correlation. The corrected item-total correlation ranged from 0.57 to 0.78 indicating a good fit, due to all values being above 0.30[37] (Table 4).

Convergent validity

Convergent validity between PCS-Sp and FACS-Sp was demonstrated. To assess convergent validity criteria, the PCS was compared with The Fear-avoidance Components Scale (FACS) due to the lack of a gold standard for the evaluation of the catastrophizing. The level of correlation found was acceptable ($r = 0.53$, $p < 0.01$) between both scales.

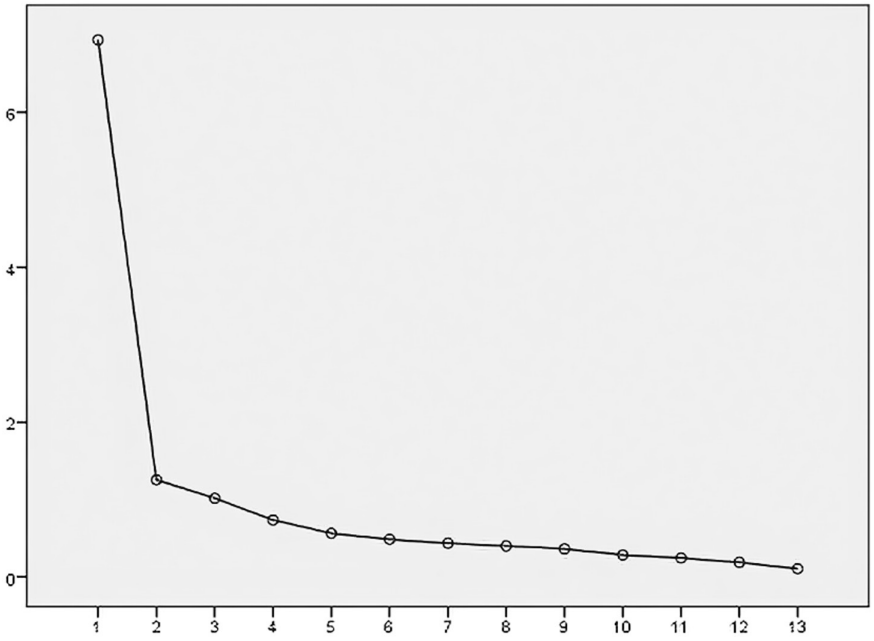

FIGURE 1 Scree plot of the rotated factors.

TABLE 2 Total variance explained

	Initial eigenvalues		
Factor	**Total**	**% of variance**	**Cumulative %**
1	6.94	53.39	53.39
2	1.25	9.64	63.01
3	1.02	7.82	70.83

TABLE 3 Factor loading matrix after varimax rotation

	Factor		
	1	**2**	**3**
Item 1			0.52
Item 2	0.63		
Item 3	0.72		
Item 4	0.84		
Item 5	0.71		
Item 6			0.57
Item 7			0.61
Item 8		0.55	
Item 9		0.75	
Item 10		0.85	
Item 11		0.77	
Item 13			0.75

DISCUSSION

To the best of our knowledge, this is the first time that the measurement properties of the PCS have been evaluated in Spanish BCS and the oncology population. After psychometric analysis, the item 12 was removed, resulting in a 12-item version that showed adequate measurement values for internal structure, internal consistency, and convergent validity. Therefore, at the light of the present results, the 12-item PCS-Sp is a valid and reliable instrument to evaluate pain catastrophizing in Spanish BCS.

The adjustment values obtained of a three-dimensional scale structure using maximum likelihood extraction were satisfactory. This adjustment was consistent with the original scale[22,38] and with the Spanish version validated in patients with fibromyalgia[15] and in healthy subjects[16] assessing the three components of catastrophizing (rumination, magnification, and helplessness). This three-factors model has shown the best fit in others populations and languages (pain-free students, chronic low back pain patients, and fibromyalgia patients).[23,39] However, one item (item12) showed cross-loading in the three factors, being a 12-item scale different compared with the validated version in Spanish population[15,16] with a 13-item version and with the original scale with a 14-item version.[22,38] Despite the three-dimensional scale structure shown in the present study, some studies have found a bi-dimensional model for this questionnaire,[24,40] and the differences between different models of the questionnaire have been studied due to the problem of the questionnaire to discriminating distinctions about factors.[41]

Values for internal consistency were excellent, ranging from 0.91 to 0.92[42] for each of the factors. The values found in the present study were consistent with the values of the original version with values ranging from 0.89 to 0.91.[38] The present scale has been validated in other Spanish population with similar values of internal

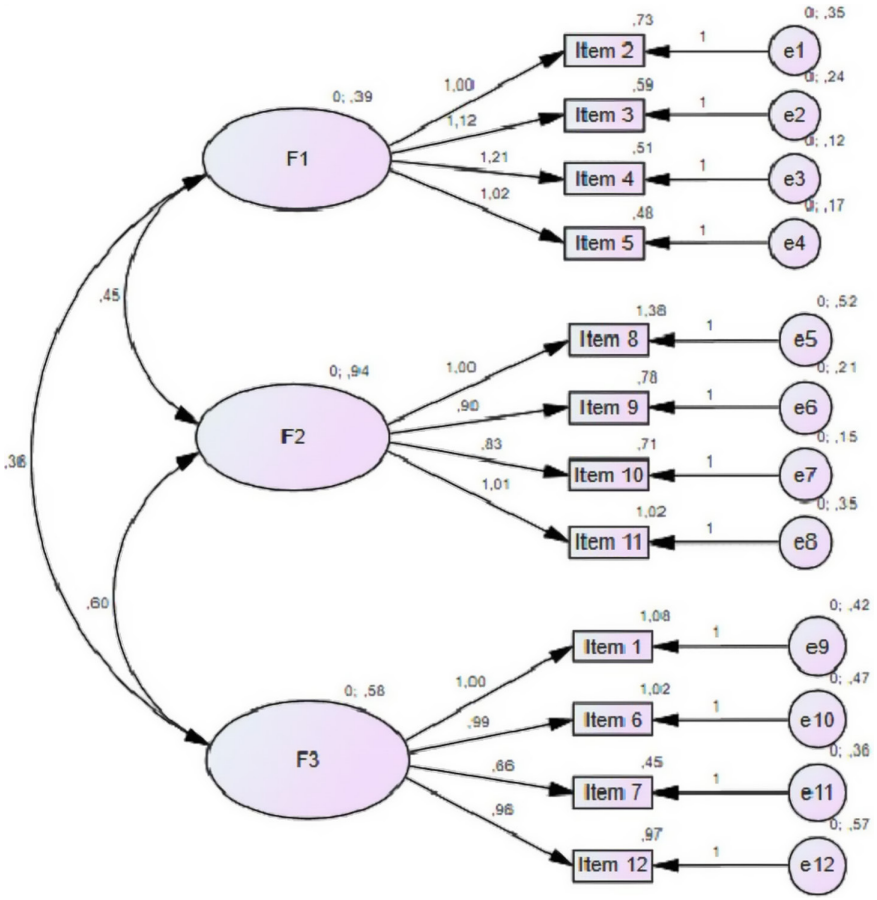

FIGURE 2 Patch way (three factors).

TABLE 4 Descriptive statistics and internal consistency for items from the PCS

PCS items	Mean ± SD	Corrected item-total correlation	Cronbach's alpha if item deleted
1	1.08 (±1.00)	0.64	0.91
2	0.73 (±0.85)	0.64	0.91
3	0.59 (±0.85)	0.69	0.91
4	0.51 (±0.83)	0.72	0.91
5	0.47 (±0.76)	0.63	0.91
6	1.02 (±1.02)	0.57	0.91
7	0.44 (±0.78)	0.74	0.91
8	1.38 (±1.21)	0.78	0.91
9	0.78 (±0.99)	0.77	0.91
10	0.71 (±0.89)	0.76	0.91
11	1.03 (±1.14)	0.57	0.92
13	1.00 (±1.05)	0.65	0.91
Total	9.83 (±9.51)		

Abbreviation: PCS, Pain Catastrophizing Scale.

consistency ranging from 0.78 to 082 for people with fibromyalgia and from 0.92–0.93 from Spanish healthy women.[43]

A gold standard was not available for validation of convergent validity. The Spanish versions of PCS and FACS showed a significant correlation ($r = 0.53$, $p < 0.01$), providing support for construct validity. This correlation was expected, as some items of PCS were reviewed in FACS development in order to integrate de cognitive (pain catastrophizing) construct of the current fear-avoidance model in this PRO.[27] Although the original version of the PCS has shown significant correlations with different variables such as pain intensity ($r = 0.57$–0.58), depression ($r = 0.44$–0.45), anxiety ($r = 0.39$–0.40) and anger ($r = 0.55$),[38] the Spanish version of PCS has shown similar values of convergent validity with others variables such as $r = 0.73$ (anxiety towards pain), $r = 0.61$ (vigilance and pain awareness) and $r = 0.22$ (intensity of the pain) for healthy women[43] and $r = 0.28$ (anxiety), $r = -0.41$ (quality of life), $r = 0.66$ (fear-avoidance belief) and $r = 0.42$ (depression) for people with fibromyalgia.[15]

In the present sample, the mean score of the PCS was 9.83 (±9.51). This concurs with previous research indicating a mean score of 10 ± 10 in this population.[20] Thus, although their score revealed no relevant level of pain catastrophizing,[22] they presented a high variability, as seen in standard deviation. Therefore, it is essential to determine which patient is suffering from pain catastrophizing, as it is considered a variable associated with

upper limb function after BC surgery,[44] and it contributes to upper-extremity-specific disability[45] and pain-related disability[46] in this population.

There are several risk factors for suffering chronic pain in this population at long term, such as weight gain and the lack of physical activity.[4] On the other hand, PC is a risk factor for post-surgical pain in BCS,[8] and it is associated with pain severity[17] and upper limb severity dysfunction.[18] Therefore, this new 12-item validated PCS will help clinicians manage pain in BCS Spanish population, for example, by assessing pain cognitions after cancer,[47] predicting upper limb dysfunction,[20] or measuring the effect of pain neuroscience education after surgery.[48]

The present study had a series of limitations. First, the patients involved in the present study were very heterogeneous about the kind of surgical intervention, cancer treatment, and current treatment, so this could have led to bias in the response of the scale. The lack of longitudinal data also did not allow the assessment of other psychometric properties such as test–retest reliability or sensitivity to change.

CONCLUSION

Catastrophizing is an important factor in the management of the pain in breast cancer survivors. The Spanish version of PCS is a valid and reliable tool to measure pain catastrophizing in BCS. Given the importance of assessing pain in this population and its widespread use in the oncology population, the PCS can be a valuable tool for researchers in future research and clinical practice for future intervention in this population.

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CONFLIT OF INTEREST

Authors wish to confirm that there are no known conflicts of interest associated with this publication, and there has been no significant financial support for this work that could have influenced its outcome.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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