Health Anxiety as a Mediator Between Childhood Maltreatment and Pain Catastrophizing in Adults with Chronic Pain

Background: Recent research has highlighted the role of adverse childhood experiences in shaping maladaptive pain responses in adulthood, particularly pain catastrophizing. The Fear-Avoidance Model of chronic pain emphasizes pain catastrophizing as a key cognitive factor that triggers fear, avoidance, and hypervigilance, ultimately perpetuating pain and disability. Health anxiety, a cognitive-emotional vulnerability, may serve as a key mediator in this pathway.

Methods: A descriptive-correlational study was conducted with 260 adults aged 18–40 years (M = 24.65 years, SD = 3.9) suffering from chronic pain, recruited from Hamedan, Iran, in the second half of 2024. Participants completed the Childhood Trauma Questionnaire (CTQ), Pain Catastrophizing Scale (PCS), and Health Anxiety Inventory (HAI). Path analysis was performed using AMOS v24, with SPSS v26 for data preparation. Indirect effects were tested via bootstrapping with 5000 samples.

Results: Childhood maltreatment was significantly associated with both health anxiety ($\beta = 0.64$, $p = 0.023$) and pain catastrophizing ($\beta = 0.41$, $p < 0.001$). Health anxiety also had a strong direct effect on pain catastrophizing ($\beta = 0.59$, $p < 0.001$) and partially mediated the link between childhood maltreatment and pain catastrophizing (indirect effect $\beta = 0.38$, 95% CI [0.23, 0.52], $p < 0.001$). Model fit indices were acceptable (RMSEA = 0.07, CFI = 0.92, GFI = 0.94, $\chi^2/df = 2.12$).

Conclusion: Grounded in the Fear-Avoidance Model, the findings suggest that early trauma may influence pain perception through psychological mechanisms like health anxiety and catastrophizing. Clinically, these results highlight the importance of screening for childhood trauma and suggest that interventions targeting health anxiety may be a valuable component of chronic pain management, potentially reducing maladaptive pain responses.

Keywords: childhood maltreatment, chronic pain, health anxiety, mediation, pain catastrophizing

Introduction

Chronic pain, an umbrella term encompassing a spectrum of clinical conditions such as fibromyalgia, migraines, and idiopathic pain states, is typically defined as pain persisting beyond three months (Raffaeli et al., 2021). In Iran, the prevalence of chronic pain among adults aged 18 to 65 has been reported between 9% and 21%, while among older adults aged 60 to 90, this rate increases markedly to around 67% (Ghadrnezhad et al., 2023). The experience of chronic pain can be rooted in both physiological and psychological factors and may arise from physical injury, underlying medical conditions, or even prolonged emotional stress (Hong et al., 2022).

One psychological factor that has received increasing attention in chronic pain research is pain catastrophizing. Defined as an exaggerated and negative mental set brought to bear during actual or anticipated painful experiences, pain catastrophizing is closely associated with both the intensity of pain and the degree of disability it causes (Matthie et al., 2020). It consists of three interrelated components: rumination (repetitive focus on pain), magnification (amplification of the threat or seriousness of pain), and helplessness (a perceived lack of control or ability to cope) (Kim & Lee, 2023; Pérez-Cruzado et al., 2022). Within a cognitive-behavioral framework, pain catastrophizing is a core construct in the Fear-Avoidance Model of chronic pain. This model posits that exaggerated negative thoughts about pain increase fear of pain, which subsequently leads to avoidance behaviors, hypervigilance, and emotional distress. Over time, these patterns contribute to physical inactivity, disuse, and depression, reinforcing a vicious cycle that maintains chronic pain and disability (Hilger et al., 2023). Individuals who score high in pain catastrophizing are more likely to perceive their pain as severe, become consumed by worry about their symptoms, and feel less capable of managing their discomfort (Montag et al., 2023; Pérez-Cruzado et al., 2022). This maladaptive cognitive style has consistently been linked to greater emotional distress and functional impairment in those suffering from chronic pain (Paschali et al., 2021).

Emerging evidence suggests that the roots of such maladaptive responses to pain may lie in adverse early life experiences. Specifically, growing evidence indicates that individuals with a history of childhood maltreatment are at increased risk for developing chronic pain (Saadati et al., 2024) and also experience greater pain intensity and pain-related disability (Todd et al., 2022). Although the term “childhood maltreatment” often evokes extreme events such as physical abuse or exposure to domestic violence and trauma (Hildenbrand et al., 2019), it also includes a broader spectrum of adverse experiences. Common subtypes include emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect (Li et al., 2023). The psychological and physiological impacts of such experiences are rarely limited to childhood; rather, they often persist and evolve throughout adolescence and into adulthood, influencing various aspects of mental and physical health (Guo et al., 2021; Zhao & Quan, 2023). From a trauma-informed perspective, early adversity can shape cognitive schemas, emotional regulation, and stress response systems, thereby increasing vulnerability to conditions like chronic pain and maladaptive coping strategies (Tidmarsh et al., 2022).

Anxiety, particularly health anxiety, can exacerbate pain catastrophizing (Clark et al., 2019). Health anxiety is also associated with all categories of childhood abuse and overall childhood abuse severity (Reiser et al., 2021). Health anxiety is defined as extreme anxiety and the distress that an individual experiences because of inaccurate interpretations of his or her body sensations (Nadeem et al., 2022). The DSM-5 diagnostic criteria for illness anxiety disorder (previously known as HA) specifies that the following symptoms need to be present for at least 6 months: pre-occupation with illness, absence of somatic symptoms, hypervigilance of own health, self-monitoring for signs of illness, complete avoidance of medical care or conversely frequent seeking of medical care (Haig-Ferguson et al., 2021). Individuals having health anxiety tend to worry excessively about their health, and they believe that they are experiencing severe disease even in the absence of any physical symptoms (Nadeem et al., 2022). Beyond the emotional component, health anxiety also includes cognitive processes such as catastrophic thinking and behavioral patterns like avoidance, both of which overlap with mechanisms implicated in pain catastrophizing (Thai Quynh-Chi et al., 2021).

The Present Study

What bridges the gap between past trauma and present pain? Guided by the Fear-Avoidance Model of chronic pain, the present study examines whether health anxiety mediates the relationship between childhood maltreatment and pain catastrophizing. The following hypotheses were proposed:

1. Childhood maltreatment is positively associated with health anxiety.
2. Childhood maltreatment is positively associated with pain catastrophizing.
3. Health anxiety is positively associated with pain catastrophizing.
4. Health anxiety mediates the relationship between childhood maltreatment and pain catastrophizing.

Methods

Design study and participant

This study employed a descriptive-correlational design and used path analysis to examine whether health anxiety mediates the relationship between childhood maltreatment and pain catastrophizing. The target population included adults aged 18 to 40 years who experienced chronic pain and resided in Hamedan, Iran, during the period from July to December 2024. Inclusion criteria were: (1) being within the specified age range, (2) having experienced chronic pain (i.e., pain lasting longer than three months), and (3) providing informed consent to participate.

Sample Size

Participants were recruited through convenience sampling from local pain management clinics, general practitioners' offices, and online platforms such as Telegram groups and Instagram channels focused on health awareness in Iran. While this mixed recruitment strategy allowed for efficient data collection, particularly through digital outreach, it is important to note that convenience sampling inherently limits the generalizability of the findings. The resulting sample may not fully represent the broader chronic pain population in Hamedan or other regions of Iran.

A total of 275 individuals initially agreed to participate. All completed questionnaires were screened for missing data, and only fully completed responses were retained. No substantial missing data were found. A multivariate outlier analysis using Mahalanobis distance was then conducted to detect extreme values that could distort the path analysis results. This procedure led to the exclusion of 15 participants, resulting in a final sample of 260 valid cases for analysis.

Although no formal a priori power analysis was conducted, the final sample size is consistent with Kline (2023) recommendation of a minimum of 250 participants for path analysis involving moderately complex models. Nevertheless, the use of non-probability sampling introduces potential selection bias, and the findings should be interpreted with appropriate caution.

Instruments and variable

The following standardized and previously validated instruments were used in this study. All scales had been psychometrically validated in Iran and were administered in their Persian versions.

Childhood Trauma Questionnaire (CTQ): Developed by Bernstein et al. (2003), is a 28-item self-report inventory that retrospectively assesses five dimensions of childhood maltreatment: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. Responses are rated on a 5-point Likert scale ranging from 1 (never true) to 5 (very often true), with subscale scores ranging from 5 to 25 and a total score range of 25 to 125. Higher scores reflect greater exposure to childhood trauma. The scale includes three validity-check items (items 10, 16, and 22) to detect minimization or denial. The Persian version of the CTQ was translated and validated in a study on individuals with and without a history of suicide attempts. The instrument demonstrated excellent internal consistency in that study, with Cronbach's alpha coefficients ranging from 0.81 to 0.97 across subscales. Discriminant analysis confirmed the scale's ability to distinguish between clinical and non-clinical populations. Emotional abuse had the strongest association with both depression and suicide risk. In the present study, the Persian CTQ was used without modification. Internal consistency was also strong in the current sample: emotional abuse ($\alpha = 0.89$), physical abuse ($\alpha = 0.85$), sexual abuse ($\alpha = 0.91$), emotional neglect ($\alpha = 0.86$), physical neglect ($\alpha = 0.83$), and total score ($\alpha = 0.94$).

Pain Catastrophizing Scale (PCS): Sullivan et al. (1995) developed the PCS to assess negative cognitive-emotional responses to pain. It is a 13-item self-report measure designed to assess the extent of negative, exaggerated thoughts and feelings that individuals experience in response to

actual or anticipated pain. The instrument comprises three subscales: rumination (e.g., persistent focus on pain), magnification (e.g., exaggeration of the threat of pain), and helplessness (e.g., perceived lack of control over pain). Each item is rated on a 5-point Likert scale from 0 (not at all) to 4 (all the time), yielding a total score range of 0 to 52. Scores above 30 are generally considered clinically significant and may indicate elevated risk for chronic pain and disability, thereby suggesting the need for psychological intervention. The Persian version of the PCS was developed and validated by Rahmati et al. (2017) using forward–backward translation procedures, with permission from the original author. The instrument was administered to a sample of 116 Iranian patients with non-malignant musculoskeletal pain. Internal consistency was high across all subscales and the total score, with Cronbach's alpha coefficients of 0.93 or above, indicating excellent reliability. Known-groups validity was supported by significant differences in PCS scores across gender subgroups. Exploratory factor analysis yielded two principal components that together explained 58.56% of the total variance, reflecting a meaningful underlying structure in the Persian version. In the present study, the Persian PCS was used without modification. Internal consistency coefficients were also acceptable in this sample: rumination ($\alpha = 0.82$), magnification ($\alpha = 0.76$), helplessness ($\alpha = 0.86$), and total score ($\alpha = 0.91$).

Health Anxiety Inventory (HAI): The HAI, developed by Salkovskis et al. (2002) is an 18-item self-report instrument designed to assess cognitive, emotional, behavioral, and perceptual components of health-related anxiety and hypochondriasis. The short form used in this study includes items scored on a 4-point scale ranging from 0 to 3, with higher scores reflecting greater levels of health anxiety. The total score ranges from 0 to 54. Scores ≥ 27 are typically interpreted as indicating clinically elevated health anxiety. The Persian version of the HAI has been validated in Iranian populations. Nargesi et al. (2017) administered the questionnaire to a sample of 300 medical students at Lorestan University of Medical Sciences. Confirmatory factor analysis supported a three-factor structure: (1) General health worry, (2) Illness likelihood, and (3) Negative consequences of illness. The internal consistency was acceptable, with Cronbach's alpha coefficients of 0.79 for general worry, 0.85 for illness likelihood, 0.83 for negative consequences, and 0.87 for the total score. The scale also demonstrated good convergent validity, correlating significantly with the Ahvaz Hypochondriasis Questionnaire ($r = 0.79$, $p < 0.001$). Given its brevity, cultural adaptation, and strong psychometric properties, the HAI is suitable for use in both clinical and non-clinical Iranian populations. In the current study, the Persian version was employed without modification, and internal consistency was high ($\alpha = 0.92$).

Although both the PCS and HAI assess responses to distress and bodily symptoms, they target distinct constructs: the PCS focuses on pain-specific cognitive appraisals, while the HAI addresses general health-related worry and somatic hypervigilance.

Statistical Analysis

Data were analyzed using SPSS version 26 and AMOS version 24. Pearson correlation analysis was conducted to examine bivariate relationships among variables. Path analysis was employed to test the hypothesized mediation model, with all variables treated as observed variables.

The model was identified with three observed variables and three direct paths, allowing estimation of all parameters. Maximum likelihood estimation (MLE) was used for parameter estimation. The model was overidentified, and the number of free parameters allowed proper estimation. Assumptions of multivariate normality (Mardia's test, $p > .05$), absence of multicollinearity (VIF < 2), and lack of influential outliers (Mahalanobis distance, $p > .001$) were confirmed.

Model fit was assessed using the Chi-square to degrees of freedom ratio (χ^2/df), Comparative Fit Index (CFI), Goodness-of-Fit Index (GFI), and Root Mean Square Error of Approximation (RMSEA). Indirect effects were tested using bootstrapping procedures (5,000 samples) with 95% bias-corrected confidence intervals.

Ethics

Prior to data collection, informed consent was obtained from all participants. They were assured of the anonymity and confidentiality of their responses and informed that participation was voluntary.

Results

Demographic profile

The study sample consisted of 260 individuals with chronic pain (M = 24.65 years, SD = 3.9), with a nearly equal gender distribution (53.1% female, 46.9% male). The majority of participants were young adults, aged between 18 and 25 years (57.3%), followed by 26- to 30-year-olds (35.4%), and a smaller proportion (7.3%) over 30. In terms of marital status, most were single (76.5%), while 21.2% were married, and 2.3% were divorced or widowed. Educationally, 35.8% of participants had at least a high school diploma, while 42.7% held a bachelor's degree and 21.5% had postgraduate qualifications. All participants reported experiencing chronic pain for more than three months, meeting the study's inclusion criteria.

Descriptive & Correlational Analysis

The mean score for childhood maltreatment was M = 58.12, SD = 12.34, for health anxiety M = 29.76, SD = 8.21, and for pain catastrophizing M = 31.90, SD = 9.47.

The results of Pearson correlations among the key study variables revealed that childhood maltreatment was significantly and positively associated with health anxiety ($r = 0.45$, $p < .01$) and pain catastrophizing ($r = 0.42$, $p < .01$). Health anxiety also showed a strong positive correlation with pain catastrophizing ($r = 0.55$, $p < .01$). These findings support the hypothesized associations among variables and suggest that individuals with higher exposure to childhood maltreatment are more likely to experience elevated health anxiety and to engage in maladaptive cognitive-emotional responses to pain.

Direct Effects

Table 1 presents the results of the direct effects analysis, which examines the relationships between the study variables.

Table 1. Standardized Coefficients and Significance Levels of Direct Effects

Path	β	S.E.	C.R.	P
Childhood Maltreatment → Pain Catastrophizing	0.41	0.11	3.57	< .001
Childhood Maltreatment → Health Anxiety	0.64	0.28	2.27	.023
Health Anxiety → Pain Catastrophizing	0.59	0.06	9.89	< .001

The results in Table 1 indicate that childhood maltreatment has significant and positive direct effects on both health anxiety (β = 0.64, p = .023) and pain catastrophizing (β = 0.41, p < .001), while health anxiety also has a strong direct effect on pain catastrophizing (β = 0.59, p < .001).

Indirect Effects

To examine the mediating roles of health anxiety in the relationship between childhood maltreatment andz pain catastrophizing, Table 2 presents the results of the indirect effects analysis.

Table 2. Indirect Effects

Relationship	Indirect Effect	Confidence Interval		P	Conclusion
		Lower Bound	Upper Bound		
Childhood Maltreatment → Health Anxiety → Pain Catastrophizing	0.38	0.23	0.52	<.001	partial mediation

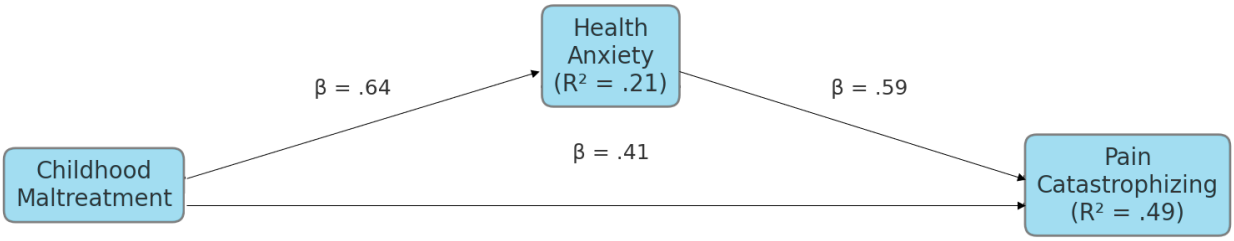
As shown in Table 2, the indirect effect of childhood maltreatment on pain catastrophizing through health anxiety was statistically significant (β = 0.38, p < .001), with a 95% confidence interval [0.23, 0.52] that excluded zero, indicating partial mediation.

Explained Variance

The model explained 21% of the variance in health anxiety (R^2 = .21) and 49% in pain catastrophizing (R^2 = .49), reflecting acceptable levels of predictive accuracy.

A diagram of the final path model, including standardized coefficients and R^2 values, is presented in Figure 1.

Figure 1. Final Path Model with Standardized Coefficients and R^2 Values



Model fit

Table 3 presents the fit indices of the developed model.

Table 3. Fit Indices for the Developed Model

Fit Indices	RMSEA	CFI	GFI	X^2/df
Acceptable Range	< 0.08	> 0.90	> 0.90	< 3.00
Obtained Values	0.07	0.92	0.94	2.12

From Table 3, the conclusion is made that the fit indices of the research model are established on the basis of significance as well as fit. According to (Kline, 2023), for model fit, the ratio of chi-square to degrees of freedom (X^2/df) should be less than 3, comparative fit index (CFI) and goodness-of-fit index (GFI) should be more than 0.90, and the root mean square error of approximation (RMSEA) should be less than 0.08. The values calculated for the research model are under these parameters, which indicate an acceptable fit.

Conflicts of Interests

Authors have no conflict of interests.

Acknowledgment

The authors would like to express their gratitude to all participants for their valuable contributions to this study.

Discussion

The present study investigated the mediating role of health anxiety in the relationship between childhood maltreatment and pain catastrophizing in adults with chronic pain. Results indicated that individuals reporting higher levels of childhood maltreatment were more likely to experience elevated health anxiety, which in turn significantly predicted greater pain catastrophizing. These findings support cognitive–emotional mediation models suggesting that early adverse experiences shape long-term maladaptive emotional and cognitive responses to pain. The direct association between childhood maltreatment and health anxiety aligns with existing literature showing that early trauma often contributes to persistent fears about bodily vulnerability and health-related uncertainty (Kisely et al., 2022; Reiser et al., 2021). Maltreated children may internalize feelings of helplessness and physical threat, leading to core maladaptive beliefs such as “my body is fragile” or “any symptom may signal danger.” Over time, such beliefs may solidify into health anxiety, which manifests as excessive preoccupation with illness, hypervigilance, and avoidance.

Childhood maltreatment also showed a significant direct relationship with pain catastrophizing. This finding is consistent with studies suggesting that individuals with early trauma histories often have difficulties regulating emotions and accurately interpreting bodily sensations (Heule et al., 2025; MacDonald et al., 2021). These difficulties may result in greater emotional reactivity, attentional bias to pain, and reliance on maladaptive coping strategies such as catastrophizing. Neurobiological evidence also supports this link: early stress exposure may affect brain structures like the amygdala and prefrontal cortex, which are involved in emotional and pain regulation (Teicher et al., 2016).

The strong association between health anxiety and pain catastrophizing supports the role of cognitive distortions in the experience and interpretation of pain. Individuals with elevated health anxiety are more likely to misinterpret benign bodily sensations as threatening, which amplifies worry and contributes to catastrophic thinking (Todd et al., 2022). These individuals may also engage in maladaptive coping styles such as avoidance and reassurance seeking, reinforcing their focus on pain and maintaining the cycle of distress.

The present study demonstrated that the relationship between childhood maltreatment and pain catastrophizing is also mediated indirectly through health anxiety. This finding can be explained within the framework of cognitive–emotional mediation models. Childhood maltreatment, as an early life stressor, contributes to the formation of maladaptive beliefs about health, bodily vulnerability, and a persistent sense of threat. These cognitive schemas often persist into adulthood and give rise to elevated levels of health anxiety. Health anxiety, in turn, acts as a cognitive–emotional risk factor that heightens sensitivity to physical symptoms and promotes catastrophic interpretations of pain.

From a theoretical perspective, these findings are consistent with the Fear-Avoidance Model, which posits that early trauma contributes to pain-related dysfunction through psychological mechanisms such as health anxiety and catastrophizing. Individuals with unresolved early adversity may become hypervigilant to somatic cues, interpret them as dangerous, and avoid activity, thereby reinforcing pain and disability.

Clinically, these results underscore the importance of screening for trauma histories and health anxiety in individuals presenting with chronic pain. Psychological interventions targeting health anxiety—such as cognitive restructuring and exposure-based strategies from cognitive-behavioral therapy (CBT)—may help patients challenge maladaptive beliefs about pain and illness, reduce somatic hypervigilance, and improve coping. Trauma-informed pain care that integrates such approaches may be especially beneficial in populations with early adversity.

Given that the current sample was predominantly composed of young, single adults, future studies should explore potential cultural and gender influences on these psychological pathways. Social norms around health, expression of distress, and coping may vary across subgroups and influence how trauma and pain are experienced and interpreted.

Limitations

Despite the valuable insights provided by this study, several limitations should be acknowledged. First, all study variables were assessed using self-report questionnaires collected from the same source, which raises the possibility of shared method variance. Future studies could mitigate this risk by incorporating multi-informant or multimethod approaches, such as clinician ratings or behavioral observations.

Second, although path analysis was used to examine hypothesized relationships, no latent variable modeling or parceling strategies were applied, and error covariances were not estimated. This

analytic choice limits the ability to account for measurement error and latent construct validity. Future research might benefit from full structural equation modeling (SEM) incorporating latent variables to improve model precision.

Third, while the Childhood Trauma Questionnaire (CTQ) provides a broad measure of maltreatment, the analysis used only the total score. As a result, the distinct effects of subtypes of maltreatment (e.g., emotional abuse, physical neglect) on health anxiety and pain catastrophizing were not explored. Disaggregating trauma subtypes in future models could yield more nuanced findings and intervention targets.

Fourth, although assumptions of multicollinearity were tested and not violated in this study, the conceptual overlap between health anxiety and pain catastrophizing may still influence estimates. Additional statistical techniques, such as variance inflation factor (VIF) diagnostics and confirmatory factor analysis (CFA), are recommended for future studies to further ensure construct independence.

Fifth, the CTQ relies on retrospective recall, which introduces the risk of recall bias—especially given the emotional salience of early adverse experiences. Prospective or informant-based methods may yield more accurate assessments of childhood trauma exposure.

Finally, the cross-sectional and correlational design of the study prohibits causal inference. To establish directionality and test developmental models, longitudinal or experimental designs are warranted. Future studies could explore how early life adversity contributes to maladaptive pain responses over time and examine the potential effects of interventions targeting health anxiety in trauma-exposed individuals.

Conclusion

In sum, the present study provides valuable insight into the psychological mechanisms linking childhood maltreatment to pain catastrophizing in individuals with chronic pain. The findings highlight health anxiety as a key cognitive–emotional mediator in this pathway. Specifically, early adverse experiences contribute to maladaptive health beliefs and a heightened sense of bodily vulnerability, which in turn foster chronic worry about health and exaggerated perceptions of pain. These results are consistent with cognitive-emotional mediation models and underscore the long-term psychological and neurobiological consequences of childhood trauma.

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