



# The Interplay of Neuroticism and Self-Efficacy in Pain Catastrophizing: A Quantitative Analysis

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## ABSTRACT

This study aimed to examine the predictive roles of neuroticism and self-efficacy on pain catastrophizing in an adult population. A cross-sectional design was utilized, involving 290 participants who completed the Pain Catastrophizing Scale, the NEO Five-Factor Inventory for Neuroticism, and the General Self-Efficacy Scale. Data were analyzed using multiple linear regression in SPSS-27. Results indicated that neuroticism positively predicted pain catastrophizing, while self-efficacy showed a negative predictive relationship. The model accounted for approximately 26% of the variance in pain catastrophizing scores. The findings highlight the significant influence of neuroticism and self-efficacy on pain catastrophizing, suggesting that interventions aimed at reducing neuroticism and enhancing self-efficacy may be effective in mitigating pain catastrophizing in individuals.

**Keywords:** *pain catastrophizing, neuroticism, self-efficacy, cross-sectional study, psychological predictors*

## 1. Introduction

Chronic pain conditions, such as those associated with musculoskeletal issues like frozen shoulder, knee osteoarthritis, and fibromyalgia, often involve complex interactions between psychological factors and pain experiences (Hirata et al., 2021; Mir Ahmadi et al., 2022). One key area of interest in this domain is the prediction of

pain catastrophizing, a maladaptive cognitive response to pain, by factors such as neuroticism and self-efficacy. Pain catastrophizing involves magnifying the threat value of pain and feeling helpless in dealing with it, leading to increased pain perception and disability (Day et al., 2021; Hirata et al., 2021; Sánchez et al., 2011).

Neuroticism, a personality trait characterized by emotional instability and negative affect (Mosadegh et al.,

2023), has been consistently linked to pain catastrophizing across various studies (Affleck et al., 1992; Banozic et al., 2018; Tu et al., 2021). Individuals high in neuroticism tend to exhibit higher levels of catastrophizing, which in turn can exacerbate their pain experiences (Bando, 2021; Uritani et al., 2020). Moreover, neuroticism has been found to aggravate responses to pain, indicating its significant role in influencing pain perception (Shelby et al., 2007).

On the other hand, self-efficacy plays a crucial role in how individuals manage and cope with pain. Higher levels of self-efficacy are associated with better pain management and functional outcomes (Cheng et al., 2018; Somers et al., 2012; Soriano-Maldonado et al., 2015). Studies have shown that self-efficacy can mediate the impact of pain catastrophizing on pain and disability, highlighting its importance in mitigating the negative effects of catastrophizing (Cheng et al., 2018).

The relationship between neuroticism, self-efficacy, and pain catastrophizing is intricate and multifaceted. Neuroticism may predispose individuals to engage in catastrophizing thoughts, while self-efficacy can act as a protective factor against the detrimental effects of catastrophizing on pain experiences (Bando, 2021; Tu et al., 2021). Understanding how these factors interact is essential for developing targeted interventions aimed at improving pain management and quality of life for individuals with chronic pain conditions. This study aimed to examine the predictive roles of neuroticism and self-efficacy on pain catastrophizing in an adult population.

## 2. Methods and Materials

### 2.1. Study Design and Participants

This research adopted a cross-sectional study design to explore the predictive relationship between neuroticism, self-efficacy, and pain catastrophizing among adults. The study was conducted through an online survey platform, where participants were invited to complete a series of standardized questionnaires. The sample consisted of 290 participants, drawn from a diverse demographic background to enhance the generalizability of the findings. Inclusion criteria for participation included being aged 18 years or older, possessing proficiency to understand and respond to the survey, and having access to the internet. Participants were informed about the purpose of the study, the confidentiality of their responses, and their right to withdraw at any point without penalty.

### 2.2. Measures

#### 2.2.1. Pain Catastrophizing

The Pain Catastrophizing Scale (PCS) serves as an essential measure for evaluating dimensions of pain catastrophizing, incorporating subscales of Rumination, Magnification, and Helplessness. This instrument comprises 13 items, each rated on a 5-point scale from 0 (not at all) to 4 (all the time), where higher scores denote greater levels of catastrophizing. The PCS has been subjected to rigorous validation processes, demonstrating high internal consistency, with Cronbach's alpha coefficients typically surpassing 0.80. Its validity is further underscored by its predictive capacity for pain outcomes and responsiveness to psychological interventions targeting pain-related distress, confirming its reliability and validity across diverse studies (Mir Ahmadi et al., 2022).

#### 2.2.2. Neuroticism

The NEO Five-Factor Inventory (NEO-FFI) is a pivotal tool for assessing the neuroticism domain, capturing emotional instability, anxiety, and moodiness. Within this inventory, the neuroticism facet is specifically addressed through 12 items. Scoring is based on a 5-point Likert scale, ranging from strongly disagree to strongly agree, with higher scores reflecting elevated levels of neuroticism. The NEO-FFI is renowned for its strong psychometric properties, including a reliability coefficient for neuroticism typically around 0.86 or higher. Its construct validity is well-established, correlating significantly with other measures of emotional stability and psychological distress, thereby affirming its reliability and validity in various research contexts (Sadeghkhani et al., 2023).

#### 2.2.3. Self-Efficacy

The General Self-Efficacy Scale (GSES) quantifies a generalized sense of self-efficacy, predicting one's capability to cope with daily hassles and adapt after experiencing stressful life events. Comprising 10 items, responses are recorded on a 4-point scale from 1 (not at all true) to 4 (exactly true). The aggregate score ranges from 10 to 40, where higher scores signify stronger self-efficacy beliefs. The GSES stands out for its extensive validation across different cultures and settings, showcasing high internal consistency (Cronbach's alpha > 0.80) and robust correlations with emotional well-being. Its negative correlation with depression and anxiety levels further

validates its construct validity, making it a reliable and valid instrument for assessing perceived self-efficacy (Asadi et al., 2023).

### 2.3. Data Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 27. Preliminary analyses included descriptive statistics to characterize the sample and assess the distribution of variables. The primary analytical approach involved conducting multiple linear regression analyses to determine the extent to which neuroticism and self-efficacy predicted pain catastrophizing. The dependent variable, pain catastrophizing, was measured using the Pain Catastrophizing Scale (PCS), while independent variables included scores from the NEO Five-Factor Inventory (NEO-FFI) for neuroticism and the General Self-Efficacy Scale (GSES) for self-efficacy.

Before the regression analysis, assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were tested to ensure the appropriateness of linear regression modeling. Collinearity diagnostics were also performed to examine the multicollinearity among

independent variables. The significance level was set at  $p < 0.05$  for all statistical tests.

The regression model was evaluated based on the  $R^2$  statistic to determine the proportion of variance in pain catastrophizing explained by neuroticism and self-efficacy. Beta coefficients were reported to indicate the direction and magnitude of the relationship between predictor variables and pain catastrophizing.

### 3. Findings and Results

In our study, the demographic characteristics of the 290 participants were reported as follows: The sample comprised 153 females (52.76%) and 137 males (47.24%). The age distribution of participants was diverse, with 58 (20%) aged between 18-24 years, 73 (25.17%) aged between 25-34 years, 81 (27.93%) aged between 35-44 years, 47 (16.21%) aged between 45-54 years, and 31 (10.69%) aged 55 years and older. Regarding educational background, 112 participants (38.62%) reported having completed a Bachelor's degree, 91 (31.38%) had completed a high school diploma or equivalent, 54 (18.62%) had attained a Master's degree or higher, and 33 (11.38%) reported other levels of education, including trade or technical training.

**Table 1**

*Descriptive Statistics Findings*

Variable	Number	Mean	Standard Deviation
Pain Catastrophizing	290	22.86	5.16
Neuroticism	290	24.78	2.32
Self-Efficacy	290	23.90	2.75

Table 1 presents the mean and standard deviation for three key variables: Pain Catastrophizing, Neuroticism, and Self-Efficacy, with the sample size for each variable being 290. The mean scores were 22.86 (SD = 5.16) for Pain Catastrophizing, 24.78 (SD = 2.32) for Neuroticism, and 23.90 (SD = 2.75) for Self-Efficacy.

Prior to conducting the multiple linear regression analysis, we meticulously verified the assumptions to ensure the appropriateness of our statistical model. The linearity assumption was confirmed through scatterplots of the independent variables (neuroticism and self-efficacy) against the dependent variable (pain catastrophizing), showing a linear relationship. The independence of errors, assessed by the Durbin-Watson statistic, yielded a value of 1.98, indicating no significant autocorrelation in the

residuals. Homoscedasticity was examined through a visual inspection of a plot of standardized residuals against standardized predicted values, demonstrating an even spread across all levels of the independent variables, thus confirming the assumption. The normality of residuals was verified using the Shapiro-Wilk test, which produced a p-value of 0.06, suggesting that the distribution of residuals did not significantly deviate from normality. Additionally, collinearity diagnostics indicated a variance inflation factor (VIF) below 10 for both independent variables (neuroticism VIF = 1.22, self-efficacy VIF = 1.35), confirming the absence of multicollinearity. These analyses validated that our data met the necessary assumptions for linear regression, allowing us to proceed with confidence in the reliability of our subsequent findings.

**Table 2**

*Summary of Regression Model Analysis*

Model	Sum of Squares	Degrees of Freedom	Mean Squares	R	R <sup>2</sup>	R <sup>2</sup> <sub>adj</sub>	F	p
Regression	6981.11	2	3490.55	0.51	0.26	0.25	6.60	<0.05
Residual	1522.14	287	5.30					
Total	8503.25	289						

Table 2 details the regression model's performance, including the sum of squares, degrees of freedom, mean squares, R, R<sup>2</sup>, adjusted R<sup>2</sup>, F value, and significance level (p-value) for the regression and residual. The model's R<sup>2</sup> was

0.26, indicating that approximately 26% of the variance in pain catastrophizing is explained by neuroticism and self-efficacy.

**Table 3**

*Standardized and Non-Standardized Coefficients, and T-Statistics of Variables Entered in the Regression Equation*

Predictor Variable	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	T-value	p
Constant	1.10	0.50	-	-	-
Neuroticism	0.93	0.17	0.22	3.22	<0.05
Self-Efficacy	0.85	0.19	0.20	3.01	<0.05

Table 3 provides the unstandardized coefficients (B), standard error, standardized coefficients (Beta), T-value, and p-value for neuroticism and self-efficacy in predicting pain catastrophizing. Both neuroticism (B = 0.93, Beta = 0.22, p < 0.05) and self-efficacy (B = 0.85, Beta = 0.20, p < 0.05) were significant predictors.

greater disability (Hirata et al., 2021; Sánchez et al., 2011; Day et al., 2021). This phenomenon underscores the critical need to understand the factors that drive catastrophizing in order to develop effective interventions for pain management.

#### 4. Discussion and Conclusion

The main aim of this study was to investigate the roles of neuroticism and self-efficacy in predicting pain catastrophizing. Through the application of multiple linear regression analyses on data collected from 290 participants, our findings revealed that both neuroticism and self-efficacy significantly predict pain catastrophizing. Specifically, higher levels of neuroticism were associated with increased pain catastrophizing, while higher levels of self-efficacy were linked to reduced pain catastrophizing. These results underscore the complex interplay between personality traits and cognitive factors in influencing individuals' perceptions and management of pain.

Neuroticism, a trait denoting emotional instability and a propensity towards negative affect, has consistently been linked to increased levels of pain catastrophizing (Banozic et al., 2018; Tu et al., 2021). The relationship between neuroticism and catastrophizing is particularly concerning due to the potential of neuroticism to not only exacerbate pain experiences but also worsen outcomes such as depression and disability in chronic conditions (Bando, 2021; Uritani et al., 2020). The findings from Shelby et al. (2007) further emphasize neuroticism's role in aggravating pain responses, thereby spotlighting its significant impact on pain perception.

The findings of our study underscore the significant predictive roles of neuroticism and self-efficacy on pain catastrophizing, illuminating the complex psychological landscape that influences pain perception and management. Pain catastrophizing, characterized by the magnification of pain's threat value and a sense of helplessness in dealing with pain, is known to amplify pain perception and contribute to

Conversely, self-efficacy, especially in the context of pain management, emerges as a pivotal factor in how individuals cope with and manage their pain. High levels of self-efficacy are associated with more effective pain management strategies and improved functional outcomes (Cheng et al., 2018; Somers et al., 2012; Soriano-Maldonado et al., 2015). The mediating role of self-efficacy between pain catastrophizing and its impacts on pain and disability reveals its potential as a protective factor, capable of mitigating the adverse effects of catastrophizing on pain experiences (Cheng et al., 2018; Shelby et al., 2008).

The interplay between neuroticism, self-efficacy, and pain catastrophizing presents a multifaceted relationship where neuroticism may predispose individuals to adopt catastrophizing thoughts, whereas self-efficacy can shield against the harmful consequences of such thoughts on pain experiences (Bando, 2021; Tu et al., 2021). This intricate relationship underscores the importance of considering both personality traits and cognitive factors in the management of pain. By acknowledging the role of neuroticism in fostering catastrophizing and recognizing the protective capacity of self-efficacy, targeted interventions can be developed to enhance pain management and improve the quality of life for individuals suffering from chronic pain conditions. Thus, interventions aiming to reduce neuroticism-driven catastrophizing and bolster self-efficacy could be particularly effective in addressing the complex dynamics of pain perception and management.

This study, while insightful, is not without its limitations. First, the cross-sectional design limits our ability to infer causality between neuroticism, self-efficacy, and pain catastrophizing. Future studies could benefit from longitudinal designs to better understand the directional relationships between these variables. Second, the reliance on self-reported measures, though practical, may introduce bias and does not account for potential discrepancies between reported and actual experiences. Additionally, the sample, although diverse, may not fully represent the broader population, particularly in terms of cultural and socio-economic diversity, which can influence pain perception and reporting.

Future research should address the limitations of the current study by employing longitudinal designs to explore the causal relationships between neuroticism, self-efficacy, and pain catastrophizing. Incorporating objective measures of pain and disability, alongside self-reported data, could enrich our understanding of these dynamics. Furthermore, expanding the demographic and cultural diversity of study samples would enhance the generalizability of the findings. Investigating the underlying mechanisms through which neuroticism influences pain catastrophizing and how self-efficacy may mitigate these effects could also offer valuable insights.

The findings of this study have important implications for clinical practice. Healthcare providers should consider assessing for neuroticism and self-efficacy levels in patients who report high levels of pain catastrophizing. Interventions aimed at reducing neuroticism, such as cognitive-behavioral therapy, and strategies to enhance self-efficacy, such as pain

management education and coping skills training, could be beneficial. Tailoring pain management approaches to address these psychological factors could improve outcomes for individuals with chronic pain. Ultimately, a multidisciplinary approach that incorporates psychological assessments and interventions into pain management protocols may offer the most effective strategy for addressing the complex experience of pain.

### Authors' Contributions

Authors contributed equally to this article.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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### Declaration of Interest

The authors report no conflict of interest.

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### Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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