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Original Article

Physiotherapy Section

Translation, Cross-cultural Adaptation, and Validation of the Kannada Version of the Pain Catastrophising Scale in Post-stroke Chronic Shoulder Pain: A Cross-sectional Study

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ABSTRACT

Introduction: Pain catastrophising is a critical factor in the persistence of chronic pain and adversely affects rehabilitation outcomes after stroke. The Pain Catastrophising Scale (PCS) is a gold-standard tool for assessing maladaptive pain-related cognitions. However no validated Kannada version exists for individuals with Post-Stroke Chronic Shoulder Pain (PSCSP), limiting clinical assessment for Kannada-speaking populations.

Aim: To translate, culturally adapt, and validate the adult PCS into Kannada for individuals experiencing PSCSP.

Materials and Methods: This cross-sectional study was conducted at a physiotherapy OPD at KLE Hospital and Medical Research Centre, Hubballi, Karnataka, India from June to November 2025. Following Beaton DE et al., guidelines, the PCS was translated and culturally adapted. About 60 participants with PSCSP were recruited for psychometric validation, and 31 were reassessed to determine test-retest reliability. Participants completed the Kannada PCS (K-PCS), Visual Analogue Scale (VAS), Fear-Avoidance Beliefs Questionnaire (FABQ-KA), and World Health Organisation Quality of Life Scale (WHOQOL-BREF). Internal consistency was evaluated using Cronbach's alpha and test–retest reliability via the Intraclass correlation coefficient (ICC). Construct validity was Examined through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analyses (CFA). Convergent and divergent validity were assessed using Spearman's correlation coefficients, while discriminative validity was determined through Receiver Operating Characteristic (ROC) curve analysis. A p-value < 0.05 was considered significant.

Results: The K-PCS demonstrated excellent content validity (S-CVI/Ave=0.95). It demonstrated good internal consistency (α=0.87) and excellent test-retest reliability (ICC=0.96). EFA identified a three-factor structure accounting for 62.2% of the variance, which was supported by CFA (CFI=0.92; RMSEA=0.07). Moderate positive correlation with the VAS (rho=0.38, p-value=0.003) supported convergent validity. Weak correlations with FABQ-KA and WHOQOL-BREF indicate that the K-PCS measures a construct distinct from fear-avoidant beliefs and quality of life, supporting its divergent validity despite expected overlap in musculoskeletal pain populations. ROC analysis indicated excellent discriminative ability (AUC=0.97).

Conclusion: The Kannada version of the PCS is a valid, reliable, and culturally appropriate instrument for assessing pain catastrophising in PSCSP. Its strong psychometric properties support its use in clinical and research settings to guide targeted rehabilitation for Kannada-speaking stroke survivors.

Keywords: Culturally appropriate, Kannada translation, Psychometric properties

INTRODUCTION

Pain-related disorders are the leading cause of disability and global health burden worldwide [1]. Pain is now regarded as the fifth vital sign, emphasising its importance in clinical evaluation [2]. Chronic pain is a major reason for seeking medical care and imposes a substantial economic burden due to healthcare costs and productivity loss [3]. The PSSP is a frequent and disabling complication, affecting a significant proportion of stroke survivors, with reported prevalence up to 61.43% in India, 22-47% globally [4,5]. The prevalence of shoulder pain increases from the acute to the chronic stage after stroke [6]. The shoulder pain typically develops on the haemiplegic side and persists for more than three months, occurring at rest or during movement [7]. This condition contributes to delayed upper-limb functional recovery, prolonged hospitalisation, and reduced performance of activities of daily living [8,9]. Chronic pain is also associated with markedly reduced quality of life compared to the general population and individuals with other long-standing health conditions [10].

Chronic pain arises from a complex interaction of biological, psychological, and social factors [3]. Among psychological contributors, pain catastrophising is one of the most influential determinants. It reflects exaggerated negative cognitive and emotional responses to pain, including helplessness, rumination, and magnification [11]. Pain catastrophising has consistently been associated with increased pain intensity, disability, and poorer treatment outcomes across chronic pain populations [12-14]. Importantly, reductions in catastrophising during treatment are associated with improvements in pain intensity, functional capacity, and emotional wellbeing [15,16]. Consequently, addressing catastrophising has become a key component of contemporary chronic pain management [17].

The PCS, developed by Sullivan MJL et al., is a widely used 13-item instrument measuring helplessness, rumination, and magnification [18]. The original English version has demonstrated strong psychometric properties, including high internal consistency and test-retest reliability [18,19]. Catastrophising assessed using the PCS explains significant variance in pain intensity, disability, and psychological distress in chronic pain populations [12]. In India, the use of English-language assessment tools is limited by language barriers, reducing their clinical applicability. Hubli-Dharwad, with an estimated population of over 1.2 million and Kannada as the predominant language, necessitates culturally adapted assessment

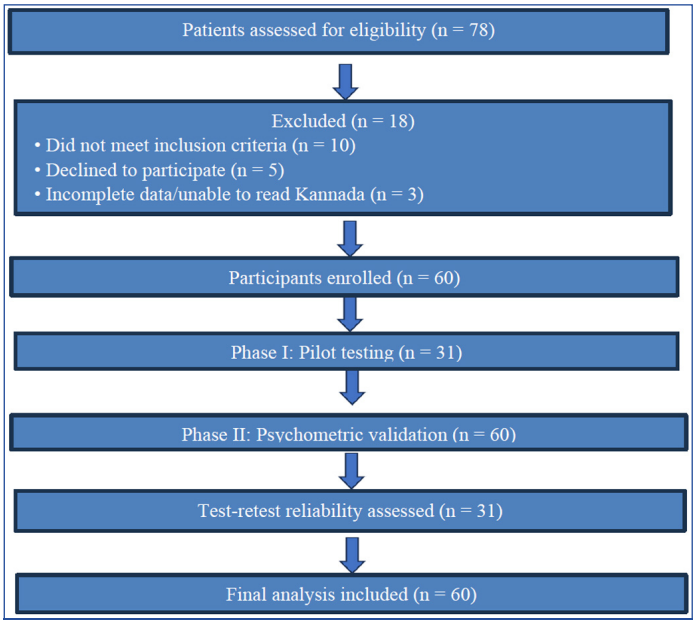
tools [20]. Despite multiple translations of the PCS into other languages, no validated Kannada version is currently available for individuals with PSCSP. Therefore, the present study aimed to develop a Kannada version of the PCS and evaluate its reliability and validity among individuals with PSCSP in Hubballi, Karnataka, India.

MATERIALS AND METHODS

A cross-sectional study was conducted at the physiotherapy OPD, KLE Hospital and Medical Research Centre, Hubballi, Karnataka, India from June to November 2025, following internationally accepted cross-cultural adaptation standards proposed by Beaton DE et al., [21]. Ethical clearance was obtained from the Institutional Ethics Committee (JGMMMC/IEC/139/-2025). Permission to translate and validate the adult PCS [18] was obtained through the Mapi Research Trust, the official distributor of the instrument.

Study Procedure

For this study, 60 participants were recruited [Table/Fig-1]. The study was completed in two stages: 1) Translation and cultural adaptation of the PCS; and 2) Validation of the Kannada version (K-PCS).



[Table/Fig-1]: Flow chart for participant recruitment.

Phase 1: Cross-cultural Adaptation

Translation and synthesis: A multidisciplinary expert panel, comprising a pain specialist, a clinical research expert, a methodology expert, and two trained translators, supervised the translation process. The PCS was independently translated from English to Kannada by two bilingual translators (T1 and T2), both of whom are native speakers of Kannada. T1 is a physiotherapy faculty member with subject expertise, while T2 had no medical background. Both translators submitted written reports detailing their rationale for word choice and phrasing. The two forward translations were compared and synthesised by T1 and T2 to produce a single reconciled Kannada version.

Back translation was carried out by two bilingual translators (BT1 and BT2) whose mother tongue was English and who were unfamiliar with the original PCS and had no medical background. They independently translated the synthesised Kannada version back into English. The back-translated versions were then compared with the original PCS to ensure semantic, idiomatic, experiential, and conceptual equivalence. The expert committee for the Kannada adaptation of the PCS, constituted according to Beaton DE et al., guidelines [21], included a psychometrician, a clinician physiotherapist with >6 years' experience in chronic pain and stroke rehabilitation, a clinical research expert, a Kannada linguist, and two translators (one health professional and one non medical bilingual). The committee met twice (August–September 2025) to review the original PCS, forward translations, synthesised Kannada version, and back-translations. Decisions were reached by consensus, resulting in a prefinal Kannada version for pilot testing. Minor wording refinements improved clarity and cultural relevance while preserving semantic, idiomatic, experiential, and conceptual equivalence.

Pilot testing (Cognitive Debriefing): The prefinal Kannada PCS was administered to 31 Kannada-speaking patients with PSCSP physiotherapy OPD in Hubballi, India, after obtaining written informed consent. Eligible participants were adults (≥18 years) with a first-ever unilateral stroke >six months prior, chronic haemiplegic shoulder pain >three months, Mini-Mental State Examination (MMSE) ≥24 (education-adjusted) [22], VAS ≥1 cm on a 0-10 cm scale, and Brunnstrom stages III-V [23]. Participants completed the questionnaire under supervision, with observations focusing on clarity and comprehension. All items were well understood, with no reported difficulties. Minor semantic and idiomatic wording refinements were made to four items without altering meaning, and no items were identified as culturally inappropriate. The finalised Kannada PCS was prepared for psychometric validation, and all translation and pilot testing documentation was submitted to Mapi Research Trust.

Phase II: Validation across Cultures

Phase II involved psychometric validation of the Kannada version of the adult Pain Catastrophising Scale (K-PCS) in 60 (this included the pilot participants and additional new participants, for a total of 60 patients) individuals with PSCSP with the same eligibility criteria as the pilot testing phase. As, pilot participants were included only after cognitive debriefing, which involved no scoring or feedback and resulted in minor semantic changes without altering item meaning. All psychometric analyses were performed on the finalised K-PCS under standardised conditions, minimising the risk of bias. Participants completed the K-PCS along with standardised outcome measures and also the socio-demographic details such as age, sex, education, occupation, type of stroke, side affected, duration since stroke, duration of shoulder pain, and Brunnstrom stage were noted.

Sample size estimation was based on Hinkin's recommendation [24] of a minimum 4:1 participant-to-item ratio for factor analysis. As the PCS contains 13 items, a minimum of 52 participants was required; therefore, 60 participants were recruited to account for potential attrition, of whom 31 were reassessed for test-retest reliability. The PCS is a 13-item self-report scale with three subdomains: rumination, magnification and helplessness. A total score between 0 and 52 is obtained by rating each item on a 5-point scale. Higher numbers suggest greater levels of catastrophising. The original version has shown exceptional reliability with Cronbach's alpha reported as 0.90 [18,19].

Outcome Measures (VAS)

Visual Analogue Scale (VAS): To measure pain intensity, participants used a 10-cm VAS, placing a mark on a line that ran from 0, meaning 'no pain,' to 10, representing the 'worst pain imaginable.' Their pain score was the measured distance from the starting point.

Fear-Avoidance Beliefs Questionnaire (FABQ-KA): This, consisting of 16 items across two subscales- physical activity (1-5) and work (6-16), was also administered. A seven-point Likert scale (0-6) was used to grade each item's responses; higher scores indicate stronger fear-avoidance beliefs. Although the Kannada FABQ was originally validated for chronic low back pain, it was used cautiously in this study as a related psychosocial measure to examine construct validity of the K-PCS. Correlation findings were

interpreted conservatively. The Kannada version of FABQ has shown good reliability, with Cronbach's α ≈ 0.88 [25].

World Health Organisation Quality of Life Scale (WHOQOL-BREF): It was used to assess quality of life. This 26-item tool measures four domains: physical, psychological, social, and environmental wellbeing. Each item is scored on a 5-point scale, and domain scores are converted to a 0-100 scale. The WHOQOL-BREF has been previously used and shown to be valid and reliable in Indian clinical populations [26,27].

STATISTICAL ANALYSIS

All analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 27.0. Data normality was assessed with the Shapiro-Wilk test, and descriptive statistics were reported as mean ± standard deviation, frequency, and percentage. Face validity was obtained from participant feedback, and content validity was established by five experts using item-level and scale-level content validity indices (I-CVI and S-CVI/Ave). Reliability was examined through internal consistency and test-retest methods. Agreement was evaluated using Bland-Altman plots, and measurement precision was determined through the Standard Error of Measurement (SEM) and minimal detectable change at the 95% confidence level (MDC_{95}).

Construct validity was assessed. Exploratory factor analysis was performed using principal component analysis with Varimax rotation, guided by eigenvalues >1 and scree plot inspection; sampling adequacy was confirmed with the Kaiser-Meyer-Olkin measure and Bartlett's test of sphericity. CFA tested the original three-factor structure using RMSEA, CFI, and TLI indices. Convergent and divergent validity were examined via Spearman's correlations with the VAS, FABQ, and WHOQOL-BREF. Known-groups validity was assessed using the Mann-Whitney U test with effect sizes (Cohen's d), and discriminative ability was evaluated through ROC analysis (AUC, sensitivity, specificity). A p-value < 0.05 was considered statistically significant.

RESULTS

The sample predominantly comprised middle-aged adults with a moderate-to-severe pain intensity and high pain catastrophising scores, reflecting a clinically relevant PSCSP population [Table/Fig-2].

Participants reported that the Kannada PCS items were easy to understand and culturally appropriate. Minor wording modifications were made to enhance clarity. The S-CVI/Ave reached 0.95 and the I-CVI scores varied from 0.80 to 1.00. The Kannada version of the adult PCS demonstrated robust internal consistency reflected by a Cronbach's α of 0.87. Subscale alphas were similarly high (Helplessness=0.83; Magnification=0.78; Rumination=0.81] [Table/Fig-3].

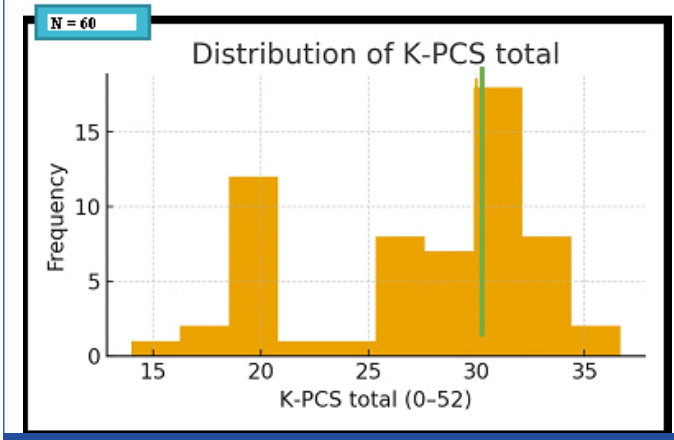
Variable	n (%)/M±SD
Age (years)	49.8±13.5
Gender n (%)	
Male	35 (58)
Female	25 (42)
Time since stroke (months)	19.4±8.7
Shoulder pain duration (years)	3.1±1.2
Brunnstrom stage III-V n (%)	Stage III, 32 (53.3)
	Stage IV, 14 (23.3)
	Stage V, 14 (23.3)
MMSE	26.25±1.9
VAS pain (0-10)	7.1±1.5
FABQ (0-96)	43.5±11.0
WHOQOL (0-100)	57.2±15.4
K-PCS total (0-52)	41.5±8.6

[Table/Fig-2]: Descriptive characteristics.

K-PCS Subscale	Cronbach's α	No. of items
Helplessness	0.83	6
Magnification	0.78	3
Rumination	0.81	4
Total	0.872	13

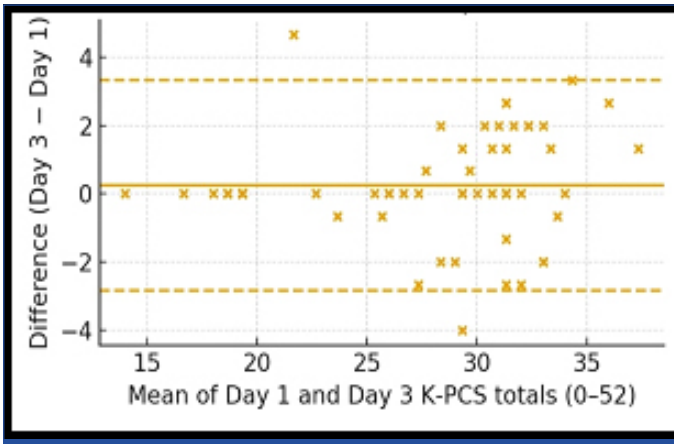
[Table/Fig-3]: Internal consistency of subgroups of the K-PCS.

Total score distribution of K-PCS (n=60) was slightly skewed toward higher catastrophising levels, with nearly half of participants scoring ≥30, reflecting clinically elevated catastrophising [Table/Fig-4].



[Table/Fig-4]: K-PCS total score distribution among participants.

Test-retest analysis with 31 participants yielded an ICC of 0.96 (95% CI: 0.93-0.98). The Bland-Altman plot revealed very small bias and close agreement, showing that responses remained stable over the three-day interval. The SEM was 1.47, and the MDC_{95} was 4.07 points, suggesting that a change of ≥4 points represents a true clinical change beyond measurement error [Table/Fig-5].



[Table/Fig-5]: Test-retest agreement of K-PCS total.

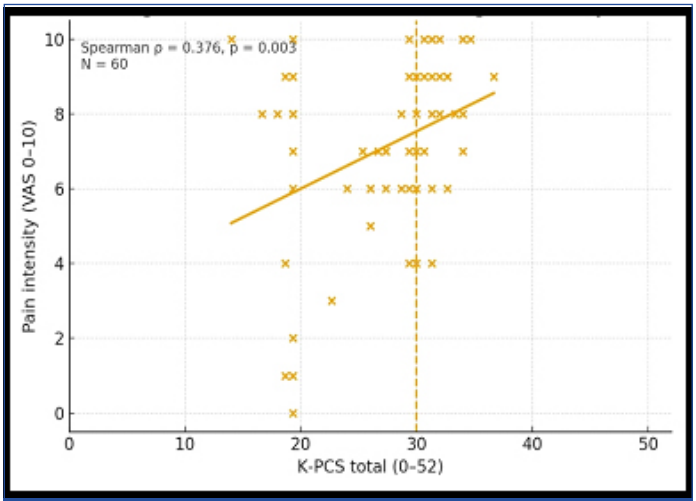
The exploratory factor analysis identified three meaningful factors, each with eigenvalues greater than 1, explaining 62.2% of the overall variance. These factors corresponded to the original PCS domains: helplessness, rumination, and magnification. All items demonstrated satisfactory loadings (≥0.40) on their respective factors, with minimal cross-loadings.

The CFA supported the three-factor solution, showing acceptable model fit (RMSEA = 0.07, CFI=0.92; TLI=0.90) [Table/Fig-6].

A moderate positive correlation was observed between K-PCS scores and VAS pain ratings (ρ=0.38, p-value=0.003), supporting convergent validity and reflecting the link between catastrophic thoughts and increased pain perception [Table/Fig-7]. Divergent validity was demonstrated through weak and non significant

Questions	Item (paraphrased)	Helplessness	Rumination	Magnification
1	"I worry whether pain will end."	**0.58**	0.22	0.05
2	"I feel I can't go on."	**0.61**	0.10	0.08
3	"Nothing will ever improve - it's terrible."	0.40	**0.42**	0.05
4	"Pain is awful and overwhelms me."	**0.72**	0.18	0.11
5	"I can't stand it anymore."	**0.75**	0.06	0.09
6	"I'm afraid that pain will get worse."	0.31	0.12	**0.57**
7	"I keep remembering other painful events."	0.19	0.37	**0.50**
8	"I anxiously want the pain to go away."	0.11	**0.74**	0.08
9	"I can't keep pain off my mind."	0.15	**0.79**	0.02
10	"I keep thinking about how much it hurts."	0.08	**0.69**	0.10
11	"I want this to end very badly."	0.20	**0.71**	0.05
12	"There's nothing I can do to reduce the pain."	**0.63**	0.22	0.14
13	"I worry that something serious may happen."	0.05	0.09	**0.78**

[Table/Fig-6]: Factor loadings from the exploratory analysis (principal components, varimax rotation). Loadings ≥ 0.40 are in bold.



[Table/Fig-7]: K-PCS total score vs VAS: Correlation Coefficient (r).
*p-value significant at the <0.05 level

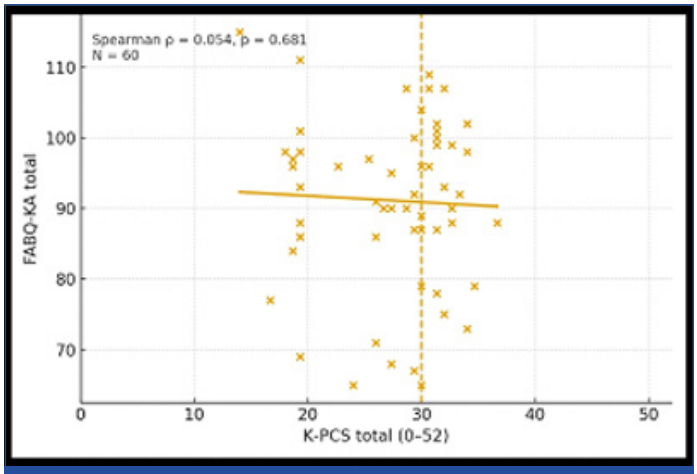
correlations with FABQ (ρ=0.054, p-value=0.681) and WHOQOL-BREF domain scores (|ρ| < 0.174, p-value>0.183) [Table/Fig-8,9].

Known-groups validity was supported, as participants with severe pain (VAS ≥7) had significantly higher K-PCS scores than those with moderate pain (VAS <7) (p-value <0.01 ; Cohen's d ≈ 0.67).

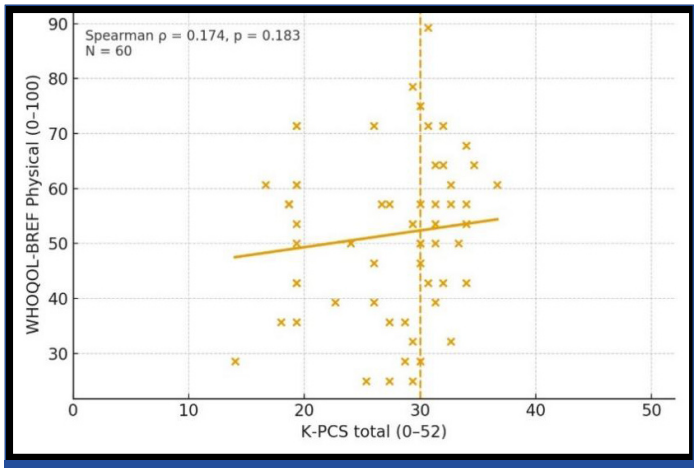
The ROC analysis demonstrated discriminative validity of K-PCS (AUC=0.97) with optimal discrimination in the present ROC analysis, yielding a sensitivity of 0.93 and specificity of 0.91 [Table/Fig-10].

DISCUSSION

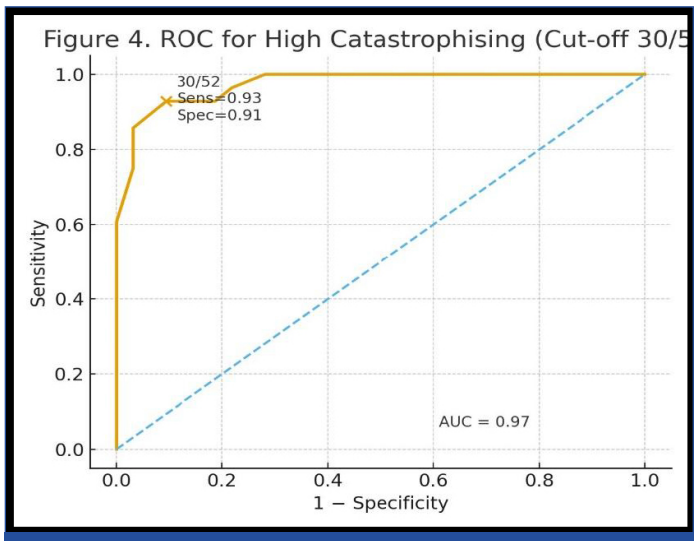
This study presents the first formal validation of the K-PCS, providing a psychometrically sound tool for assessing maladaptive cognitions in stroke survivors with chronic shoulder pain. The present study findings demonstrate that the K-PCS maintains the robust structural integrity and reliability of the original instrument



[Table/Fig-8]: K-PCS total score vs FABQ-KA: correlation coefficient (r).
*p-value significant at the <0.05 level



[Table/Fig-9]: K-PCS total score vs WHOQL: correlation coefficient (r).
*p-value significant at the <0.05 level



[Table/Fig-10]: Discriminative validity of K-PCS (ROC Curve).

while remaining culturally resonant for Kannada-speaking populations.

The internal consistency (alpha=0.87) and test–retest reliability (ICC=0.96) of the K-PCS align closely with the original validation by Sullivan MJL et al., and various international adaptations [18,19]. Furthermore, present study exploratory factor analysis accounted for 62.2% of the total variance, supporting the traditional three-factor model (Rumination, Magnification, and Helplessness). These results echo the findings of Van Damme S et al., and the recent Swedish adaptation, confirming that the underlying psychological constructs of catastrophising are cross-culturally stable [28,29].

A key finding of this study was the moderate correlation with the VAS (approx 0.38). This relationship was consistent with the observations of Hirata J et al., suggesting that while pain intensity and catastrophising are related, they are distinct constructs. Catastrophising reflects the appraisal of pain rather than the sensory intensity itself; thus, patients may report high pain intensity without necessarily engaging in high levels of catastrophic thinking, and vice-versa [30].

The unexpectedly low near-zero correlation with the FABQ highlights a conceptual divergence in the post-stroke population. While catastrophising and fear-avoidance often co-occur in musculoskeletal conditions, Ryum T and Stiles TC, noted that these constructs can act as independent mediators [31]. In stroke survivors, fear-avoidance may be driven more by motor deficits and balance concerns than by the catastrophic appraisal of pain, suggesting that the K-PCS captures a unique cognitive dimension not addressed by the FABQ. Similarly, the weak correlations with WHOQOL domains suggest that quality of life in stroke recovery is multifactorial, influenced heavily by physical disability and social support [32], whereas the K-PCS specifically targets the cognitive-emotional response to shoulder pain.

The high AUC reflects clear separation between high- and low-pain groups within this clinically homogeneous PSCSP participants. Participants classified as high catastrophisers using an external clinical criterion of severe pain intensity (VAS ≥7) were accurately identified by the K-PCS. A cut-off score of ≥30 on the K-PCS, consistent with clinically meaningful catastrophising and commonly used thresholds in prior PCS validation studies [18,33].

The K-PCS is a critical screening tool to identify patients at risk of poor rehabilitation outcomes due to maladaptive cognitions. By flagging these individuals early, clinicians can implement targeted cognitive-behavioural interventions alongside physical therapy.

Limitation(s)

Generalisability was limited by the modest sample size (N=60), recruitment from a single geographic region, and exclusion of participants unable to read Kannada, which may not reflect all Kannada dialects, literacy levels, or other chronic pain conditions. The cross-sectional design precluded assessment of the long-term responsiveness of the K-PCS. The very high AUC observed in the ROC analysis may reflect sample homogeneity or potential overfitting, and the use of a VAS score ≥7 as the external criterion rather than a standard measure of catastrophising may have influenced validity. Additionally, the presence of ceiling effects, with nearly half of the participants scoring ≥30, may limit discrimination across levels of catastrophising. Finally, the magnification subscale demonstrated comparatively lower, though acceptable, internal consistency, which may affect the stability of magnification-related findings. Future multicentre trials with larger, diverse cohorts are necessary to evaluate its predictive value for long-term functional recovery and its utility across broader clinical settings.

CONCLUSION(S)

The Kannada version of the PCS is a valid, reliable, and culturally appropriate instrument for assessing pain catastrophising in PSCSP. Its strong psychometric properties support its use in clinical and research settings to guide targeted rehabilitation for Kannada-speaking stroke survivors.

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