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Scientific Letters

Research Article

The Role of Psychosocial Factors in Adherence to a Cardiovascular Rehabilitation Programme in Post-Acute Myocardial Infarction Patients

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Abstract: Cardiovascular rehabilitation is a key multidisciplinary intervention in patient recovery after cardiac events such as acute myocardial infarction. Despite evidence of its benefits in reducing morbidity and mortality, adherence to cardiovascular rehabilitation programmes remains suboptimal. Psychosocial factors, including illness perception, coping styles, and lifestyle behaviours, have been identified as critical determinants of adherence. This study aims to explore the role of psychosocial factors in adherence to a cardiovascular rehabilitation programme among post-acute myocardial infarction patients. Specifically, the study seeks to: (1) describe psychosocial factors and adherence levels; (2) analyse differences based on sociodemographic and clinical variables; and (3) identify associations between psychosocial factors and cardiovascular rehabilitation adherence. This quantitative, descriptive study included 55 Portuguese participants. Data were collected using a Sociodemographic Questionnaire, the Brief Illness Perception Questionnaire, the Brief COPE, and a Lifestyle Scale. A higher perception of personal control was significantly associated with adherence ($p = .005$, $d = .78$). Regular physical exercise before acute myocardial infarction was also linked to better adherence ($p = .021$, $V = .312$). Women showed significantly healthier lifestyle behaviours than men ($p = .002$, $d = 1.179$). No significant associations were found for other variables. Perceived personal control and prior exercise are key to cardiovascular rehabilitation adherence. Gender differences highlight the need for personalised interventions.

Keywords: cardiovascular rehabilitation; treatment adherence; acute myocardial infarction; illness perception; coping styles; lifestyle behaviours

Received: 25 October 2025; Accepted: 29 January 2026; Published: 05 March 2026

Introduction

Cardiovascular diseases (CVD) constitute a chronic condition with an insidious progression, often asymptomatic in nature [1]. Their advancement is closely linked to the gradual development of

atherosclerosis, characterized by the deposition of atheromatous plaques within arterial walls, thereby compromising the vascular lumen [2]. The instability of these plaques may lead to thrombus formation, resulting in acute ischemic events such as acute myocardial infarction (AMI) [3]. CVD remains the leading cause of mortality in both Portugal and Europe, and it is also among the most significant contributors to morbidity, disability, and incapacity [4].

The predisposing factors associated with AMI are directly related to common risk factors such as smoking, physical inactivity, diabetes mellitus, obesity, poor dietary habits, arterial hypertension, and excessive stress [5]. These risk factors are strongly associated with lifestyle [6]. According to Martiniano [7], lifestyles encompass relatively stable patterns of behavioural practices, habits, values, and attitudes, which are characteristic of specific social groups. As stated by the Portuguese Directorate-General for Health [8], there is a pressing need to promote more favourable individual behavioural patterns to prevent disease and foster health. Cardiovascular rehabilitation (CR) emerges immediately following an AMI as a therapeutic response and is defined as the coordinated sum of interventions required to restore optimal physical, psychological, and social conditions [9]. The effectiveness of cardiovascular rehabilitation programmes (CRPs) relies not only on their clinical and educational components, but also on individual factors, particularly illness perception, that is, the way in which individuals interpret and understand their health condition [10]. Patients' perceptions of their illness play an active role in rehabilitation processes [11] and are a determining factor in treatment adherence [12].

Illness perception directly influences the coping strategies employed by individuals [13]. The concept of coping refers to a set of dynamic cognitive and behavioural strategies that individuals implement to deal with internal and/or external demands perceived as potentially stress-inducing. Coping processes can be broadly categorized into two main types: problem-focused coping and emotion-focused coping. Problem-focused coping involves strategies aimed at directly addressing the source of stress by attempting to alter, control, or eliminate the adverse condition. In contrast, emotion-focused coping seeks to manage and regulate the emotional responses associated with the stressful situation [14]. In addition to these two dimensions, Endler and Parker [15] introduced a third category known as avoidant coping, which is characterized by strategies aimed at cognitive or behavioural escape from the stressor. This form of coping seeks to minimize the impact of the stressor by distancing oneself from reality or denying its existence. A study investigated the coping strategies adopted by 220 patients with AMI and compared them to those of 220 individuals without a history of CVD. The results revealed that 53.6% of AMI patients employed emotion-focused coping strategies, whereas only 5.9% of the control group reported using such strategies. Conversely, the control group predominantly utilized problem-focused coping strategies (63.6%) [16].

Currently, at the Unidade Local de Saúde do Alto Ave (ULSAA), the CRP is structured around a multidisciplinary approach, integrating several hospital services including Physical and Rehabilitation Medicine, Cardiology, Physiotherapy, Rehabilitation Nursing, Psychology, and Nutrition. To enhance adherence, the programme incorporates educational sessions that encourage patients to engage actively with their prescribed treatment plans [17]. Adherence is defined as the extent to which a person's behaviour corresponds with the agreed recommendations from a healthcare provider [18]. Ho *et al.* [19] further describe it as the active, voluntary, and collaborative involvement of the patient in behaviours intended to produce a therapeutic outcome. Poor adherence to treatment is one of the main factors compromising clinical outcomes, potentially leading to medical and psychosocial complications, reduced quality of life, and inefficiencies within healthcare systems [20]. Conventionally, CR is structured into three sequential phases. Phase I begins during hospitalization in the Cardiology Department, once the patient is clinically stable, and focuses on early mobilization to minimize risks associated with immobility and non-adherence to therapy [21]. Phase II, delivered on an outpatient basis, includes a supervised exercise programme tailored to the patient's needs, combined with sustained lifestyle modifications [22]. Phase III aims to maintain the gains achieved, promoting continued physical activity at home to consolidate cardiovascular risk control and support ongoing improvement in physical fitness and cardiac function [22]. Timely integration into CRP significantly enhances functional capacity, accelerates return to daily activities, and reduces the incidence of clinical complications [23]. In 2022, the ULSAA implemented Phase II of the CRP, with key objectives including: increasing patient knowledge about their clinical condition and modifiable risk factors; promoting adherence to pharmacological and non-pharmacological therapies; reducing hospitalizations and mortality rates; improving psychological well-being and reducing stress; enhancing autonomy and quality of life; and supporting reintegration into professional and social roles. The psychological component, integrated into Phase II, is crucial to the programme's success, given the close relationship between mental health and cardiovascular disease. Psychological interventions aim to provide psychoeducation on the interaction between physical and emotional health, identify and promote effective coping strategies, facilitate the adoption of healthy behaviours and the resolution of emotional and practical difficulties related to the new health condition, assess psychosocial adjustment, and foster emotional self-regulation, intrinsic motivation, and self-care throughout the recovery process. Despite the established relevance of these psychosocial factors, their role in adherence to structured CRPs, particularly in the Portuguese context, remains underexplored. Clarifying this role is crucial for the development of effective therapeutic strategies and tailored psychological interventions.

Adherence to CRPs has demonstrated positive outcomes, including reduced hospital readmissions and healthcare costs, as well as improvements in quality of life and psychological well-being [24]. Nevertheless, a significant proportion of post-AMI patients fail to adhere to prescribed treatment regimens [17,25,26]. Several factors interfere with continued participation, including comorbidities, polypharmacy, cognitive decline, and social determinants [27]. The scientific community acknowledges various barriers to adherence, including financial constraints, transportation needs, and a lack of alignment between existing programmes and the actual population needs [28]. A meta-analysis revealed that fewer than 50% of patients referred to CRPs effectively enrolled, with dropout rates ranging from 12% to 56% [29]. Treatment adherence is influenced by educational level; patients with greater health literacy are more likely to comply with therapeutic recommendations [30]. Similarly, those with higher educational attainment are more likely to participate in CR following AMI [31]. In addition, patients who perceive their condition as controllable, understand their symptoms and the severity of consequences, and feel they comprehend their illness are more likely to engage in CRPs [32]. Better knowledge and confidence in managing one's health are also associated with the adoption of more positive health behaviours [33]. In the context of CVD, poor adherence is particularly evident when lifestyle and behavioural changes are required [34]. Early referral to CR and consistent follow-up after a cardiac event are associated with better adherence outcomes [35]. Residents of rural areas show higher dropout rates and lower adherence compared to those in urban settings [36]. Extrinsic motivators such as family members, particularly spouses, and healthcare professionals play an important role in reinforcing intrinsic motivation [37]. Advanced age has often been cited as a limiting factor for participation in CRPs [31,38]; however, a recent study by Nabutovsky *et al.* [39] suggests that older individuals may demonstrate higher adherence. Gender has also emerged as a relevant variable, with three studies consistently reporting lower participation rates among women [31,40]. Employment status also significantly influences adherence, as highlighted by Li *et al.* [26]. Moreover, individuals who engaged in regular physical activity before hospitalization were more likely to adhere to CRPs [41]. The presence of psychiatric disorders has been associated with lower adherence, as these conditions may hinder the ability to follow therapeutic recommendations and compromise treatment outcomes [42]. Interestingly, Krishnamurthi *et al.* [43] found that depressive symptoms in patients enrolled in CRPs were linked to higher levels of adherence, presenting a strategic opportunity to promote healthy lifestyle behaviours and mitigate adverse cardiovascular outcomes.

As evidenced, post-AMI CR remains a clinical challenge, often shaped by complex psychosocial variables. Although numerous studies have identified factors associated with adherence, the interaction between psychosocial factors, such as illness perception, coping styles, and lifestyle, and adherence to a CRP in post-AMI patients has not been sufficiently examined, particularly in the Portuguese context. This study addresses an important gap, providing insights that can guide tailored psychological interventions and optimize CRPs. Clarifying the role of these factors is crucial for developing more effective therapeutic strategies, thereby highlighting the unique relevance of this research topic within Psychology. Therefore, the present study aims to examine the role of psychosocial factors in adherence to a CRP among post-AMI patients.

Materials and Methods

Research Objectives

The main objective was to explore the role of psychosocial factors, such as illness perception, coping styles, and lifestyle (independent variables), in adherence to a CRP (dependent variable) in post-AMI patients. Specifically, the aims were to: (1) describe and characterize psychosocial factors and the level of adherence to the CRP in post-AMI patients; (2) analyse whether there are differences in adherence levels according to patients' sociodemographic and clinical variables; (3) investigate the existence of associations between psychosocial factors and adherence to the CRP, including identifying the main elements that influence programme adherence.

Research Hypotheses

H1: It is expected that statistically significant differences in adherence to the CRP will be observed based on sociodemographic variables (sex, age, marital status, and education level).

H2: It is expected that statistically significant differences in adherence will be found between patients with a psychiatric diagnosis and those without such a diagnosis.

H3: It is expected that statistically significant differences in illness perception scores will be observed between adherent and non-adherent patients.

H4: It is expected that statistically significant differences in coping style scores (problem-focused, emotion-focused, and avoidance-focused) will be found between adherent and non-adherent patients.

H5: It is expected that statistically significant differences in lifestyle scores will be observed according to adherence or non-adherence to the CRP.

H6: It is expected that regular physical exercise practice before the infarction is positively associated with adherence to the CRP.

Study Design

This study adopted a quantitative approach, with a descriptive cross-sectional design, aiming to analyse psychological and behavioural variables associated with adherence to CRP in post-AMI patients. The descriptive design seeks to characterize the psychological and behavioural profile of the participants, particularly regarding their illness perception, coping mechanisms, and lifestyle habits. The correlational aspect allows for the examination of associations between these variables and the level of adherence to the rehabilitation programme, without intending to establish direct causal relationships. Additionally, the study is cross-sectional, as data collection occurred at a single point in time, capturing psychological and behavioural phenomena instantaneously [44].

Participants

The sample consisted of 55 participants aged between 36 and 79 years (M = 59.80, SD = 9.95), all of Portuguese nationality. Most participants were male (n = 43; 78.2%). Regarding marital status, 58.2% (n = 32) were married, while 18.2% (n = 10) were single. In terms of educational attainment, 50.9% (n = 28) had completed primary education. Regarding employment status, 43.6% (n = 24) were retired, and 34.5% (n = 19) were employed. Concerning the area of residence, 61.8% (n = 34) lived in rural areas. Despite two missing responses, 23 participants (43.4%) reported having a psychiatric diagnosis. Of these 23, 39.1% had an anxiety disorder and 4.3% had a depressive disorder.

Data Collection Procedures

The study was approved by the ULSAA Ethics Committee. Data collection was conducted in December 2024, and participants were informed about the study objectives. Inclusion criteria were established to obtain a sample as homogeneous as possible [45], considering eligible individuals belonging to the target population, aged 18 years or older, and with the ability to read and write in Portuguese. Concurrently, exclusion criteria were applied to delineate participants who would not be included in the sample [45], namely individuals with known medical or psychological diagnoses that could compromise the validity of responses and participants with identified cognitive impairments.

Instruments

Sociodemographic Questionnaire

The questions included dichotomous, multiple-choice, and open-ended responses. Data were collected according to Stevens [46], covering participants' sociodemographic characteristics, namely nominal variables (such as sex, marital status, district of residence, marital situation, current employment status, and psychiatric diagnosis), interval variables (such as age), and ordinal variables (such as educational attainment, expressed as the number of years of successfully completed schooling).

Brief Illness Perception Questionnaire (BIPQ)

The BIPQ includes nine items: eight rated on a 0-10 scale and one open-ended item (item 9) asking patients to identify the main causes of their illness. This study used only the eight closed items, which assess: illness consequences (item 1), perceived duration (item 2), personal control (item 3), treatment control (item 4), symptom identity (item 5), concern (item 6), illness understanding (item 7), and emotional response (item 8). Items 3, 4, and 7 are reverse-scored, as higher values reflect more positive perceptions. The total score ranges from 0 to 80, with higher scores indicating a more negative illness perception.

The BIPQ was validated for the Portuguese population, reporting a Cronbach's alpha of .80 [47]. In this study, internal consistency was also good [48].

Brief COPE

The Brief COPE was used to describe the coping strategies employed by the participants. The Portuguese version validated by Pais Ribeiro and Rodrigues [49] includes 14 scales: active coping, planning, instrumental support, emotional social support, religion, positive reinterpretation, self-blame, acceptance, emotional expression, denial, self-distraction, behavioural disengagement, substance use, and humour. It consists of 28 items answered on a 4-point Likert scale (0 = "I haven't been doing this at all" to 4 = "I've been doing this a lot"). The analysis of coping strategies followed the tripartite model proposed by Endler and Parker [15], grouping items into problem-focused coping (items 2, 7, 10, 14, 23, 25), emotion-focused coping (items 5, 9, 12, 15, 17, 18, 20, 21, 22, 24, 27, 28), and avoidance coping (items 1, 3, 4, 6, 8, 11, 13, 16, 19, 26). Cronbach's alpha showed adequate internal consistency for most subscales, except for Acceptance (.55), with the highest value for Emotional Expression (.84) [48]. In the present study, the total alpha indicated good internal consistency [48].

Lifestyle Scale

To assess lifestyle habits, the scale developed by Dias *et al.* [50] was used, covering dietary habits, alcohol consumption, physical activity, sleep patterns, stress levels, and tobacco use. The original version consists

of 27 items, with an additional item on smoking behaviour (item 28). Responses are rated on a 5-point Likert scale (1 = "almost never" to 5 = "almost always"), with some items reverse-scored to ensure consistency, where higher scores indicate healthier behaviours. The tobacco item is scored from 1 to 3, considering "never smoked", "quit smoking", and "currently smokes". The scale is divided into subdimensions: dietary habits (19 items), alcohol consumption (item 10), physical activity (items 14 and 15), sleep and rest (item 23), stress (item 27), and tobacco use (item 28). Internal consistency, measured by Cronbach's alpha, was .862. Total scores range from 25 to 123 points, with higher scores indicating healthier lifestyles. The median score was used as a cut-off point to categorize participants into healthy and unhealthy lifestyle groups.

Data Processing and Analysis

After data collection, the data were properly organized for subsequent analysis [45]. For this purpose, statistical analyses were conducted using IBM SPSS® (Statistical Package for the Social Sciences), version 30.0. The first step consisted of organizing the data and checking for possible coding errors during data entry [45]. For Likert-type scale instruments, a quantitative treatment of the variables was applied, allowing the use of appropriate statistical techniques [51]. Descriptive statistics, measures of central tendency, and dispersion were used to characterize sociodemographic variables. To assess the internal consistency of the instruments, reliability analyses were performed for each scale and respective subscales using Cronbach's alpha. The criteria by Pereira and Patrício [48] were adopted, considering values between .60 and .70 acceptable, and values above .80 indicative of good reliability.

Regarding inferential statistics, the choice of tests was guided by the nature of the variables to be associated and the statistical assumptions required for each test [48,52]. Normality of distributions was verified based on skewness and kurtosis indices, with values between -1 and 1 considered acceptable, as suggested by Kim [53], given the sample size (n = 55).

Table 1. Skewness and kurtosis values of quantitative variables.

Scale/Dimension	*M*	*SD*	Skewness	*SE*	Kurtosis	*SE*
BIPQ	41.23	10.83	-.477	.327	.353	.644
Lifestyle Scale	90.46	16.61	.184	.330	-.205	.650
Brief COPE						
Coping Problem	2.76	.74	-.313	.327	-.939	.644
Coping Emotion	2.46	.61	-.570	.327	-.200	.644
Coping Avoidance	1.94	.58	.462	.327	-.860	.644

M = Mean; SD = Standard Deviation; SE = Standard Error

The homogeneity of variances was tested using Levene's test before analysing group differences in the studied variables [52], with the expectation that population variances would be similar, i.e., $p > .05$ [51]. To test the research hypotheses, when both variables were continuous, Pearson's correlation coefficient (r) was used, with results considered statistically significant at $p < .05$ [51], also considering the direction of the correlation (positive or negative). The strength of the relationship was evaluated according to Cohen's guidelines [54]: weak [r = .10 – .29], moderate [r = .30 – .49], and strong [r = .50 – 1.0].

To compare means between two independent groups, Student's t-test was applied, provided the assumptions of normality and homogeneity of variances were met. When at least one of these assumptions was not satisfied, the non-parametric Mann-Whitney U test was used, appropriate for smaller samples or non-normally distributed data. To examine associations between categorical nominal variables, the chi-square test of independence (χ^2) was employed. All analyses adopted a significance level of $\alpha = .05$ (5%), with two-tailed tests. Considering the nature of the study and the sample size, no formal adjustments for multiple comparisons were applied.

Results

Analysis of Differences in Adherence Levels According to Patients' Sociodemographic and Clinical Variables

Table 2. Association between sex and adherence to the cardiac rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	.525	1	.469
Continuity Correction	.158	1	.691
Cramér's V	.098		

df = degrees of freedom; p = significance level

Table 3. Independent samples t-test comparing age between participants who adhered and those who did not adhere to the cardiac rehabilitation programme.

Group	*M*	*SD*	*SE*	*t*	*df*	*p*
Adhered	60.04	9.40	1.78			
Did not adhere	59.56	10.66	2.05	.18	53	.860

M = Mean; SD = Standard Deviation; SE = Standard Error; t = t-test; df = degrees of freedom; *p* = significance

Table 4. Association between education level and adherence to the cardiovascular rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	.236	4	.994
Cramér's V	.065		
No. of valid cases	55		

df = degrees of freedom; *p* = significance level

Table 5. Association between marital status and adherence to the cardiovascular rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	2.383	4	.497
Cramér's V	.208		
No. of valid cases	55		

df = degrees of freedom; *p* = significance level

Table 6. Association between employment status and adherence to the cardiovascular rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	7.625	4	.106
Cramér's V	.372		
No. of valid cases	55		

df = degrees of freedom; *p* = significance level

Table 7. Association between psychiatric diagnosis and adherence to the cardiovascular rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	2.20	1	.139
Fisher's Exact Test			.176

df = degrees of freedom; *p* = significance level

Analysis of the Existence of Associations Between Psychosocial Factors and Adherence to the Cardiovascular Rehabilitation Programme

Table 8. Comparison of illness perception between participants who adhered and did not adhere to the cardiovascular rehabilitation programme: analysis of item 3 of the B-IPQ.

	N	*M*	*SD*	*SE*	*t*	*df*	*p*
Adhered	28	4.29	2.52	.48			
Did Not Adhere	27	2.44	2.17	.42	2.90	53	.005

N = Sample Size; M = Mean; SD = Standard Deviation; SE = Standard Error; t = t-test; df = degrees of freedom; *p* = significance

Table 9. Mann-Whitney U test for coping according to adherence to the cardiovascular rehabilitation programme.

Coping	*U*	*W*	*SE*	*Z*	*p*
Problem	353.50	731.50	56.03	.045	.964
Emotion	276.50	627.50	56.03	-1.328	.184
Avoidance	262.50	640.50	56.03	-1.58	.114

U = Mann-Whitney U statistic; Wilcoxon W = sum of ranks; SE = Standard Error; Z = standardized test value; *p* = significance

Table 10. Mann-Whitney U test for comparison of lifestyles between participants with and without adherence to the cardiovascular rehabilitation programme.

Lifestyle: Adherence vs. Non-adherence	*U*	*W*	*SE*	*Z*	*p*
	274.00	652.00	54.562	-1.164	.245

U = Mann-Whitney U statistic; Wilcoxon W = sum of ranks; SE = Standard Error; Z = standardized test value; *p* = significance

Table 11. Spearman correlation between lifestyles and adherence to the cardiovascular rehabilitation programme. There was a weak negative correlation, non-statistically significant ($p > .05$). The coefficient was calculated based on 52 participants with complete data for both variables.

Variables Compared	*N*	*ρ (rho)*	*p*
Lifestyles × Programme Adherence	52	-.163	.248

N = sample size; ρ (rho) = Spearman's correlation coefficient; *p* = significance

Table 12. T-test for comparison of lifestyles between women and men. The t, df, *p*, and d values refer to the comparison between groups and are therefore presented only once.

Group	*M*	*t*	*df*	*p*	*Cohen's d*
Women	104.94	-3.351	50	.002	-1.179
Men	87.02				

M = mean; t = Student's t-test statistic; df = degrees of freedom; *p* = significance; Cohen's d = effect size

Table 13. Association between pre-myocardial infarction physical exercise and adherence to the cardiovascular rehabilitation programme.

	Value	*df*	*p*
Pearson's Chi-square	5.357	1	.021
Continuity Correction (Yates)	4.177	1	.041
Fisher's Exact Test			.031
Linear-by-Linear Association	5.260	1	.022
Cramér's V	.312		.021

df = degrees of freedom; *p* = significance level

Table 14. Cross-tabulation of pre-myocardial infarction physical exercise and adherence to the cardiovascular rehabilitation programme.

	Practiced Physical Exercise	Did Not Practice Physical Exercise	Total
Adhered to the programme	17 (60.7%)	11 (39.3%)	28 (50.9%)
Did not adhere to the programme	8 (29.6%)	19 (70.4%)	27 (49.1%)

Discussion

Despite the well-established benefits reported in the literature, CR in post-AMI patients continues to face adherence challenges [17]. The primary objective of this study was to describe and characterize psychosocial factors and the level of adherence to a CRP in post-AMI patients. Among the 55 participants included in the study, 28 adhered to the CRP, while 27 did not.

Regarding illness perception, a wide variability was observed in the cognitive and emotional representations related to the cardiac event. Diverse coping strategies were also identified, underscoring the complexity of psychological responses following AMI and supporting the relevance attributed in the literature to the adequacy of coping strategies in the context of CR [55]. Concerning lifestyle behaviours, heterogeneity was found in the reported behaviours, reflecting the multiple profiles within the studied sample. Adherence was relatively evenly distributed between patients who adhered and those who did not adhere to the CRP, consistent with international literature reporting adherence rates often below expectations [29].

This situation highlights adherence as a persistent challenge in CVD, negatively impacting both the therapeutic benefits and the cost-effectiveness of such programmes [24]. Therefore, understanding the psychosocial determinants underlying this behaviour is urgently needed. The characterization of psychosocial factors in this study provided a robust empirical framework to understand the profiles involved in CRP adherence. This analysis laid an essential foundation for the subsequent objectives.

The second objective aimed to analyse whether there are differences in adherence levels based on sociodemographic variables (sex, age, marital status, education, employment status) and clinical variables (psychiatric diagnosis), as outlined in hypotheses H1 and H2. The results indicate that the analysed sociodemographic and clinical variables did not show a statistically significant association with adherence to the CRP, partially diverging from evidence reported in previous studies [31,38,40]. Although earlier studies frequently identify older age and sex as predictors of adherence [31], such effects may have been attenuated by the adaptation of ULSAA protocols to the specific needs of different population subgroups and the incorporation of individualized psychosocial interventions. The absence of a statistical association between sex and adherence to the CRP suggests that the factors influencing participation in CR transcend biological distinctions and may reflect cultural shifts in attitudes toward health and self-care, with a growing convergence of behaviours between men and women. Educational level has been described as a relevant factor for therapeutic adherence [30,56], mainly due to its relation to health literacy and the ability to understand clinical guidelines. The non-significance of this variable, despite contradicting some evidence, may be related to the implementation of educational and psychoeducational strategies in the CRP, which mitigate cognitive barriers associated with lower education levels, promoting a more homogeneous understanding among participants.

Marital status did not show a significant impact on adherence, which may reflect individuals' possible adaptation to various social support networks, not necessarily limited to the conjugal context. This finding suggests that the presence of social support, more than marital status *per se*, is a key factor for treatment engagement, aligning with studies highlighting the importance of psychosocial support for therapeutic adherence [37].

However, some limitations should be considered when interpreting these results. The categorization used for marital status may not reflect the diversity and complexity of participants' interpersonal relationships. This approach does not account for relevant variables such as relationship quality, degree of daily cohabitation, or the presence of effective support. Therefore, it is pertinent that future research considers more comprehensive approaches to support networks and relational dynamics to better understand their role in adherence to the CRP. The absence of a statistically significant association between the presence of a psychiatric diagnosis and adherence to the rehabilitation programme contradicts the well-established evidence in the literature, which identifies depressive and anxiety disorders as negative determinants of adherence to health interventions [42]. However, this discrepancy may reflect specific characteristics of the context under study. In the case of Phase II of the ULSAA CRP, the integration of a psychological component may have mitigated the negative impact of these conditions [43]. It is also important to highlight the methodological limitations inherent in using self-reports to identify the presence of a psychiatric diagnosis. This approach is subject to underreporting bias, notably due to the stigma associated

with mental disorders, as well as diagnostic inaccuracies, which may compromise the robustness of the comparisons made. During group sessions, there was a tendency among female participants to introduce topics of a psychopathological nature, particularly depressive and anxious symptoms. This finding underscores the importance of integrating strategies to coordinate CRP and mental health services, thereby promoting both the effectiveness of interventions and patients' overall well-being [57].

In addition to the description and characterization of psychosocial factors and adherence levels to the CRP (Objective 1), the third objective aimed to investigate the existence of associations between psychosocial factors and adherence to the programme. The results revealed that, in the analysed sample, adherence to the CRP was relatively evenly distributed between participants who adhered and those who did not. This finding aligns with the literature, which indicates that fewer than 50% of patients referred to CRPs actually adhere, with dropout rates ranging between 12% and 56% [29]. Similarly, more recent data [17,25,26] confirm that non-adherence and early discontinuation remain significant barriers to the effectiveness of CRPs, compromising clinical outcomes and increasing the risk of morbidity and mortality [58]. The data obtained in this study corroborate recent empirical evidence. This reality reinforces the urgency of an approach focused on the psychosocial determinants of adherence. A recent study published in the *Annals of Behavioural Medicine* highlights that psychosocial factors play a determining role in adherence to health behaviours following cardiovascular events, underscoring the relevance of CRPs [59].

Among the psychosocial factors analysed, the perception of personal control over the illness stood out as the variable with a statistically significant difference. Patients who adhered to the CRP exhibited higher levels of perceived control, which empirically validates Hypothesis 3 (H3). On the other hand, the remaining items of the BIPQ, such as illness identity, consequences, timeline, or illness comprehension, did not show significant differences between the groups. This result can be interpreted considering Hagger and Orbell's [60] proposition that not all dimensions of illness perception carry the same weight in predicting behaviour. In the case of adherence to the CRP in the present study, personal control plays a more decisive role than other cognitive or emotional dimensions. This may be explained by the crucial influence that perceived personal control exerts on intrinsic motivation and patient self-efficacy factors essential for adherence and maintenance of health-promoting behaviours in rehabilitation contexts [61,62].

Perceived control facilitates the activation of adaptive coping strategies, promoting a more effective response to the demands of the illness and facilitating the adoption of healthy lifestyle behaviours, which are fundamental to the success of CRPs [55,63]. Thus, promoting and strengthening this psychological construct emerges as a crucial strategy in the development of personalized clinical interventions aimed at optimizing adherence to CRPs and improving long-term clinical outcomes [64].

Regarding the coping styles analysed (H4), the results did not reveal statistically significant differences between participants who adhered to the CRP and those who did not. The lack of statistical significance does not invalidate the presence of relevant trends. Specifically, in the case of avoidance-focused coping, the results suggest that a higher tendency toward avoidance may be associated with lower adherence to the CRP. This trend aligns with the literature, which indicates that avoidance strategies, such as denial or distraction, tend to be associated with lower treatment commitment and poorer health outcomes [15,65]. Coping was assessed at a single point in time, potentially distant from the acute cardiac event, which may not fully capture the dynamic and contextual nature of these strategies, particularly during the early post-event period of heightened emotional vulnerability.

Regarding lifestyle (H5), the results did not show statistically significant differences between patients who adhered to the CRP and those who did not. However, this lack of statistical significance should not be interpreted as a lack of clinical or research relevance. In fact, the literature has clearly emphasized that healthy lifestyles are central components not only for prevention but also for maintaining the benefits achieved through CR [22,24].

The literature highlights that the greatest challenges in therapeutic adherence within the context of CVD are found precisely in behavioural areas, such as habits and lifestyle, which require sustained changes and continuous self-discipline [34].

Throughout the programme, topics related to lifestyle modification were widely addressed, and participants frequently expressed that these behavioural changes were particularly demanding. This demand arises not only from the need for a deep restructuring of daily habits but also from the high level of self-discipline and self-regulation required for their long-term maintenance.

It is also important to note that, in several cases, difficulties in consistently achieving the goals led to feelings of frustration, sadness, and demotivation, often accompanied by a pronounced sense of guilt. This negative emotional response can be understood through the lens of self-efficacy models and cognitive dissonance theory, which explain how discrepancies between expected and actual behaviour can undermine motivation and psychological well-being, particularly in contexts w28here individuals assume a high degree of personal responsibility for change [61].

Although no significant differences were found between groups regarding overall lifestyle patterns, a statistically significant difference was observed between sexes, with women presenting significantly healthier lifestyles than men. This result is relevant, as previous studies have shown that women tend, on average, to adopt more protective health behaviours, show greater concern with diet and preventive health, and display a higher predisposition for behavioural changes [66].

The absence of significant results between lifestyle and adherence to the CRP may also reflect a gap between intention and behaviour. In other words, individuals who adopt (or report adopting) healthy lifestyles may still face practical barriers (e.g., transportation, lack of time, family or financial constraints) that limit their participation in the programme. This is consistent with the challenges identified in the literature, which point to contextual and structural factors as significant obstacles to continued participation in CRPs [28].

Regular physical exercise before the myocardial infarction showed a positive and statistically significant association with adherence to the CRP, thus supporting Hypothesis 6 (H6). This result holds strong clinical relevance, as it suggests that individuals who were previously active tend to show a greater predisposition to engage in and remain in CRPs [41]. The fact that 60.7% of the patients who adhered to the CRP were already engaging in physical activity before the AMI reinforces the idea that prior physical exercise serves as a marker of predisposition toward health self-regulation.

One of the most salient findings of this analysis, which further highlights the relevance of this work, concerns the time gap between the acute cardiac event and the actual integration of patients into CRPs with a structured psychological component. International literature has consistently emphasized that the immediate post-cardiac event period is a critical window not only due to biological vulnerability, but above all because of the psychological transformations that occur during this time [67].

A significant proportion of patients eventually dropped out of the programme, citing the perception that the psychological intervention began too late, too far removed from the acute event, a moment when they reported feeling most emotionally vulnerable and in need of structured support.

This evidence, grounded in patients' subjective experiences, highlights the urgent need for early psychological intervention that ensures coordinated and consistent follow-up capable of effectively addressing emotional needs from the immediate phase following the cardiac event. The implementation of psychoeducational sessions focused on understanding the condition, identifying modifiable risk factors, and emphasizing the active role the patient can play in the recovery process should be a priority, ideally beginning shortly after the AMI episode. This early approach could enhance motivation to adhere to therapeutic recommendations and thereby contribute to the overall effectiveness of the CRP and the sustained improvement of clinical outcomes.

It is essential to consider certain limitations inherent to the design and execution of this study, which may influence the interpretation and generalization of the results. One important limitation of this study concerns the sample size, which may have limited the statistical power to detect significant associations between psychosocial variables and adherence to the CRP. Consequently, non-significant findings should be interpreted with caution, as true effects may not have been detected. Although the sample demonstrated adequate representativeness in terms of age, marital status, employment situation, and educational background, an important limitation lies in the imbalance of the sex variable, with a significant predominance of male participants. An additional limitation concerns the refusal of some participants, including those who completed the programme, to complete the questionnaires.

Another relevant issue relates to the requirement for reading and writing skills for the self-administration of the questionnaire. In practice, some participants were observed to have difficulty understanding the items, which required intervention from the psychologists responsible for the programme to read them aloud. While this support was necessary, it may have influenced the responses, as the presence of an interlocutor can alter the way participants respond, either due to social desirability or fear of judgment, thereby introducing a possible response bias and compromising the spontaneity and authenticity of the data collected.

The analysis developed throughout this study raises important questions that warrant further and more in-depth investigation. Among the aspects requiring greater attention is the need to understand the underlying reasons why some patients do not adhere to the psychological component of the protocol, while paradoxically maintaining regular attendance in the other components of the programme.

It would also be relevant for future studies to assess trauma-related symptoms. Finally, it is particularly important to compare the results observed in this study with those from programmes in which the intervention begins at earlier stages of the clinical course. Such a comparison would allow for a more robust understanding of the impact of intervention timing on the overall effectiveness of CR.

Acknowledgments

The authors would like to thank the patients for their participation and valuable contributions to this study. This research received no external funding.

Author Contributions

AF participated in the study's investigation, methodology, and writing of the original draft. GM contributed to the study's supervision. VA and AT were involved in the conceptualization and methodology of the work, as well as in the manuscript's revision and editing. All authors read and approved the final manuscript.

Conflicts of interest

The authors declare no competing interests.

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