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Modeling Health Anxiety Based on Psychological Flexibility with the Mediating Role of Pain Perception in Women with Breast Cancer

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ABSTRACT

The present study aimed to model health anxiety based on psychological flexibility with the mediating role of pain perception in women with breast cancer. This study employed a descriptive-correlational design using structural equation modeling (SEM). The statistical population consisted of women aged 30–55 years with early-stage breast cancer who were undergoing treatment or active follow-up in medical centers in Shiraz, Iran, in 2025. A total of 230 participants were selected through purposive sampling. Data were collected using the Short Health Anxiety Inventory (SHAI), the Acceptance and Action Questionnaire-II (AAQ-II), and the McGill Pain Questionnaire (MPQ). Data analysis was conducted using SPSS version 26 and AMOS. After evaluating normality, outliers, and multicollinearity assumptions, the measurement and structural models were tested. Model fit was assessed using χ^2/df, RMSEA, CFI, NFI, GFI, and AGFI indices. The proposed structural model demonstrated acceptable fit to the data (χ^2/df = 2.10, RMSEA = .05, CFI = .94, NFI = .91, GFI = .96, AGFI = .94). Psychological flexibility had a significant negative direct effect on health anxiety (β = −.22, p = .001) and pain perception (β = −.42, p = .001). Pain perception showed a significant positive direct effect on health anxiety (β = .39, p = .001). Furthermore, the indirect effect of psychological flexibility on health anxiety through pain perception was significant (β = −.15, p = .02), indicating a partial mediating role of pain perception. These findings suggest that higher psychological flexibility is associated with lower pain perception and reduced health anxiety among women with breast cancer. Psychological flexibility functions as a protective factor against health anxiety in women with breast cancer both directly and indirectly through its influence on pain perception. Interventions aimed at enhancing psychological flexibility and reducing maladaptive pain-related interpretations may contribute to lower health anxiety and improved psychological adjustment in this population.

Keywords: Health anxiety; Psychological flexibility; Pain perception; Breast cancer; Structural equation modeling.

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Introduction

Breast cancer remains one of the most prevalent malignancies affecting women worldwide and continues to represent a major public health challenge due to its physical, emotional, and social consequences. Although advances in early detection and treatment have significantly improved survival rates, many women continue to experience substantial psychological distress throughout the disease trajectory. The diagnosis of breast cancer often confronts patients with uncertainty regarding prognosis, treatment effectiveness, recurrence, and long-term health outcomes, leading to considerable emotional burden and psychological

vulnerability (1). In addition to the direct impact of the disease, ongoing medical monitoring, treatment side effects, and concerns regarding bodily changes frequently contribute to heightened psychological distress among patients.

One of the most prominent psychological concerns experienced by individuals with cancer is health anxiety. Health anxiety refers to excessive worry, persistent fear, and catastrophic interpretations concerning one's health status and bodily symptoms. While a moderate level of concern may facilitate adaptive health-related behaviors, excessive health anxiety can interfere with emotional adjustment, quality of life, treatment adherence, and overall well-being. Research has demonstrated that health anxiety is highly prevalent among individuals with chronic illnesses and cancer, where concerns regarding disease progression, recurrence, and symptom interpretation often become amplified (2). Among women with breast cancer, health anxiety may manifest as persistent monitoring of bodily sensations, excessive concern about treatment outcomes, repeated reassurance seeking, and heightened fear of recurrence.

Recent evidence suggests that health anxiety among cancer patients is associated with a variety of psychological and behavioral outcomes. For example, studies have demonstrated significant relationships between health anxiety and treatment adherence, psychological adjustment, and coping behaviors among individuals with cancer (3). Similarly, investigations among women with breast cancer have shown that health anxiety is closely associated with uncertainty, maladaptive cognitive processes, and psychological vulnerability (4). Furthermore, health anxiety has been linked to cancer literacy, screening behaviors, and resilience, suggesting that psychological factors play a critical role in shaping patients' responses to cancer-related threats (5).

To better understand factors that may protect individuals from excessive health anxiety, researchers have increasingly focused on the construct of psychological flexibility. Psychological flexibility refers to the capacity to remain in contact with present-moment experiences while accepting difficult thoughts, emotions, and bodily sensations and engaging in behaviors consistent with personal values (6). This construct represents a central component of Acceptance and Commitment Therapy (ACT) and has received considerable attention as a transdiagnostic process underlying psychological well-being and resilience across various populations and health conditions (7).

Psychological flexibility has been recognized as a fundamental dimension of adaptive psychological functioning. Individuals with higher levels of psychological flexibility are generally better able to cope with stress, uncertainty, and adversity without becoming overwhelmed by distressing internal experiences. Conversely, psychological inflexibility is characterized by experiential avoidance, cognitive fusion, rigid behavioral patterns, and difficulty adapting to challenging circumstances. Research has identified psychological inflexibility as a common underlying factor across anxiety disorders, depression, obsessive-compulsive disorder, and other forms of psychological distress (8). Recent findings have further emphasized that psychological inflexibility contributes substantially to emotional suffering and reduced quality of life across a wide range of health-related conditions (9).

The relevance of psychological flexibility becomes particularly apparent in the context of cancer. Women diagnosed with breast cancer frequently encounter uncertainty, fear, physical discomfort, and ongoing medical challenges that require adaptive coping strategies. Psychological flexibility may enable patients to acknowledge distressing emotions and physical symptoms without becoming consumed by them, thereby

promoting healthier psychological adjustment. Evidence indicates that interventions targeting psychological flexibility can improve emotional functioning and overall quality of life among cancer patients (10). Furthermore, ACT-based interventions have demonstrated effectiveness in reducing psychological distress and improving adjustment among individuals facing chronic medical conditions and cancer-related stressors (11).

The growing body of literature on psychological flexibility highlights its role as a protective factor across diverse populations. For example, ACT-based interventions designed to enhance psychological flexibility have shown positive effects on emotional well-being and self-compassion among adolescents exposed to significant stressors (12). Similar findings have emerged across clinical populations, suggesting that increased flexibility contributes to improved coping, reduced anxiety, and greater resilience. Within the cancer context, enhancing psychological flexibility may help individuals tolerate uncertainty regarding their illness while maintaining engagement in meaningful life activities despite ongoing challenges.

Another important factor influencing psychological functioning among women with breast cancer is pain perception. Pain is among the most common and distressing symptoms experienced by cancer patients. A large body of evidence indicates that cancer-related pain affects a substantial proportion of patients during diagnosis, treatment, and survivorship phases (13). Pain may arise from the cancer itself, surgical interventions, chemotherapy, radiotherapy, hormonal treatments, or treatment-related complications. Beyond its physical dimensions, pain also encompasses emotional, cognitive, and social components that shape the individual's overall experience.

Research has demonstrated that pain is not merely a physiological phenomenon but is significantly influenced by psychological processes. The perception of pain may vary considerably depending on emotional state, attention, coping strategies, beliefs, and cognitive appraisals. Individuals who catastrophize pain or perceive it as threatening often report greater pain intensity and higher levels of psychological distress (14). Consequently, understanding psychological factors that influence pain perception has become increasingly important in cancer care.

Recent studies continue to underscore the multidimensional nature of cancer-related pain. Qualitative investigations have revealed that patients with advanced cancer frequently describe pain as a complex experience intertwined with emotional suffering, uncertainty, fear, and concerns about disease progression (15). Likewise, research among cancer patients has shown that pain interference significantly affects psychological well-being, hope, and quality of life (16). Studies evaluating pain management interventions have also demonstrated that addressing psychological factors can contribute substantially to improved pain outcomes (17). Furthermore, evidence suggests that enhancing psychological flexibility through acceptance-based interventions can reduce chronic pain experiences and improve psychological adjustment among cancer patients (18).

The relationship between psychological flexibility and pain perception has attracted growing scholarly attention. Theoretical frameworks underlying ACT propose that psychological flexibility allows individuals to experience pain without excessive avoidance, catastrophizing, or emotional reactivity. Rather than attempting to eliminate unpleasant sensations, psychologically flexible individuals learn to accept discomfort while continuing to engage in meaningful activities. This approach may reduce the psychological amplification of pain and decrease the distress associated with painful experiences (11). Recent research

further supports the mediating role of psychological flexibility in explaining how individuals respond to chronic pain and associated maladaptive outcomes (19).

Pain perception may also play a critical role in the development and maintenance of health anxiety among women with breast cancer. Because pain is often interpreted as a signal of illness progression, recurrence, or treatment failure, individuals who experience higher levels of pain may become increasingly vigilant regarding bodily sensations. This heightened vigilance can contribute to catastrophic interpretations and persistent health-related worries. Consequently, pain perception may serve as an important psychological mechanism linking broader psychological processes to health anxiety.

Although previous studies have independently examined health anxiety, psychological flexibility, and pain perception, fewer investigations have explored how these variables interact within a comprehensive explanatory model among women with breast cancer. Existing research has highlighted associations between health anxiety and cognitive flexibility (4), between resilience and health anxiety (5), and between psychological flexibility and chronic pain outcomes (19). However, the potential mediating role of pain perception in the relationship between psychological flexibility and health anxiety remains insufficiently understood.

From a theoretical perspective, psychological flexibility may reduce health anxiety directly by enabling individuals to accept uncertainty and distressing health-related thoughts. Simultaneously, it may reduce health anxiety indirectly by influencing how pain is perceived and interpreted. Women who are psychologically flexible may be less likely to catastrophize pain, interpret bodily sensations as evidence of disease progression, or engage in excessive symptom monitoring. As a result, lower pain-related distress may contribute to reduced health anxiety. Examining these pathways may provide a more nuanced understanding of the psychological mechanisms underlying adjustment to breast cancer.

Structural equation modeling offers a powerful methodological framework for investigating such complex relationships because it allows simultaneous examination of direct and indirect effects among multiple variables while accounting for measurement error (20). By testing a comprehensive model, researchers can gain deeper insight into the mechanisms through which psychological flexibility and pain perception influence health anxiety among women with breast cancer.

Given the substantial psychological burden associated with breast cancer, the importance of health anxiety for patient adjustment, the growing recognition of psychological flexibility as a protective factor, and the central role of pain perception in cancer experiences, further investigation of these relationships is warranted. Understanding these mechanisms may inform the development of more effective psycho-oncological interventions aimed at enhancing psychological flexibility, improving pain management, and reducing health-related fears among women living with breast cancer.

Therefore, the present study aimed to model health anxiety based on psychological flexibility with the mediating role of pain perception in women with breast cancer.

Methods and Materials

Study Design and Participants

The present study was fundamental in terms of purpose and descriptive-correlational in terms of method. The study was conducted using a structural equation modeling approach to examine health anxiety based on

psychological flexibility with the mediating role of pain perception in women with breast cancer. In the proposed model, psychological flexibility was considered the exogenous predictor variable, pain perception was considered the mediating variable, and health anxiety was considered the endogenous outcome variable. This design was appropriate because the purpose of the study was to test direct and indirect relationships among psychological variables rather than to manipulate an intervention or compare treatment groups.

The statistical population consisted of women aged 30 to 55 years with breast cancer who were receiving treatment or active follow-up in medical centers in Shiraz, Iran, in 2025. Participants were selected from women diagnosed with early-stage breast cancer. Based on the requirements of structural equation modeling and the need for an adequate sample size to test the proposed model, 230 participants were selected using purposive sampling.

Participants were included if they were women between 30 and 55 years of age, had a confirmed diagnosis of breast cancer, were in the early stage of the disease, were undergoing treatment or follow-up care, and were willing to participate in the study. They also had to be able to understand the questionnaire items and complete the research instruments independently. Participants who did not complete the questionnaires, provided invalid or patterned responses, or were unwilling to continue participation were excluded from the analysis.

Data Collection

Data were collected using standardized self-report questionnaires. The main instruments used in this article included the Short Health Anxiety Inventory, the Acceptance and Action Questionnaire–II, and the McGill Pain Questionnaire. These instruments were selected because they directly measured the main constructs of the proposed model: health anxiety, psychological flexibility, and pain perception.

Health anxiety was assessed using the 18-item Short Health Anxiety Inventory developed by Salkovskis and Warwick. This instrument evaluates excessive concern about health, fear of serious illness, and preoccupation with bodily symptoms. The scale is designed to assess health anxiety across both clinical and non-clinical populations and is especially relevant for patients with medical conditions who may experience heightened concern about physical symptoms. In the present study, health anxiety was operationally defined as the total score obtained from this questionnaire, with higher scores indicating greater health anxiety.

Psychological flexibility was measured using the Acceptance and Action Questionnaire–II developed by Bond and colleagues. This questionnaire assesses psychological inflexibility and experiential avoidance, which are conceptually opposite to psychological flexibility. Items evaluate the extent to which individuals are able to accept unpleasant internal experiences, remain psychologically open, and act in accordance with personal values despite distress. In the present study, psychological flexibility was operationally defined based on the score obtained from this instrument. Higher psychological flexibility reflects a greater ability to respond adaptively to difficult thoughts, emotions, and bodily sensations.

Pain perception was assessed using the McGill Pain Questionnaire. This instrument measures the sensory, affective, and evaluative dimensions of pain experience. It provides a multidimensional assessment of pain rather than limiting pain to physical intensity alone. This feature was particularly relevant for women with breast cancer because pain in this group may be influenced by treatment, surgery, physical symptoms, emotional distress, and cognitive interpretation of bodily sensations. In the present study, pain perception

was operationally defined as the score obtained from the McGill Pain Questionnaire, with higher scores indicating greater perceived pain.

Data Analysis

Data were analyzed using SPSS version 26 and AMOS software. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize demographic characteristics and the main study variables. Before testing the structural model, data screening was conducted. Missing values, outliers, normality, linearity, and multicollinearity were examined to ensure that the data met the assumptions required for structural equation modeling.

Structural equation modeling was used to test the proposed model. First, the measurement model was evaluated to examine whether the observed indicators adequately represented the latent variables. Then, the structural model was tested to examine the direct and indirect relationships among psychological flexibility, pain perception, and health anxiety. The direct effect of psychological flexibility on health anxiety, the direct effect of psychological flexibility on pain perception, and the direct effect of pain perception on health anxiety were examined. In addition, the indirect effect of psychological flexibility on health anxiety through pain perception was tested to determine the mediating role of pain perception.

Model fit was evaluated using several common fit indices, including the chi-square statistic, the ratio of chi-square to degrees of freedom, the comparative fit index, the goodness-of-fit index, the adjusted goodness-of-fit index, the normed fit index, the Tucker–Lewis index, and the root mean square error of approximation. Standardized path coefficients and significance values were used to interpret the strength and direction of the relationships among the variables. The significance level was set at .05.

Findings and Results

The study was conducted on 230 women with breast cancer who were receiving treatment or active follow-up in medical centers in Shiraz. Descriptive statistics were calculated for the main study variables, including health anxiety, psychological flexibility, and pain perception. The descriptive findings showed that the mean score for the probability of illness, as a component of health anxiety, was 20.10 (SD = 3.97), and the mean score for consequences of illness was 11.60 (SD = 2.13). The mean score for psychological flexibility was 16.40 (SD = 2.32). Regarding pain perception, the mean score for affective pain was 50.50 (SD = 14.10), and the mean score for sensory pain was 42.80 (SD = 12.40).

The skewness and kurtosis values of the variables were within the acceptable range of -3 to +3, indicating that the distribution of the study variables did not substantially deviate from normality. Therefore, the data were considered appropriate for structural equation modeling.

Table 1. Descriptive Statistics of the Study Variables

Variable	Component	M	SD	Skewness	Kurtosis
Health anxiety	Probability of illness	20.10	3.97	-0.595	1.620
Health anxiety	Consequences of illness	11.60	2.13	-0.127	0.786
Psychological flexibility	Total score	16.40	2.32	0.163	0.126
Pain perception	Affective pain	50.50	14.10	-1.110	-0.307
Pain perception	Sensory pain	42.80	12.40	-1.230	0.020

Before testing the structural model, the data were screened for missing values, outliers, normality, and multicollinearity. Missing data were observed in some subscales; therefore, the median replacement method was used to replace missing values. Outliers were examined using standardized scores, and values outside the acceptable range were replaced with the mean of the corresponding variable. The normality of the variables was evaluated using skewness and kurtosis indices, and all values were within the acceptable range.

Multicollinearity was examined using tolerance and variance inflation factor values. The tolerance value for psychological flexibility was .942 and its variance inflation factor was 1.06. For the pain perception components, tolerance values were .564 for affective pain and .603 for sensory pain, and variance inflation factor values were 1.30 and 1.41, respectively. These findings indicated that there was no severe multicollinearity among the predictor variables.

Before testing the structural paths, the measurement model was evaluated. The factor loadings of the observed indicators on their latent variables were statistically significant. For pain perception, affective pain had a standardized factor loading of .88, and sensory pain had a standardized factor loading of .92. For health anxiety, probability of illness had a standardized factor loading of .72, and consequences of illness had a standardized factor loading of .83. All factor loadings were significant at the .001 level, indicating that the observed indicators adequately represented their corresponding latent constructs.

Table 2. Standardized Factor Loadings of the Measurement Model

Latent variable	Indicator	Standardized loading	p
Pain perception	Affective pain	.88	.001
Pain perception	Sensory pain	.92	.001
Health anxiety	Probability of illness	.72	.001
Health anxiety	Consequences of illness	.83	.001

The measurement model findings confirmed that the indicators of health anxiety and pain perception had significant factor loadings. Therefore, the measurement structure was acceptable for testing the structural relationships among psychological flexibility, pain perception, and health anxiety.

Structural equation modeling was used to test the proposed model of health anxiety based on psychological flexibility with the mediating role of pain perception. The results showed that the model had acceptable fit to the data. The ratio of chi-square to degrees of freedom was 2.10, which was lower than the recommended cutoff of 3. The root mean square error of approximation was .05, indicating good model fit. Other fit indices also supported the adequacy of the model: comparative fit index = .94, normed fit index = .91, goodness-of-fit index = .96, and adjusted goodness-of-fit index = .94.

Table 3. Fit Indices of the Structural Model

Fit index	Value	Recommended criterion	Interpretation
χ^2/df	2.10	< 3	Acceptable
RMSEA	.05	< .10	Acceptable
CFI	.94	> .90	Acceptable

NFI	.91	> .90	Acceptable
GFI	.96	> .90	Acceptable
AGFI	.94	> .90	Acceptable

Overall, the fit indices indicated that the proposed structural model had an acceptable fit. Therefore, the model of health anxiety based on psychological flexibility with the mediating role of pain perception was supported.

The direct effects among the study variables were examined using standardized path coefficients. The results showed that psychological flexibility had a negative and significant direct effect on health anxiety, β = -.22, t = -3.36, p = .001. This finding indicates that higher psychological flexibility was associated with lower health anxiety among women with breast cancer.

The direct effect of psychological flexibility on pain perception was also negative and significant, β = -.42, t = -3.88, p = .001. This result indicates that higher psychological flexibility was associated with lower pain perception. In other words, women with greater psychological flexibility reported lower levels of perceived pain.

In addition, pain perception had a positive and significant direct effect on health anxiety, β = .39, t = 3.56, p = .001. This finding indicates that women who reported higher pain perception also reported higher health anxiety.

Table 4. Direct Effects in the Structural Model

Predictor	Outcome	Effect type	β	t	p
Psychological flexibility	Health anxiety	Direct	-.22	-3.36	.001
Psychological flexibility	Pain perception	Direct	-.42	-3.88	.001
Pain perception	Health anxiety	Direct	.39	3.56	.001

These findings show that psychological flexibility functioned as a protective variable against both pain perception and health anxiety. Pain perception, in contrast, functioned as a risk factor for health anxiety.

The mediating role of pain perception in the relationship between psychological flexibility and health anxiety was examined using the Sobel test. The results showed that the indirect effect of psychological flexibility on health anxiety through pain perception was negative and statistically significant, β = -.15, t = -3.26, p = .02. This finding indicates that pain perception significantly mediated the relationship between psychological flexibility and health anxiety.

Table 5. Indirect Effect of Psychological Flexibility on Health Anxiety Through Pain Perception

Predictor	Mediator	Outcome	Effect type	β	t	p
Psychological flexibility	Pain perception	Health anxiety	Indirect	-.15	-3.26	.02

The negative indirect coefficient indicates that higher psychological flexibility reduced health anxiety partly through reducing pain perception. In other words, women with higher psychological flexibility tended to perceive pain less intensely, and lower pain perception was associated with lower health anxiety. Therefore, pain perception served as a significant psychological mechanism explaining part of the relationship between psychological flexibility and health anxiety.

The results supported the proposed model. The structural model showed acceptable fit indices, and all direct and indirect paths were statistically significant. Psychological flexibility had a negative direct effect

on health anxiety and pain perception. Pain perception had a positive direct effect on health anxiety. In addition, pain perception significantly mediated the relationship between psychological flexibility and health anxiety. Overall, the findings suggest that psychological flexibility may reduce health anxiety in women with breast cancer both directly and indirectly by reducing pain perception. These results highlight the importance of psychological flexibility and pain-related cognitive-emotional processes in understanding health anxiety among women with breast cancer.

Discussion and Conclusion

The present study aimed to examine a structural model of health anxiety based on psychological flexibility with the mediating role of pain perception among women with breast cancer. The findings demonstrated that the proposed model exhibited an acceptable fit to the data, indicating that psychological flexibility and pain perception constitute important psychological mechanisms associated with health anxiety in this population. Specifically, psychological flexibility showed a significant negative direct effect on health anxiety and pain perception, whereas pain perception demonstrated a significant positive direct effect on health anxiety. Furthermore, pain perception significantly mediated the relationship between psychological flexibility and health anxiety. These findings contribute to the growing literature emphasizing the importance of transdiagnostic psychological processes in cancer adjustment and provide further evidence for the relevance of psychological flexibility in psycho-oncology.

One of the most important findings of the present study was the significant negative direct effect of psychological flexibility on health anxiety. Women with higher levels of psychological flexibility reported lower levels of health anxiety, suggesting that the ability to accept unpleasant internal experiences and remain engaged in valued activities may protect individuals from excessive health-related fears. This finding is consistent with theoretical perspectives describing psychological flexibility as a core component of adaptive psychological functioning (6). According to this perspective, psychologically flexible individuals are better able to acknowledge distressing thoughts and emotions without becoming dominated by them. Consequently, they are less likely to interpret health-related concerns in catastrophic ways or become trapped in cycles of worry and symptom monitoring.

The present finding is also consistent with evidence demonstrating the role of psychological flexibility in reducing emotional distress across a variety of psychological conditions. Research has shown that psychological inflexibility functions as a transdiagnostic process underlying anxiety, depression, and obsessive-compulsive symptoms (8). Similarly, investigations have reported that individuals with greater psychological flexibility exhibit better emotional adjustment and lower psychological distress when confronted with challenging life circumstances (12). In the context of breast cancer, where uncertainty about disease progression and recurrence is common, psychological flexibility may enable patients to tolerate ambiguity while avoiding maladaptive cognitive and emotional responses.

The observed association between psychological flexibility and lower health anxiety is further supported by studies conducted among cancer populations. Hulbert-Williams and colleagues emphasized that psychological flexibility plays a critical role in helping patients cope with cancer-related stressors and adapt more effectively to illness-related challenges (10). Acceptance-based approaches encourage patients to experience fear, uncertainty, and discomfort without engaging in excessive avoidance or cognitive fusion. As

a result, health-related concerns become less disruptive and less likely to escalate into persistent anxiety. This interpretation is particularly relevant for women with breast cancer, who frequently encounter ongoing concerns about treatment outcomes, recurrence, and bodily symptoms.

The findings are also consistent with studies focusing specifically on health anxiety among women with breast cancer. Mohamadi Nia and Nasehi reported that cognitive flexibility significantly contributed to the prediction of health anxiety in women with breast cancer (4). Although cognitive flexibility and psychological flexibility represent distinct constructs, both involve adaptive responses to uncertainty and internal experiences. The current findings extend this literature by demonstrating that psychological flexibility contributes not only to general psychological adjustment but also specifically to reduced health anxiety among women confronting cancer-related challenges.

Another important finding of the study was the significant negative effect of psychological flexibility on pain perception. Women who reported greater psychological flexibility perceived lower levels of pain. This finding supports contemporary psychological models suggesting that pain is not solely determined by physiological processes but is also shaped by cognitive, emotional, and behavioral responses. Psychological flexibility may reduce pain perception by decreasing experiential avoidance, cognitive fusion, and maladaptive attentional processes. Rather than viewing pain as a threatening or uncontrollable experience, psychologically flexible individuals may approach pain with greater acceptance and emotional openness.

This finding aligns closely with previous research on chronic pain and acceptance-based interventions. McCracken and Vowles argued that psychological flexibility represents a central mechanism through which individuals adapt to chronic pain and reduce pain-related suffering (11). Similarly, research has shown that greater mindfulness and acceptance are associated with lower pain catastrophizing and reduced emotional distress related to pain (14). In breast cancer patients, such processes may be particularly important because pain is often accompanied by concerns regarding disease progression, treatment complications, or recurrence.

Recent empirical findings further support the relationship between psychological flexibility and pain-related outcomes. Barrado-Moreno and colleagues demonstrated that psychological flexibility functions as an important mediating factor in chronic pain populations and contributes to healthier behavioral and emotional outcomes (19). Likewise, Aghili and Bahmani found that acceptance and commitment therapy significantly improved chronic pain experiences among cancer patients, highlighting the importance of flexibility-based mechanisms in pain management (18). The current findings extend these observations by demonstrating that psychological flexibility is associated with reduced pain perception among women with breast cancer.

The study also revealed that pain perception had a significant positive direct effect on health anxiety. Women who experienced higher levels of perceived pain reported greater health anxiety. This finding is theoretically meaningful because pain often serves as a salient indicator of potential threat in individuals with cancer. For many patients, pain is interpreted not merely as a physical sensation but as a possible sign of disease progression, recurrence, or treatment failure. Such interpretations can trigger heightened vigilance, fear, and excessive concern regarding health status.

This result is consistent with previous literature emphasizing the psychological significance of pain in cancer populations. Cancer-related pain is among the most prevalent and distressing symptoms experienced

by patients and is frequently associated with emotional suffering and reduced quality of life (13). Qualitative evidence indicates that patients often perceive chronic pain as a source of uncertainty and fear, contributing to ongoing psychological distress (15). Similarly, studies have shown that pain interference is closely associated with diminished hope and poorer psychological well-being among individuals with cancer (16).

The positive relationship between pain perception and health anxiety is also supported by broader conceptualizations of health anxiety. According to systematic reviews, health anxiety is strongly influenced by the interpretation of bodily sensations and illness-related cues (2). Individuals who perceive physical symptoms as threatening are more likely to engage in symptom monitoring, reassurance seeking, and catastrophic thinking. In women with breast cancer, pain may become a particularly powerful trigger for these processes because of its perceived association with disease progression. Consequently, heightened pain perception may directly contribute to increased health anxiety.

Another notable finding was the significant mediating role of pain perception in the relationship between psychological flexibility and health anxiety. The results indicated that psychological flexibility reduced health anxiety indirectly through its influence on pain perception. In other words, women with greater psychological flexibility tended to report lower pain perception, which in turn contributed to lower levels of health anxiety. This finding represents one of the most important contributions of the study because it identifies a potential psychological mechanism linking flexibility to health-related emotional outcomes.

The mediating role of pain perception can be explained through acceptance-based models of psychological functioning. Individuals with higher psychological flexibility may be less likely to catastrophize pain, avoid pain-related experiences, or interpret discomfort as evidence of serious threat. Consequently, pain becomes less emotionally distressing and less likely to activate health-related fears. This interpretation is consistent with research emphasizing that psychological flexibility influences how individuals respond to unpleasant physical sensations and health-related stressors (7). By altering the meaning attributed to pain, psychological flexibility may indirectly reduce the development and maintenance of health anxiety.

The findings also align with previous studies demonstrating the importance of psychological factors in cancer adjustment. Basharpour and colleagues found that psychological resources significantly influence the relationship between cancer-related concerns and health anxiety (5). Similarly, Soleimani Nameqi and colleagues reported that health anxiety is closely linked with treatment-related psychological processes among cancer patients (3). The present study extends these findings by identifying pain perception as a specific pathway through which psychological flexibility influences health anxiety.

From a clinical perspective, the findings have important implications for psycho-oncology services. They suggest that interventions designed solely to reduce symptoms may not be sufficient to address health anxiety among women with breast cancer. Instead, psychological interventions should target underlying processes such as experiential avoidance, cognitive fusion, and maladaptive pain interpretations. Acceptance and commitment therapy may be particularly effective because it directly aims to increase psychological flexibility and alter individuals' relationships with difficult thoughts, emotions, and bodily sensations (10). Such interventions may help patients respond more adaptively to uncertainty and pain while maintaining engagement in meaningful life activities.

The findings further highlight the importance of integrating psychological and medical approaches to pain management. Contemporary cancer care increasingly recognizes that effective pain management requires

attention not only to physiological mechanisms but also to cognitive and emotional processes. Studies have shown that interventions addressing psychological responses to pain can improve patient outcomes and reduce suffering (17, 21). By promoting psychological flexibility, healthcare professionals may simultaneously reduce pain-related distress and health anxiety.

Overall, the findings support a comprehensive biopsychosocial perspective of cancer adjustment. They suggest that health anxiety among women with breast cancer is influenced not only by the presence of illness but also by the psychological processes through which symptoms and experiences are interpreted. The structural model demonstrated that psychological flexibility functions as a protective factor, pain perception functions as a risk factor, and pain perception serves as a significant mechanism linking psychological flexibility to health anxiety. These findings contribute to the growing body of literature emphasizing the importance of psychological flexibility in health-related outcomes and provide valuable insights for developing targeted interventions for women with breast cancer.

Several limitations should be considered when interpreting the findings of the present study. First, the correlational nature of the research design limits the ability to establish causal relationships among psychological flexibility, pain perception, and health anxiety. Second, all variables were assessed using self-report measures, which may be influenced by response biases, social desirability, and subjective perceptions. Third, the sample consisted exclusively of women with breast cancer receiving treatment in a specific geographical region, potentially limiting the generalizability of the findings to other cancer populations, male patients, or individuals from different cultural contexts. Additionally, other potentially influential variables such as social support, fear of cancer recurrence, coping strategies, depression, and disease severity were not included in the proposed model.

Future studies should employ longitudinal designs to examine the causal relationships among psychological flexibility, pain perception, and health anxiety over time. Experimental and intervention-based studies are also needed to determine whether enhancing psychological flexibility can effectively reduce pain perception and health anxiety among women with breast cancer. Researchers may further investigate additional mediating and moderating variables, including resilience, emotional regulation, social support, illness perceptions, fear of recurrence, and treatment adherence. Comparative studies involving different cancer types, disease stages, and treatment phases would also contribute to a more comprehensive understanding of the proposed model. Moreover, qualitative investigations could provide deeper insights into patients' lived experiences regarding pain, flexibility, and health-related fears.

Healthcare professionals working with women diagnosed with breast cancer should routinely assess psychological flexibility, pain-related perceptions, and health anxiety as interconnected components of psychological adjustment. Psycho-oncology services may benefit from incorporating acceptance-based interventions that help patients respond more adaptively to uncertainty, distressing emotions, and bodily symptoms. Educational programs designed to improve patients' understanding of pain and its psychological dimensions may reduce catastrophic interpretations and excessive health concerns. Multidisciplinary cancer care teams should collaborate to integrate psychological support with medical pain management strategies. Such approaches may enhance emotional well-being, reduce health anxiety, improve treatment engagement, and promote overall quality of life among women living with breast cancer.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

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

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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