

Structural Modeling of Quality of Life in Patients with Cardiovascular Disease Based on Illness Perception, Health Anxiety, and Perceived Social Support: The Mediating Roles of Emotion Regulation Difficulties and Resilience

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ABSTRACT

This study aimed to develop and test a structural model of quality of life in patients with cardiovascular disease based on illness perception, health anxiety, and perceived social support, with emotion regulation difficulties and resilience as mediating variables. This cross-sectional analytical study was conducted on 420 adult patients with cardiovascular disease attending cardiology outpatient clinics and cardiac rehabilitation services at Rajaie Cardiovascular Medical and Research Center, Tehran, Iran, in 2026. Participants were selected through consecutive sampling. Data were collected using the Brief Illness Perception Questionnaire, Short Health Anxiety Inventory, Multidimensional Scale of Perceived Social Support, Difficulties in Emotion Regulation Scale-16, 10-item Connor-Davidson Resilience Scale, and WHOQOL-BREF. Structural equation modeling with robust maximum likelihood estimation was used to examine the measurement and structural models, and indirect effects were evaluated using 5,000 bias-corrected bootstrap resamples. The structural model demonstrated good fit, $\chi^2(168) = 312.48$, $\chi^2/df = 1.86$, CFI = .958, TLI = .949, RMSEA = .045, and SRMR = .041, explaining 52% of the variance in emotion regulation difficulties, 39% in resilience, and 63% in quality of life. Illness perception and health anxiety positively predicted emotion regulation difficulties and negatively predicted resilience, whereas perceived social support negatively predicted emotion regulation difficulties and positively predicted resilience (all $p < .001$). Emotion regulation difficulties negatively predicted quality of life ($\beta = -.31$, $p < .001$), while resilience positively predicted it ($\beta = .36$, $p < .001$). Illness perception ($\beta = -.20$, $p = .002$), health anxiety ($\beta = -.17$, $p = .009$), and perceived social support ($\beta = .15$, $p = .004$) retained significant direct effects on quality of life. All six specific indirect effects were significant, supporting partial mediation. Quality of life in patients with cardiovascular disease is influenced by interrelated cognitive, emotional, and interpersonal factors, with emotion regulation difficulties and resilience serving as significant mediating mechanisms. Interventions targeting maladaptive illness perceptions, health anxiety, emotional regulation, resilience, and social support may improve psychosocial adjustment and quality of life in cardiovascular populations.

Keywords: Cardiovascular Disease; Quality of Life; Illness Perception; Health Anxiety; Perceived Social Support; Emotion Regulation; Resilience; Structural Equation Modeling

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Introduction

Cardiovascular diseases remain among the most consequential chronic health conditions because their impact extends beyond physiological impairment to encompass persistent psychological, behavioral, interpersonal, and functional challenges that may substantially diminish patients' quality of life. Advances in diagnosis, pharmacological treatment, interventional cardiology, and rehabilitation have increased survival among patients with coronary artery disease, heart failure, arrhythmias, and valvular disorders; however, prolonged survival frequently entails living with symptoms, uncertainty, treatment demands, functional restrictions, fear of recurrence or deterioration, and dependence on sustained self-management. Quality of life in this population therefore cannot be understood solely in terms of disease severity or objective clinical indicators, because patients with similar cardiovascular diagnoses and comparable physiological status may report markedly different levels of physical, psychological, social, and environmental well-being. Contemporary psychosocial models increasingly emphasize that the way individuals interpret their illness, appraise bodily symptoms, mobilize social resources, regulate negative emotions, and maintain adaptive capacity may influence their subjective health outcomes as strongly as some biomedical parameters. Recent cardiovascular research has consequently shifted toward multidimensional explanatory frameworks that examine interacting psychological and social pathways rather than isolated predictors of quality of life (1-3). This perspective is particularly relevant for structural modeling, which permits simultaneous estimation of direct and indirect relationships among multiple psychosocial constructs and can therefore provide a more integrated account of the processes through which cardiovascular disease affects patients' daily functioning and perceived well-being (4).

A central construct in explaining adaptation to chronic illness is illness perception, referring to the organized cognitive and emotional representations through which individuals understand and respond to a health threat. According to the Common-Sense Model of Self-Regulation, patients actively construct beliefs about the identity of an illness, its causes, consequences, expected duration, controllability, treatment effectiveness, coherence, and emotional meaning, and these representations guide coping decisions and self-management behaviors (5). Illness perception is therefore not a passive reflection of disease severity but a dynamic interpretive framework that shapes how patients respond to symptoms and medical information. When cardiovascular disease is perceived as highly threatening, uncontrollable, unpredictable, or overwhelming, patients may experience greater psychological distress, adopt maladaptive coping responses, and perceive larger disruptions in their everyday lives. In contrast, perceptions of coherence, controllability, and treatment effectiveness may facilitate more adaptive responses and better adjustment. Evidence from patients with acute coronary syndrome indicates that illness perception can function as an important psychological mechanism linking disease severity and psychological stress to health-related quality of life (6). Similarly, research among patients with atrial fibrillation has shown that illness perception is associated with quality of life both directly and through coping strategies and psychological status, suggesting that illness representations exert their influence partly through downstream emotional and behavioral processes (7). The availability of psychometrically validated Persian measures of illness perception further supports examination of this construct in Iranian clinical populations, with studies reporting acceptable reliability and validity of the Persian Brief Illness Perception Questionnaire in chronic pain populations (8, 9).

Health anxiety represents another potentially important psychological determinant of quality of life in cardiovascular disease. Although some concern about bodily sensations and disease progression is understandable among individuals with a genuine cardiac diagnosis, health anxiety becomes problematic when patients interpret ordinary or ambiguous bodily sensations catastrophically, remain excessively preoccupied with disease deterioration, repeatedly monitor physical symptoms, or experience persistent fears that exceed objective medical risk. Cardiovascular conditions are particularly relevant to health anxiety because normal fluctuations in heart rate, chest sensations, breathlessness, fatigue, or dizziness may acquire threatening meanings, especially in patients with previous acute events. Prospective evidence has shown that elevated health anxiety is not merely a psychological correlate of physical illness but may itself be associated with increased risk of ischemic heart disease, highlighting the complex reciprocal relationship between cardiovascular functioning and illness-focused fear (10). More recent clinical evidence demonstrates that targeted self-care education can reduce health anxiety among patients with coronary artery disease, indicating that this construct is potentially modifiable rather than an inevitable consequence of cardiac illness (11). Reliable assessment of health anxiety in medically ill populations is therefore essential, and recent validation of the Persian Short Health Anxiety Inventory has supported its factor structure, internal consistency, and construct validity within Iranian clinical samples (12). Despite this evidence, health anxiety has not always been incorporated alongside illness perception in integrated explanatory models of quality of life among patients with diverse cardiovascular diagnoses.

Perceived social support constitutes an important interpersonal resource that may buffer the psychological burden of cardiovascular disease and facilitate adaptation to chronic treatment demands. Social support can provide emotional reassurance, practical assistance, informational guidance, companionship, encouragement for treatment adherence, and a sense of belonging that may reduce perceived vulnerability in the context of illness. Importantly, perceived social support concerns the individual's subjective belief that dependable assistance is available when needed, and this perception may be especially relevant to emotional well-being and coping. In patients with cardiovascular disease, higher perceived social support has been associated with better quality of life, indicating that family members, friends, and significant others may influence adjustment not only by providing concrete help but also by reducing isolation and increasing perceived competence in managing illness (13). Evidence has also linked perceived social support with treatment compliance and improved quality of life among cardiac patients, reinforcing its relevance to both behavioral and subjective outcomes (14). In patients recovering from myocardial infarction, greater perceived support has additionally been associated with adherence to cardiac rehabilitation, suggesting that social resources may facilitate sustained engagement in health-promoting behaviors after major cardiac events (15). These findings support the expectation that social support may exert both direct effects on quality of life and indirect effects through patients' emotional and adaptive capacities.

Emotion regulation difficulties may represent one of the key psychological mechanisms through which negative illness appraisals and inadequate social resources influence quality of life. Emotion regulation refers to the processes by which individuals monitor, interpret, modify, and respond to emotional experiences, particularly under conditions of distress. Difficulties in emotion regulation can include nonacceptance of negative emotions, problems maintaining goal-directed behavior when distressed,

impaired impulse control, limited access to effective regulation strategies, and poor emotional clarity. The DERS-16 provides a concise multidimensional assessment of these difficulties and has demonstrated strong reliability and validity in its original development (16), while the Persian version has shown satisfactory psychometric performance and supports the assessment of emotion dysregulation in Iranian samples (17). The relevance of emotion regulation to cardiovascular health is not purely psychological. Experimental evidence suggests that habitual emotion regulation tendencies are related to cardiovascular responses to stress, indicating that how individuals manage emotional experiences may influence physiological reactivity as well as subjective distress (18). For patients with established cardiovascular disease, recurrent inability to regulate fear, sadness, frustration, or illness-related uncertainty may therefore contribute to both psychological strain and unfavorable perceptions of functioning, reducing overall quality of life.

Resilience represents a complementary adaptive mechanism and refers broadly to the capacity to maintain or regain psychological functioning when confronted with adversity, stress, chronic illness, and major life disruption. Rather than implying the absence of distress, resilience reflects the ability to adapt effectively despite stressors and to preserve a sense of competence, purpose, and psychological stability. In cardiovascular populations, resilience has attracted increasing attention because chronic cardiac illness typically imposes recurring stressors, including symptom unpredictability, functional limitation, treatment burden, fear of progression, and concerns regarding mortality. Structural modeling among patients with cardiac disease has demonstrated that resilience is positively related to quality of life and may operate alongside other psychosocial resources such as dignity (1). In patients with heart failure, resilience has also emerged as an important mediator in the relationship between fear of disease progression and quality of life, indicating that greater adaptive capacity may attenuate the negative consequences of illness-related fears (2). More recent evidence has similarly identified psychological resilience as a central mechanism linking fear of progression and psychological distress to quality of life in chronic heart failure (3). These findings are particularly relevant because they suggest that resilience should not be treated merely as a background personality characteristic but as an intervening process with explanatory importance in cardiovascular adaptation. The availability of a validated Persian version of the CD-RISC-10 with satisfactory internal consistency, test–retest reliability, and factorial validity also facilitates rigorous examination of resilience in Iranian patients with chronic medical conditions (19).

The simultaneous consideration of emotion regulation difficulties and resilience is theoretically important because these constructs capture distinct but related dimensions of adaptation. Emotion regulation difficulties primarily represent vulnerabilities in managing internal affective states, whereas resilience reflects the broader capacity to recover, persist, and function adaptively in the presence of adversity. An individual may experience intense negative emotions but nevertheless remain resilient through effective coping resources, while another may show extensive emotion regulation problems that undermine adaptive functioning even in the presence of social support. Their joint inclusion therefore permits a more nuanced understanding of why illness perception, health anxiety, and perceived social support may be associated with quality of life. More threatening illness representations and excessive health anxiety may increase emotional dysregulation by intensifying fear, vigilance, and catastrophic interpretations, while simultaneously reducing resilience through sustained perceived threat and diminished confidence in coping. Conversely, greater perceived social support may reduce emotion regulation difficulties by providing reassurance,

interpersonal regulation, and emotional validation, while strengthening resilience by increasing patients' sense that they possess external resources for managing illness-related demands. Such pathways are consistent with empirical evidence demonstrating that psychological status, coping resources, and resilience can mediate relationships between disease-related fears and quality of life in cardiovascular populations (2, 3, 7).

The proposed relationships also carry particular significance in the context of cardiovascular care in Iran. Iranian patients with chronic cardiovascular disease may encounter ongoing medical costs, repeated follow-up appointments, uncertainty about prognosis, changes in employment or family roles, limitations in physical functioning, and the need for prolonged adherence to medication and lifestyle recommendations. These pressures can create a clinical environment in which illness representations, health-related fears, family and interpersonal resources, emotional functioning, and resilience operate simultaneously. Iranian research has already documented the importance of social support for quality of life in cardiovascular disease (13), the relevance of social support for cardiac rehabilitation adherence (15), and the potential of structured educational interventions to reduce health anxiety among patients with coronary artery disease (11). At the same time, Persian psychometric studies have established suitable measurement tools for illness perception, health anxiety, emotion regulation difficulties, and resilience (8, 9, 12, 17, 19). Collectively, these developments create a strong methodological basis for moving beyond isolated bivariate associations toward testing an integrated structural model within an Iranian cardiovascular population.

Despite the growing body of research, several conceptual gaps remain. First, many previous studies have focused on single diagnostic groups, such as myocardial infarction, acute coronary syndrome, atrial fibrillation, or heart failure, whereas psychosocial mechanisms relevant to quality of life may operate across diverse cardiovascular diagnoses (2, 6, 7). Second, illness perception and health anxiety are often studied independently, although both involve cognitive-emotional interpretations of health threats and may exert partially overlapping yet distinct effects. Third, perceived social support is frequently modeled as a direct correlate of quality of life without examining the psychological processes through which supportive relationships may enhance adaptation. Fourth, emotion regulation difficulties and resilience have usually been evaluated separately, despite their theoretical complementarity as vulnerability and protective mechanisms. Finally, although mediation studies have demonstrated that psychological distress, coping, and resilience can help explain the relationship between disease-related fears and quality of life, relatively few studies have simultaneously modeled multiple cognitive, emotional, and interpersonal antecedents alongside two distinct mediating mechanisms in a single structural framework (1-3). Structural equation modeling is particularly suitable for addressing this gap because it enables simultaneous estimation of latent constructs, measurement error, correlated predictors, direct effects, and multiple indirect pathways within a theoretically specified model (4).

Accordingly, a comprehensive model of quality of life in cardiovascular disease should recognize that patients' subjective well-being may be shaped by a network of interrelated cognitive appraisals, anxiety processes, interpersonal resources, emotional regulation capacities, and adaptive strengths. More threatening illness perceptions and greater health anxiety are expected to be associated with poorer quality of life both directly and indirectly through greater emotion regulation difficulties and reduced resilience, whereas perceived social support is expected to have a positive relationship with quality of life through both

reduced emotional dysregulation and enhanced resilience. Such a model integrates the Common-Sense Model of illness representation with contemporary perspectives on social support, emotion regulation, and psychological resilience, while remaining compatible with empirical findings linking these constructs to cardiovascular outcomes and patient-reported well-being (1, 5, 14, 18). By identifying the relative contribution of these direct and indirect pathways, an integrated structural approach may also provide clinically meaningful information regarding potentially modifiable psychosocial targets for cardiac rehabilitation, psychoeducation, supportive interventions, and psychological care.

The present study aimed to develop and test a structural model of quality of life in patients with cardiovascular disease based on illness perception, health anxiety, and perceived social support, with emotion regulation difficulties and resilience examined as mediating variables.

Methods and Materials

Study Design and Participants

The present study was designed as a cross-sectional analytical investigation using structural equation modeling to examine a theoretical model of quality of life among patients with cardiovascular disease based on illness perception, health anxiety, and perceived social support, with emotion regulation difficulties and resilience considered as mediating variables. The study was conducted among adult patients attending cardiology outpatient clinics and cardiac rehabilitation services at Rajaie Cardiovascular Medical and Research Center, affiliated with Iran University of Medical Sciences, Tehran, Iran, between January and June 2026. This center is one of the major specialized cardiovascular referral and research centers in Iran and provides diagnostic, therapeutic, follow-up, and rehabilitation services to patients with a wide range of cardiovascular disorders. The cross-sectional design was considered appropriate because the primary objective was to evaluate the simultaneous relationships among psychological, interpersonal, and quality-of-life constructs and to test the direct and indirect pathways proposed in the conceptual model at a defined point in the course of cardiovascular disease. The methodological approach and reporting framework were developed in accordance with recommendations commonly applied to observational studies, particularly the principles of the STROBE statement.

Participants were recruited through consecutive sampling from eligible patients attending the selected outpatient and rehabilitation services during the study period. Consecutive sampling was used to minimize discretionary participant selection and to obtain a sample representing the range of clinically stable cardiovascular patients routinely attending the study setting. The inclusion criteria consisted of being 18 years of age or older, having a physician-confirmed diagnosis of cardiovascular disease, including coronary artery disease, chronic heart failure, clinically significant cardiac arrhythmia, or valvular heart disease, for at least six months, being clinically stable at the time of participation, having sufficient ability to read and understand Persian and complete the questionnaires, and being capable of providing informed consent. Patients were excluded when they had experienced acute coronary syndrome, decompensated heart failure, stroke, or a major cardiovascular intervention or surgical procedure during the previous four weeks, because these acute clinical events could substantially alter psychological responses and perceived quality of life. Patients with severe cognitive impairment, active psychotic disorders, or other conditions preventing reliable self-report were also excluded. Additional exclusion criteria consisted of medical instability

requiring urgent clinical intervention and more than 20% missing responses across the questionnaire battery.

A total of 450 potentially eligible patients were approached during the recruitment period. Of these, 12 individuals declined participation and eight did not satisfy the predetermined eligibility criteria. Consequently, 430 patients completed the study questionnaires. Following data screening, 10 cases were removed because of extensive missing questionnaire data, resulting in a final analytic sample of 420 patients. The sample consisted of 248 men (59.0%) and 172 women (41.0%), with a mean age of 57.8 years ($SD = 10.9$). Most participants were married or living with a partner (77.9%). Regarding educational attainment, 43.1% had completed high school or less, 30.0% had a diploma or associate degree, and 26.9% held a bachelor's degree or higher. Coronary artery disease was the most common primary cardiovascular diagnosis and was present in 51.9% of the participants, followed by chronic heart failure in 20.0%, valvular heart disease in 14.3%, and clinically significant arrhythmia in 13.8%. The mean duration of cardiovascular disease was 6.1 years ($SD = 4.7$). Hypertension was reported in 61.4% of the sample, dyslipidemia in 48.6%, diabetes mellitus in 34.5%, and current smoking in 18.8%, while 36.4% of participants were receiving or had participated in cardiac rehabilitation. The sample size of 420 was considered adequate for estimation of a structural equation model of moderate complexity because it provided a conservative ratio between participants and freely estimated model parameters and sufficient statistical information for the stable estimation of small-to-moderate standardized path coefficients. Rather than relying solely on a fixed participant-to-variable rule, adequacy of the sample was considered in relation to model complexity, the number and reliability of indicators, the anticipated magnitude of structural relationships, the estimation procedure, and the inclusion of latent variables.

Data collection was conducted by trained research personnel in coordination with cardiology staff. Potentially eligible patients were identified through clinic schedules and clinical records, and eligibility was subsequently confirmed before questionnaire administration. Participants completed the measures in a quiet area of the clinic or cardiac rehabilitation unit. When a participant had a visual or motor limitation that made independent questionnaire completion difficult, a trained researcher was permitted to read the questionnaire items verbatim and record the participant's selected responses without interpreting, explaining, or suggesting answers. Relevant clinical information, including cardiovascular diagnosis, duration of cardiovascular disease, and major medical comorbidities, was obtained from the medical record when available. Completion of the entire questionnaire battery generally required approximately 25 to 35 minutes.

Data Collection Tools

Illness perception was assessed using the Brief Illness Perception Questionnaire (Brief IPQ) developed by Broadbent and colleagues. The Brief IPQ is a concise instrument designed to assess patients' cognitive and emotional representations of their illness. It contains nine items, of which eight are quantitative items rated on scales ranging from 0 to 10 and one is an open-ended item addressing perceived causes of the illness. The quantitative components assess perceived consequences of illness, expected timeline, personal control, treatment control, illness identity or symptom experience, concern about the illness, understanding or coherence of the illness, and emotional representation. The causal item is interpreted qualitatively and is

not included in calculation of the quantitative illness-perception score. After reverse scoring the personal-control, treatment-control, and illness-coherence items as appropriate for calculation of an illness-threat index, the eight quantitative items can be combined to obtain a score ranging from 0 to 80, with higher scores reflecting a more threatening and negative representation of illness. The original instrument demonstrated satisfactory test–retest reliability as well as concurrent, discriminant, and predictive validity across different patient populations, including individuals with cardiovascular conditions. Persian investigations have also supported the reliability and construct validity of the instrument, with previous Iranian psychometric research reporting internal consistency coefficients of approximately .90 and intraclass correlation coefficients of approximately .90. In the present study, the internal consistency coefficient for the Brief IPQ was Cronbach's $\alpha = .86$, indicating satisfactory reliability for assessment of illness perception among patients with cardiovascular disease.

Health anxiety was measured using the Short Health Anxiety Inventory (SHAI). The SHAI is an 18-item self-report instrument derived from the original Health Anxiety Inventory and was developed to measure excessive concern, beliefs, and fears related to health and illness while minimizing contamination of scores by the actual presence of physical symptoms. This characteristic is particularly important in studies involving individuals with established medical disorders because patients with cardiovascular disease may experience genuine somatic symptoms that should not automatically be interpreted as pathological health anxiety. Each item is presented as a set of statements reflecting increasing levels of health-related concern and is scored from 0 to 3. The total score therefore ranges from 0 to 54, with higher scores indicating greater health anxiety. Psychometric studies of the original instrument demonstrated strong internal consistency and satisfactory convergent and construct validity in clinical and nonclinical populations. Evidence from the Persian version has similarly supported its application in Iranian medical populations. A recent psychometric evaluation of the Persian SHAI supported a two-factor structure corresponding broadly to intrusive health-related thoughts and fear of illness and demonstrated satisfactory model fit and internal consistency, with a reported total Cronbach's alpha of .864. In the present study, the SHAI demonstrated high internal consistency, with Cronbach's $\alpha = .89$.

Perceived social support was assessed using the Multidimensional Scale of Perceived Social Support (MSPSS). The MSPSS is a 12-item self-report measure developed to evaluate individuals' perceptions of the availability and adequacy of social support derived from three major interpersonal sources: family, friends, and a significant other. Each of these dimensions is represented by four items, and responses are scored on a seven-point Likert-type scale. Higher scores indicate greater perceived availability of supportive interpersonal resources. The scale can be interpreted using either an overall perceived-social-support score or the three source-specific subscale scores. The original validation demonstrated strong internal consistency for the overall measure and its three subscales, with reliability coefficients generally ranging from .85 to .91. The Persian MSPSS has been evaluated in Iranian cardiovascular populations, including patients with myocardial infarction, and the expected three-factor structure has been replicated. Iranian research has reported an overall internal consistency coefficient of approximately .84 and subscale coefficients ranging from .85 to .93, together with satisfactory test–retest reliability. In the present study, the total MSPSS demonstrated Cronbach's $\alpha = .91$. For structural equation modeling, the family, friends, and significant-other subscale scores were used as observed indicators of a latent perceived-social-support

construct, thereby allowing the model to represent the multidimensional nature of perceived interpersonal support while simultaneously estimating its overall structural effects.

Emotion regulation difficulties were evaluated using the Difficulties in Emotion Regulation Scale-16 (DERS-16). The DERS-16 is a shortened version of the original Difficulties in Emotion Regulation Scale and was developed to provide an efficient assessment of clinically relevant problems in the awareness, acceptance, control, and management of emotional experiences. The measure contains 16 items scored on a five-point Likert-type scale ranging from 1 to 5, with higher scores reflecting greater difficulty in emotion regulation. The DERS-16 encompasses five dimensions: nonacceptance of emotional responses, difficulties engaging in goal-directed behavior when distressed, impulse-control difficulties, limited access to effective emotion-regulation strategies, and lack of emotional clarity. The original abbreviated instrument showed excellent internal consistency, with a reported Cronbach's alpha of .92, high convergence with the full 36-item DERS, and satisfactory temporal stability, including a test–retest intraclass correlation coefficient of approximately .85. The Persian DERS-16 has also demonstrated favorable psychometric properties, including a Cronbach's alpha of .91, five-week test–retest reliability of .92, an acceptable factor structure, and evidence of concurrent validity. In the present study, internal consistency for the total DERS-16 was $\alpha = .93$. For the structural equation model, scores for nonacceptance, goal-directed difficulties, impulse-control difficulties, limited access to regulation strategies, and lack of emotional clarity were modeled as observed indicators of the latent construct of emotion regulation difficulties. Higher values for this latent construct therefore represented greater overall emotional dysregulation.

Resilience was measured using the 10-item Connor-Davidson Resilience Scale (CD-RISC-10). The CD-RISC-10 is a shortened unidimensional version of the original Connor-Davidson Resilience Scale and measures individuals' perceived capacity to adapt successfully to stress, hardship, change, and adversity. The scale contains 10 items rated from 0, representing “not true at all,” to 4, representing “true nearly all the time.” Item scores are summed to obtain a total score ranging from 0 to 40, with higher scores indicating greater resilience. The abbreviated version demonstrated a stable unidimensional structure and satisfactory internal consistency in its initial psychometric evaluation, with Cronbach's $\alpha = .85$. Psychometric evidence for the Persian version has also been reported among Iranian individuals with chronic diseases. In an Iranian validation study involving older adults with chronic medical conditions, the instrument demonstrated Cronbach's $\alpha = .89$, an intraclass correlation coefficient of .90, and acceptable confirmatory factor analytic indices supporting a one-factor structure, including RMSEA = .073 and SRMR = .030. These characteristics supported its use as a concise measure of psychological adaptability in a medically affected population. In the present study, the CD-RISC-10 showed high internal consistency, with Cronbach's $\alpha = .90$. Because the scale has a well-supported unidimensional structure and contains relatively homogeneous items, its total score was included as an observed composite variable in the structural model.

Quality of life, which constituted the principal outcome variable in the proposed structural model, was measured using the World Health Organization Quality of Life-BREF (WHOQOL-BREF). This 26-item questionnaire is the abbreviated version of the WHOQOL-100 and provides a multidimensional assessment of individuals' subjective evaluation of their position in life within their cultural, social, and personal context. The instrument produces four primary domains comprising physical health, psychological health, social relationships, and environmental quality of life, together with two stand-alone items concerning

overall quality of life and satisfaction with general health. The physical domain assesses aspects such as mobility, daily activities, energy, pain, sleep, and work capacity; the psychological domain encompasses positive and negative feelings, self-esteem, thinking, body image, and spirituality; the social domain addresses personal relationships, social support, and intimate relationships; and the environmental domain includes financial resources, safety, healthcare access, opportunities for information and recreation, housing, transportation, and the physical environment. Domain scores may be transformed to a 0–100 scale, with higher values reflecting better quality of life. The WHOQOL-BREF has demonstrated extensive cross-cultural psychometric support, and its domains have shown strong correspondence with those of the original WHOQOL-100. Iranian validation studies have supported the applicability of its four-domain structure, with satisfactory test–retest reliability and acceptable internal consistency across most domains in both healthy and medically affected populations. In the present study, Cronbach's alpha coefficients were .82 for physical health, .84 for psychological health, .72 for social relationships, and .86 for the environmental domain. In the structural equation model, these four domain scores were specified as observed indicators of a latent quality-of-life construct, thereby permitting the outcome to be represented as a multidimensional construct rather than relying solely on a single aggregated total score.

Data Analysis

Data were analyzed through a two-stage analytical strategy comprising preliminary statistical analysis and structural equation modeling. Initial analyses included screening of the dataset for coding errors, missing values, outliers, distributional characteristics, and the assumptions relevant to multivariate modeling. Descriptive statistics were calculated for demographic, clinical, and principal study variables using frequencies and percentages for categorical variables and means and standard deviations for continuous variables. Internal consistency of the study instruments was examined using Cronbach's alpha coefficients. Zero-order Pearson correlation coefficients were calculated to examine the bivariate relationships among illness perception, health anxiety, perceived social support, emotion regulation difficulties, resilience, and quality of life. The proportion and pattern of missing data were evaluated before structural modeling. When missingness for individual indicators was below 5% and compatible with assumptions underlying likelihood-based estimation, missing observations were handled using full-information maximum likelihood rather than listwise deletion in order to retain available information and reduce unnecessary loss of statistical power. Univariate normality was evaluated using skewness and kurtosis coefficients, while the potential influence of multivariate non-normality was considered during selection of the SEM estimation method. Because psychosocial questionnaire scores may deviate from strict multivariate normality, robust maximum likelihood estimation was used to obtain standard errors and test statistics that were less sensitive to non-normality. Potential multicollinearity among predictor variables was assessed by inspecting intercorrelations as well as variance inflation diagnostics.

Before evaluation of the hypothesized structural pathways, confirmatory factor analysis was conducted to examine the adequacy of the measurement model. Perceived social support was represented as a latent construct indicated by the family, friends, and significant-other dimensions of the MSPSS. Emotion regulation difficulties were represented by the five DERS-16 subscale scores reflecting emotional nonacceptance, difficulty maintaining goal-directed behavior, impulse-control problems, limited access to

emotion-regulation strategies, and lack of emotional clarity. Quality of life was specified as a latent endogenous construct represented by the physical, psychological, social-relationship, and environmental domains of the WHOQOL-BREF. Illness perception, health anxiety, and resilience were entered as observed composite variables because the study emphasized their overall construct scores and because using composite measures reduced unnecessary model complexity. The adequacy of the latent-variable measurement structure was additionally examined through standardized factor loadings, composite reliability, and average variance extracted. Composite reliability values of approximately .70 or higher were considered indicative of satisfactory construct reliability, while average variance extracted values around .50 or higher were interpreted as evidence that a latent construct accounted for an adequate proportion of variance in its indicators.

Overall model fit was evaluated using several complementary indices rather than relying on the chi-square statistic alone, because chi-square is sensitive to sample size and may indicate statistically significant model-data discrepancy even when practical model fit is satisfactory. The ratio of chi-square to degrees of freedom, the comparative fit index, the Tucker–Lewis index, the root mean square error of approximation together with its 90% confidence interval, and the standardized root mean square residual were therefore examined concurrently. Comparative fit index and Tucker–Lewis index values approaching or exceeding .95, root mean square error of approximation values approximately .06 or lower, and standardized root mean square residual values approximately .08 or lower were interpreted as evidence of good approximate model fit, while slightly less stringent values were considered acceptable when supported by the overall pattern of model diagnostics. Fit indices were interpreted collectively and in relation to theoretical plausibility rather than being treated as rigid pass-or-fail thresholds. Modification indices were examined only when necessary to identify possible localized areas of model strain, and theoretically unjustified residual correlations or post hoc paths were not introduced solely to improve global goodness-of-fit statistics.

Following confirmation of an acceptable measurement model, the hypothesized structural model was estimated. Direct paths were specified from illness perception, health anxiety, and perceived social support to emotion regulation difficulties, resilience, and quality of life. Additional direct paths were estimated from emotion regulation difficulties and resilience to quality of life in order to examine their proposed mediating roles. Based on the theoretical expectation that the predictor constructs were related but conceptually distinct, illness perception, health anxiety, and perceived social support were allowed to covary. The residual terms of emotion regulation difficulties and resilience were also permitted to covary because these variables represent interrelated emotional and adaptive processes that may share unexplained variance beyond the effects of the modeled predictors. Standardized path coefficients were used to evaluate the direction and relative magnitude of associations within the model. The coefficient of determination was calculated for each endogenous construct to determine the proportion of variance explained by its predictors, with particular attention to the amount of variance in quality of life accounted for by illness perception, health anxiety, perceived social support, emotion regulation difficulties, and resilience.

The mediating effects of emotion regulation difficulties and resilience were examined by decomposing the associations between the principal predictors and quality of life into direct, indirect, and total effects. Indirect effects were evaluated using a nonparametric bootstrap procedure with 5,000 resamples because bootstrapping does not require the assumption that the sampling distribution of an indirect effect is

normally distributed. Bias-corrected 95% confidence intervals were calculated for each indirect pathway, and an indirect effect was considered statistically significant when its confidence interval did not include zero. This approach permitted simultaneous examination of whether illness perception, health anxiety, and perceived social support were associated with quality of life partly through changes in emotion regulation difficulties and resilience. Two-sided statistical tests were used, and a significance level of $p < .05$ was adopted for direct structural coefficients. As a supplementary assessment of model robustness, a sensitivity model was also considered in which age, sex, and duration of cardiovascular disease were entered as covariates predicting quality of life. Stability of the principal path coefficients and mediation effects after inclusion of these demographic and clinical covariates was interpreted as support for the robustness of the proposed structural relationships.

Findings and Results

The final analytic sample consisted of 420 patients with cardiovascular disease, with a mean age of 57.8 years ($SD = 10.9$). Of the participants, 248 (59.0%) were men and 172 (41.0%) were women, while 327 (77.9%) were married or living with a partner. Regarding educational status, 181 participants (43.1%) had a high school education or lower, 126 (30.0%) had a diploma or associate degree, and 113 (26.9%) held a bachelor's degree or higher. Coronary artery disease was the most frequent primary cardiovascular diagnosis, reported in 218 participants (51.9%), followed by chronic heart failure in 84 (20.0%), valvular heart disease in 60 (14.3%), and clinically significant arrhythmia in 58 (13.8%). The mean duration of cardiovascular disease was 6.1 years ($SD = 4.7$). Hypertension was present in 258 participants (61.4%), dyslipidemia in 204 (48.6%), diabetes mellitus in 145 (34.5%), and 79 participants (18.8%) were current smokers. In addition, 153 participants (36.4%) were participating in cardiac rehabilitation. Preliminary screening indicated less than 3% item-level missingness, no substantial violations of univariate distributional assumptions, and no evidence of problematic multicollinearity among the principal predictor variables.

Table 1. Descriptive statistics and correlations among principal study variables (N = 420)

Variable	M ± SD	1	2	3	4	5	6
1. Illness perception	47.6 ± 12.3	—					
2. Health anxiety	20.8 ± 8.1	.52***	—				
3. Perceived social support	57.9 ± 13.0	-.31***	-.36***	—			
4. Emotion regulation difficulties	44.1 ± 11.4	.50***	.59***	-.42***	—		
5. Resilience	25.9 ± 7.0	-.44***	-.46***	.54***	-.52***	—	
6. Quality of life	—	-.53***	-.55***	.50***	-.63***	.65***	—

As shown in Table 1, the principal psychosocial variables were significantly associated with one another in theoretically expected directions. Illness perception showed a strong positive correlation with health anxiety ($r = .52$, $p < .001$) and was positively associated with emotion regulation difficulties ($r = .50$, $p < .001$), while it was negatively associated with resilience ($r = -.44$, $p < .001$) and quality of life ($r = -.53$, $p < .001$). Similarly, health anxiety was positively correlated with emotion regulation difficulties ($r = .59$, $p < .001$) and negatively correlated with resilience ($r = -.46$, $p < .001$) and quality of life ($r = -.55$, $p < .001$). Perceived social support demonstrated the opposite pattern, showing a negative association with emotion regulation difficulties ($r = -.42$, $p < .001$) and positive associations with resilience ($r = .54$, $p < .001$) and

quality of life ($r = .50$, $p < .001$). Emotion regulation difficulties were inversely related to quality of life ($r = -.63$, $p < .001$), whereas resilience showed the strongest positive bivariate association with quality of life ($r = .65$, $p < .001$). The moderate inverse correlation between emotion regulation difficulties and resilience ($r = -.52$, $p < .001$) indicated substantial conceptual relatedness while remaining sufficiently below levels suggestive of construct redundancy.

The confirmatory measurement model demonstrated good fit to the observed data, $\chi^2(158) = 275.60$, $\chi^2/df = 1.74$, CFI = .963, TLI = .955, RMSEA = .042, 90% CI [.033, .050], and SRMR = .038. These indices collectively indicated that the proposed latent-variable measurement structure adequately reproduced the observed covariance matrix. All standardized factor loadings were statistically significant at $p < .001$ and ranged from .70 to .88. Composite reliability coefficients ranged from .87 to .88 and average variance extracted values ranged from .59 to .69, exceeding commonly accepted thresholds for construct reliability and convergent validity. The correlations among the latent constructs also remained below levels indicative of excessive overlap, supporting the empirical distinctiveness of perceived social support, emotion regulation difficulties, and quality of life.

Table 2. Confirmatory factor analysis results for the latent constructs

Latent construct / indicator	Standardized loading	CR	AVE
Perceived social support		.87	.69
Family support	.86		
Friend support	.79		
Significant-other support	.83		
Emotion regulation difficulties		.88	.59
Nonacceptance	.72		
Goal-directed difficulties	.78		
Impulse-control difficulties	.81		
Limited access to strategies	.88		
Lack of emotional clarity	.70		
Quality of life		.88	.65
Physical health	.84		
Psychological health	.88		
Social relationships	.72		
Environment	.76		

As presented in Table 2, all observed indicators loaded substantially on their intended latent constructs. For perceived social support, standardized factor loadings ranged from .79 for friend support to .86 for family support, with CR = .87 and AVE = .69. The emotion regulation difficulties construct demonstrated standardized loadings ranging from .70 for lack of emotional clarity to .88 for limited access to effective emotion regulation strategies, with CR = .88 and AVE = .59. For quality of life, the four WHOQOL-BREF domains produced standardized loadings ranging from .72 for social relationships to .88 for psychological health, with CR = .88 and AVE = .65. Thus, all indicators exceeded the conventional minimum loading criterion of .50, and all three latent constructs demonstrated acceptable composite reliability and convergent validity. These findings supported retention of the proposed measurement model and justified subsequent testing of the structural relationships.

The hypothesized structural model also demonstrated satisfactory fit to the data, $\chi^2(168) = 312.48$, $\chi^2/df = 1.86$, CFI = .958, TLI = .949, RMSEA = .045, 90% CI [.037, .053], and SRMR = .041. The model explained 52% of the variance in emotion regulation difficulties, 39% of the variance in resilience, and 63% of the

variance in latent quality of life. These coefficients of determination indicated substantial explanatory capacity, particularly for quality of life. All hypothesized direct pathways were statistically significant. More threatening illness perceptions and higher levels of health anxiety predicted greater emotion regulation difficulties and lower resilience, whereas greater perceived social support predicted fewer emotion regulation difficulties and higher resilience. Emotion regulation difficulties were negatively associated with quality of life, whereas resilience was positively associated with quality of life. Furthermore, illness perception, health anxiety, and perceived social support retained statistically significant direct effects on quality of life after inclusion of the two mediators, suggesting a pattern of partial rather than complete mediation.

Table 3. Structural path estimates for the hypothesized model

Structural path	B	SE	β	z	p	95% CI for B
Illness perception → Emotion regulation difficulties	0.31	0.05	.34	6.20	< .001	[0.21, 0.41]
Health anxiety → Emotion regulation difficulties	0.65	0.08	.46	8.13	< .001	[0.49, 0.81]
Perceived social support → Emotion regulation difficulties	-0.21	0.04	-.24	-5.25	< .001	[-0.29, -0.13]
Illness perception → Resilience	-0.16	0.03	-.28	-5.33	< .001	[-0.22, -0.10]
Health anxiety → Resilience	-0.19	0.04	-.22	-4.75	< .001	[-0.27, -0.11]
Perceived social support → Resilience	0.22	0.03	.41	7.33	< .001	[0.16, 0.28]
Emotion regulation difficulties → Quality of life	-0.42	0.07	-.31	-6.00	< .001	[-0.56, -0.28]
Resilience → Quality of life	0.79	0.11	.36	7.18	< .001	[0.57, 1.01]
Illness perception → Quality of life	-0.25	0.08	-.20	-3.13	.002	[-0.41, -0.09]
Health anxiety → Quality of life	-0.33	0.13	-.17	-2.54	.009	[-0.58, -0.08]
Perceived social support → Quality of life	0.16	0.06	.15	2.67	.004	[0.04, 0.28]

As shown in Table 3, health anxiety was the strongest predictor of emotion regulation difficulties ($\beta = .46$, $p < .001$), followed by illness perception ($\beta = .34$, $p < .001$), whereas perceived social support negatively predicted emotion regulation difficulties ($\beta = -.24$, $p < .001$). In the prediction of resilience, perceived social support demonstrated the strongest standardized effect ($\beta = .41$, $p < .001$), while illness perception ($\beta = -.28$, $p < .001$) and health anxiety ($\beta = -.22$, $p < .001$) were associated with lower resilience. Both mediators significantly predicted quality of life, with resilience showing a positive effect ($\beta = .36$, $p < .001$) and emotion regulation difficulties showing a negative effect ($\beta = -.31$, $p < .001$). The direct effect of illness perception on quality of life remained negative and significant ($\beta = -.20$, $p = .002$), as did the direct effect of health anxiety ($\beta = -.17$, $p = .009$), whereas perceived social support retained a significant positive direct effect on quality of life ($\beta = .15$, $p = .004$). The persistence of these direct paths alongside significant mediator-to-outcome paths suggested that emotion regulation difficulties and resilience accounted for only part of the effects of the three principal psychosocial predictors on quality of life.

Table 4. Standardized indirect effects based on 5,000 bias-corrected bootstrap resamples

Indirect pathway	Standardized effect	Boot SE	95% bootstrap CI	Result
Illness perception → Emotion regulation difficulties → Quality of life	-.105	.021	[-.151, -.067]	Significant
Illness perception → Resilience → Quality of life	-.101	.020	[-.146, -.064]	Significant
Health anxiety → Emotion regulation difficulties → Quality of life	-.143	.024	[-.193, -.096]	Significant
Health anxiety → Resilience → Quality of life	-.079	.018	[-.119, -.047]	Significant
Perceived social support → Emotion regulation difficulties → Quality of life	.074	.017	[.043, .111]	Significant
Perceived social support → Resilience → Quality of life	.148	.024	[.103, .198]	Significant
Total indirect effect: Illness perception → Quality of life	-.206	.031	[-.270, -.150]	Significant

Total indirect effect: Health anxiety → Quality of life	-.222	.034	[-.290, -.160]	Significant
Total indirect effect: Perceived social support → Quality of life	.222	.032	[.162, .288]	Significant

Bootstrap analysis supported all six hypothesized specific indirect pathways. Illness perception had significant negative indirect effects on quality of life through both emotion regulation difficulties ($\beta = -.105$, 95% CI [-.151, -.067]) and resilience ($\beta = -.101$, 95% CI [-.146, -.064]), yielding a total indirect effect of $\beta = -.206$. Health anxiety similarly showed significant negative indirect effects through emotion regulation difficulties ($\beta = -.143$, 95% CI [-.193, -.096]) and resilience ($\beta = -.079$, 95% CI [-.119, -.047]), with a total indirect effect of $\beta = -.222$. The indirect pathway from health anxiety through emotion regulation difficulties represented the strongest negative specific mediation effect in the model. Perceived social support demonstrated significant positive indirect effects on quality of life through lower emotion regulation difficulties ($\beta = .074$, 95% CI [.043, .111]) and greater resilience ($\beta = .148$, 95% CI [.103, .198]), producing a total indirect effect of $\beta = .222$. The pathway through resilience was therefore the stronger of the two mechanisms linking perceived social support to quality of life. Because all bootstrap confidence intervals excluded zero and the corresponding direct effects from illness perception, health anxiety, and perceived social support to quality of life remained statistically significant, the findings supported partial mediation by both emotion regulation difficulties and resilience.

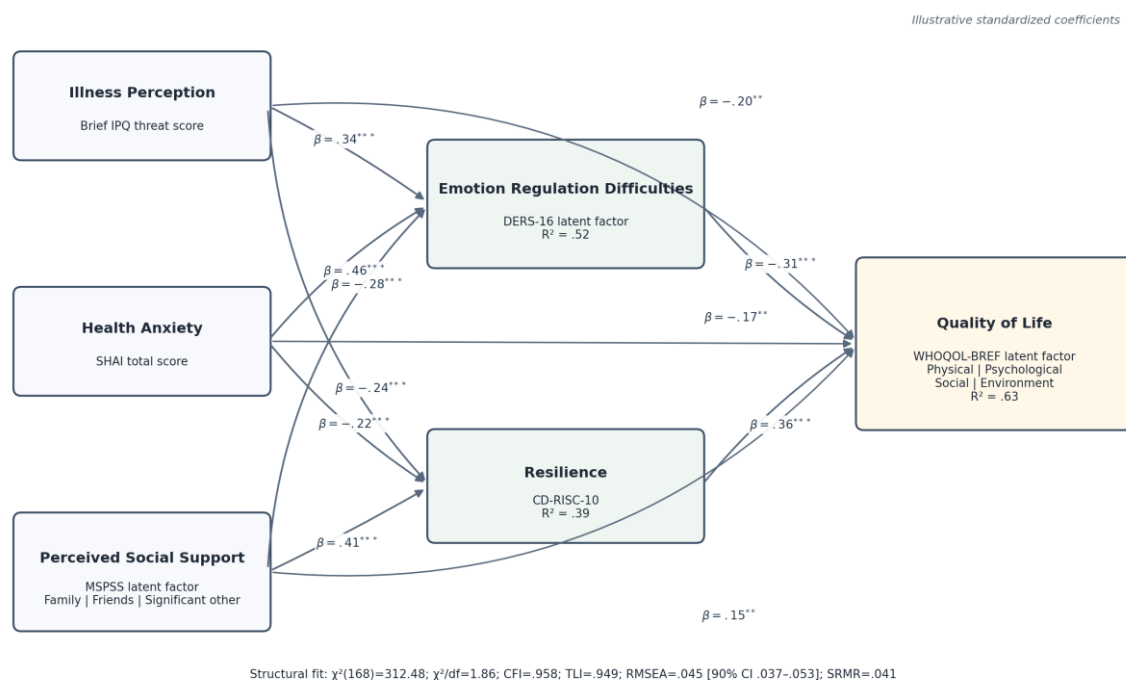


Figure 1. Final Structural Model of Quality of Life in Patients with Cardiovascular Disease Showing Standardized Direct Path Coefficients and Explained Variance in Emotion Regulation Difficulties, Resilience, and Quality of Life

Discussion and Conclusion

The present study examined a structural model of quality of life among patients with cardiovascular disease in which illness perception, health anxiety, and perceived social support were specified as principal

predictors, while emotion regulation difficulties and resilience were evaluated as mediating mechanisms. The findings provided overall support for the proposed model. The structural model demonstrated satisfactory fit to the data and explained 52% of the variance in emotion regulation difficulties, 39% of the variance in resilience, and 63% of the variance in quality of life. More threatening illness perceptions and greater health anxiety were associated with higher levels of emotion regulation difficulties and lower resilience, whereas greater perceived social support was associated with fewer emotion regulation difficulties and greater resilience. Both mediators were significantly related to quality of life in the expected directions: emotion regulation difficulties predicted poorer quality of life, while resilience predicted better quality of life. In addition, illness perception and health anxiety retained significant negative direct effects on quality of life, whereas perceived social support retained a significant positive direct effect. The persistence of these direct effects alongside significant indirect pathways indicates partial mediation and suggests that the psychosocial determinants examined in this study influence quality of life through both immediate and mediated processes. This general pattern is consistent with contemporary models of cardiovascular adaptation emphasizing that patients' subjective health outcomes are determined not only by objective disease characteristics but also by the cognitive, emotional, interpersonal, and adaptive processes through which illness is interpreted and managed (1-3, 5).

One of the principal findings was the negative relationship between illness perception and quality of life. Patients who perceived their cardiovascular disease as more threatening, consequential, persistent, emotionally distressing, or difficult to control reported lower quality of life. This finding is consistent with the Common-Sense Model of Self-Regulation, according to which individuals construct cognitive and emotional representations of illness that guide coping behavior, self-management, emotional responses, and subsequent health outcomes (5). Within this framework, a threatening illness representation may intensify the perceived burden of disease even when objective clinical status is relatively stable. Patients who believe that their condition is highly disruptive, uncontrollable, or likely to produce severe consequences may become more attentive to symptoms, interpret everyday limitations more negatively, and experience greater interference in physical, psychological, and social functioning. This interpretation is supported by previous cardiovascular research. Zhang et al. demonstrated that illness perception played an important mediating role in the relationship between disease severity, psychological stress, and health-related quality of life among patients with acute coronary syndrome (6). Similarly, Zheng et al. found that illness perception was significantly associated with quality of life in patients with atrial fibrillation and that this relationship was partly explained through coping strategies and psychological status (7). The present findings extend these observations by showing that illness perception remained directly associated with quality of life even after emotion regulation difficulties and resilience were included in the model, suggesting that illness representations may influence quality of life through additional mechanisms such as behavioral restriction, symptom interpretation, treatment beliefs, and perceived loss of control.

The results further showed that illness perception was positively associated with emotion regulation difficulties and negatively associated with resilience. These pathways provide an important explanation for how illness representations may be translated into poorer quality of life. When cardiovascular disease is understood as unpredictable, dangerous, uncontrollable, or highly disruptive, patients may experience persistent fear, frustration, anger, or sadness, and these emotional responses may become more difficult to

regulate. At the same time, threatening illness representations may undermine adaptive confidence and reduce the individual's sense that he or she can cope effectively with future challenges. The significant indirect effects through both mediators support this interpretation. Illness perception exerted a negative indirect effect on quality of life through emotion regulation difficulties and an almost equally large negative indirect effect through resilience. These results are broadly consistent with evidence suggesting that illness-related appraisals affect quality of life through intermediate psychological processes rather than exclusively through direct cognitive effects (6, 7). The findings also fit with the psychometric and conceptual literature on illness perception, which conceptualizes illness beliefs as multidimensional and dynamically linked to emotional adjustment and coping responses (8, 9). From this perspective, modifying maladaptive illness representations may have downstream benefits for both emotional regulation and resilient adaptation.

Health anxiety emerged as another substantial negative predictor of quality of life and was particularly strongly associated with emotion regulation difficulties. This result is clinically plausible because patients with cardiovascular disease often experience bodily sensations that can be interpreted as signs of imminent danger, including palpitations, chest discomfort, fatigue, dizziness, or breathlessness. When these sensations are monitored excessively or interpreted catastrophically, they may trigger repeated cycles of fear, vigilance, reassurance seeking, and avoidance, thereby increasing emotional distress and diminishing perceived well-being. The observed direct negative association between health anxiety and quality of life suggests that excessive concern about disease may independently impair functioning even after other psychosocial factors are considered. The prospective findings of Berge et al., which linked health anxiety to later risk of ischemic heart disease, underline the broader clinical significance of excessive illness-related fear and indicate that health anxiety may have both psychological and physiological relevance (10). The present findings are also compatible with evidence from Barati et al., who showed that structured self-care education using the teach-back method reduced health anxiety in patients with coronary artery disease (11). Together, these findings reinforce the view that health anxiety is neither an unavoidable consequence of cardiac disease nor a purely secondary emotional reaction, but rather a potentially modifiable psychological factor with meaningful implications for quality of life.

The strongest indirect negative pathway in the model was from health anxiety to quality of life through emotion regulation difficulties. This result suggests that patients with elevated health anxiety may be especially vulnerable to dysregulated emotional responses. Persistent preoccupation with health threats may make it difficult to disengage from fear, maintain goal-directed activity during distress, control impulsive reassurance-seeking behavior, or access effective regulatory strategies. Such difficulties may then generalize into broader impairments in psychological and social functioning. The role of emotion regulation is supported by research showing that habitual emotion regulation tendencies are associated with cardiovascular responses to stress (18). This relationship suggests that emotional regulation processes may connect psychological appraisal with both subjective and physiological manifestations of stress in cardiovascular populations. The present study therefore contributes to the literature by identifying emotion regulation difficulties as an important explanatory mechanism linking health anxiety to quality of life. The validity of this interpretation is strengthened by the use of the DERS-16, a measure with well-established psychometric properties in both its original and Persian forms (16, 17). The findings imply that excessive

health-related worry may become particularly detrimental when patients lack effective strategies for accepting, understanding, and regulating emotional distress.

Perceived social support demonstrated the opposite pattern from illness perception and health anxiety. Greater perceived support was associated with better quality of life, fewer emotion regulation difficulties, and higher resilience. These findings are consistent with a substantial body of cardiovascular research showing that social resources contribute to both psychological adaptation and treatment-related behavior. Maleki Chollou et al. reported that perceived social support was significantly associated with quality of life in people with cardiovascular disease (13), while Wenn et al. showed that perceived social support was related to both treatment compliance and quality of life among cardiac patients (14). In addition, Akhurramov et al. found that perceived social support was associated with adherence to cardiac rehabilitation among patients with myocardial infarction (15). The current results extend these findings by demonstrating that the contribution of social support is not limited to a direct association with quality of life. Instead, social support also appears to operate through internal psychological processes. Patients who perceive greater availability of support from family, friends, and significant others may be better able to regulate distressing emotions because they can seek reassurance, share concerns, obtain practical assistance, and benefit from interpersonal emotional regulation. At the same time, supportive relationships may strengthen resilience by increasing confidence that coping resources are available during episodes of illness-related adversity.

The indirect pathway from perceived social support to quality of life through resilience was larger than the pathway through emotion regulation difficulties, suggesting that resilience may be a particularly important mechanism through which social support promotes better adjustment. Social support can reinforce a patient's sense of security, competence, hope, and continuity, all of which may facilitate adaptation to chronic disease. This interpretation is consistent with the broader resilience literature in cardiac populations. Huang et al. showed that resilience was positively associated with quality of life in patients with cardiac disease using a structural modeling approach (1). Chen et al. further demonstrated that resilience mediated the association between fear of progression and quality of life in patients with heart failure (2), while Ding et al. identified psychological resilience as an important component in the pathway linking fear of disease progression, psychological distress, and quality of life in chronic heart failure (3). The present study is consistent with these findings and broadens them by positioning resilience as a mediator not only of disease-related fear but also of perceived social support and illness perception. This reinforces the conceptualization of resilience as a dynamic adaptive capacity that may be strengthened or weakened by both internal appraisals and interpersonal resources rather than as a fixed personality trait.

The independent association between resilience and quality of life was one of the strongest direct effects in the model. Higher resilience was associated with better quality of life even after controlling for illness perception, health anxiety, social support, and emotion regulation difficulties. This finding highlights the importance of adaptive capacity in the context of chronic cardiovascular disease. Resilient patients may be more able to tolerate uncertainty, maintain valued activities despite limitations, adapt to treatment demands, and recover psychologically from episodes of symptom exacerbation or medical intervention. The observed association is highly consistent with recent evidence in cardiac populations emphasizing the protective role of resilience in quality-of-life outcomes (1-3). It is also consistent with the availability of

psychometrically robust resilience measures in Persian-speaking chronic disease populations, such as the CD-RISC-10, which has shown satisfactory internal consistency, temporal stability, and factorial validity (19). The present findings therefore support inclusion of resilience as a central construct in psychosocial models of cardiovascular adaptation.

Emotion regulation difficulties also remained independently associated with poorer quality of life after the effects of resilience and the three exogenous predictors were taken into account. This indicates that problems in understanding, accepting, and regulating emotions may impair quality of life over and above the effects of general adaptive capacity. The distinction is important because resilience and emotion regulation, although related, are not interchangeable. Resilience reflects a broader ability to adapt to adversity, whereas emotion regulation difficulties describe specific deficits in managing emotional responses. Their moderate inverse association in the present study supports this conceptual distinction. The independent contribution of emotion regulation difficulties is consistent with experimental evidence demonstrating associations between emotion regulation tendencies and cardiovascular stress responses (18), and with psychometric work indicating that the DERS-16 captures multiple dimensions of dysregulation relevant to clinical functioning (16, 17). These findings suggest that interventions targeting emotion regulation may offer benefits even among patients who otherwise possess moderate levels of resilience.

A further important finding was that all three principal predictors retained significant direct effects on quality of life after the mediators were included. This pattern indicates partial rather than complete mediation and suggests that the model captures only some of the pathways through which illness perception, health anxiety, and social support influence patient-reported well-being. Illness perception may directly affect quality of life by shaping expectations about disability and illness consequences; health anxiety may directly impair quality of life through heightened symptom monitoring and activity restriction; and social support may have direct effects through practical assistance, companionship, and facilitation of treatment adherence. The continued significance of direct pathways is therefore theoretically coherent and consistent with prior evidence showing direct associations between illness perception, social support, and quality-of-life outcomes in cardiovascular populations (6, 7, 13, 14). From a structural modeling perspective, the substantial proportion of explained variance in quality of life indicates that the combined model has meaningful explanatory value, while the residual variance also makes clear that additional biomedical, socioeconomic, behavioral, and contextual factors remain relevant (4).

The findings should be interpreted in light of several limitations. First, the cross-sectional design prevents causal inference and does not establish temporal ordering among illness perception, health anxiety, social support, emotion regulation difficulties, resilience, and quality of life. Although the structural model was theoretically specified, alternative directional relationships are plausible, including the possibility that poor quality of life intensifies health anxiety or alters illness perceptions. Second, the study relied primarily on self-report measures, which may introduce common-method variance, recall bias, and social desirability effects. Third, participants were recruited from a specialized cardiovascular referral and rehabilitation setting, which may limit generalizability to patients treated in primary care, rural settings, or less specialized hospitals. Fourth, the sample included several diagnostic groups, which improved clinical breadth but may have introduced heterogeneity related to disease severity, prognosis, and treatment demands. Fifth, although age, sex, and disease duration were considered in sensitivity analysis, other potentially relevant

clinical and contextual variables, such as functional class, left ventricular ejection fraction, medication burden, socioeconomic status, psychiatric history, and severity of comorbid conditions, were not incorporated into the principal model.

Future research should examine the proposed pathways using longitudinal and prospective designs to clarify temporal ordering and evaluate whether changes in illness perception, health anxiety, emotion regulation, and resilience precede changes in quality of life. Repeated-measures structural equation modeling or cross-lagged panel models could help distinguish reciprocal relationships among these constructs. Future studies should also test the model separately across major cardiovascular diagnoses, disease-severity strata, age groups, and rehabilitation status to determine whether the strength of direct and mediated effects differs across clinical subgroups. Incorporating objective clinical indicators, treatment adherence, physical activity, functional capacity, socioeconomic conditions, and psychiatric comorbidity would provide a more comprehensive biopsychosocial model. Experimental and intervention studies are also needed to determine whether modifying maladaptive illness perceptions, reducing health anxiety, strengthening emotion regulation skills, enhancing social support, or building resilience leads to measurable improvements in quality of life and whether combined interventions produce stronger effects than single-component approaches.

From a practical perspective, the findings support routine psychosocial assessment as part of comprehensive cardiovascular care. Cardiology and rehabilitation teams may benefit from screening patients for threatening illness perceptions, excessive health anxiety, low perceived social support, emotion regulation difficulties, and reduced resilience, particularly when patients report poor quality of life despite relative medical stability. Psychoeducation can be used to correct catastrophic or inaccurate beliefs about cardiovascular disease and strengthen realistic perceptions of controllability, while brief psychological interventions may help patients identify and regulate distressing emotions more effectively. Family-inclusive care and structured involvement of significant others may enhance perceived support and reinforce engagement with rehabilitation and self-management. Resilience-oriented interventions that emphasize adaptive coping, problem solving, realistic optimism, persistence, and maintenance of meaningful activities may also help patients manage the chronic and uncertain nature of cardiovascular disease. Integrating these approaches into multidisciplinary cardiac rehabilitation could provide a more complete response to the psychological and interpersonal determinants of quality of life.

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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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