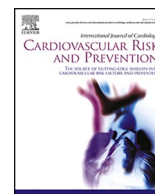





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## Can psychological interventions affect cardiac rehabilitation patients' well-being? Preliminary results from a longitudinal study

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### ABSTRACT

**Background:** Research has explored the link between psychological factors and cardiovascular diseases [CVDs], with a focus on identifying predictors of these disorders. Cardiac Rehabilitation [CR] is crucial for heart disease patients, particularly those with psychological comorbidities, as it helps in self-care and understanding their condition. This study aims to compare the psychological health of CVD patients – in terms of anxiety, depression, and illness perception – before (baseline, T0) and after (over time, T1) multidisciplinary cardiac rehabilitation treatment, considering the effects of different psychological interventions (psychoeducational group, progressive muscle relaxation training, and individual counseling).

**Methods:** A total of 181 patients with acute coronary syndrome [ACS], cardiac decompensation [CD], or cardiac surgery [CS], participated in a rehabilitation program between January and August 2023. Self-report questionnaires were used to investigate levels of anxiety, depression (Hospital Anxiety and Depression Scale), and illness perception (Brief Illness Perception Questionnaire) at T0 and T1.

**Results:** Statistically significant changes were found over time. Individual counseling led to significant reductions in depression and anxiety, and improved illness perception. Anxiety levels were also influenced by the type of cardiovascular disease and by the presence or absence of physical comorbidity.

**Conclusions:** The study highlights significant improvements in levels of anxiety, depression, and illness perception from T0 to T1. Individual counseling is the most high-impact psychological intervention. These findings show the importance of psychological interventions in enhancing CVD patients' psychological and physical well-being.

## 1. Background

Cardiovascular Diseases [CVDs] are a set of disorders that affect the heart and/or blood vessels, thus veins and arteries, and include coronary artery disease, cerebrovascular disease, rheumatic heart disease, and other conditions. These diseases, in addition to cancer, chronic respiratory disorders, and diabetes, are the world's main public health problem and the main cause of mortality. Several studies have focused on the role that psychological risk factors (e.g. depression, anxiety, and psychological stress) and protective factors (e.g. illness perception) play in the progression, outcome, and therapy adherence to CVD [1–5]. They

have shown that heart patients have a higher risk (about twice) of developing psychological and emotional difficulties, which can lead to poor adherence to drug treatment and lifestyle modifications [6] and can also contribute to the increase in psychological stress [7]. Emotional response is also related to illness perception, the beliefs related to one's medical condition [8–10]. A good one can allow patients to recognize symptoms and causes of their condition as treatable [11]; a bad one can induce patients to consider their heart illness as critical and not treatable and have negative effects on their psychological well-being [12,13] and quality of life [4]. Therefore, it is crucial to recognize the roles of psychological and social factors in determining individual psychological

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health and well-being. As a result, recent guidelines on Cardiac Rehabilitation [CR] have identified psychological assessment and interventions for CVD patients as essential components of a multidisciplinary treatment approach, which can help reduce emotional distress, improve illness perception, and improve healthy behavioral changes especially those in comorbidity with psychological disorders [6, 14,15]. Not many studies have investigated the effect of the combination of psychological and cardiac treatment on heart patients' psychological well-being. Those who did showed significant differences in methods (e. g. use of heterogeneous types of psychological treatments, patients' clinical heterogeneous) and results [16,17]. These studies also underestimate the role of psychological factors in CVD patients and their style of healthy (or not) lifestyle [18]. Consequently, further research is needed to investigate psychological factors and interventions' effects within the context of CR.

In line with these theoretical backgrounds, we aimed to investigate the impact of psychological treatments on the well-being of patients who have undergone multidisciplinary cardiac rehabilitation. This study involved ASST (*Azienda Socio Sanitaria Territoriale* - Territorial Social Health Company) Bergamo Est's CR, which includes – in the CR program – different types of psychological interventions (in addition to the traditional clinic cardiac rehabilitation pathway): educational intervention, progressive muscle relaxation training using Jacobson's technique, and individual counseling. Educational intervention groups aim to increase patients' knowledge and awareness of their cardiovascular disease to promote treatment cooperation and adherence to therapy. Progressive muscle relaxation training is a set of practices – like deep breathing, autogenic training, guided visualization, and assisted biofeedback – conducted with Jacobson's technique to induce a natural relaxation response in bodies, reduce stress, and promote psychophysical well-being. Individual counseling is a one-to-one psychological intervention to give emotional, informational, and behavioral support to patients. Considering this, it is investigated whether patients' psychological well-being and perception of their heart disease change following the completion of a rehabilitation program (both cardiac and psychological). It is expected that patients will show higher levels of anxiety and depression, and a lower perception of illness at the onset of hospital recovery (T0) compared to the levels measured after the inpatient rehabilitation program (T1). The question posed as input for the study is: does participating in psycho-educational group meetings, relaxation training, or individual counseling have any effects on the mean levels of anxiety, depression, and illness perception of patients with cardiovascular disease?

## 2. Materials and methods

### 2.1. Design

The study has a longitudinal design, with two data collection points. Patients admitted to the CR program were assigned to different psychological intervention groups: psychoeducational group (for all patients), relaxation training, and individual counseling (the last two are based on their levels of anxiety and depression at admission (T0) to the hospital unit). These levels were reassessed at the end of the treatment period, before hospital discharge (T1). The different treatment groups were compared with one another regarding the progression of their respective levels of anxiety, depression, and illness perception across the two times of data collection, to evaluate their efficacy.

### 2.2. Participants

The study took place between January 18, 2023, and August 27, 2023. The inclusion criteria were the following: diagnosis of cardiovascular disease [CVD], enrollment in the hospital's multidisciplinary cardiac rehabilitation program, sufficient proficiency in the Italian language, and being of legal age. A total of 181 participants (28.2 %

women) provided informed consent and participated in the study. Participants' ages ranged from 21 to 85 years ( $M=65.96$ ,  $SD=11.90$ ). Additional assessed demographic variables included years of educational level ( $M=10.27$ ;  $SD=3.79$ ) and relationship status (71.1 % is married). Specific clinical variables were also reported in Table 1, such as cardiac ejection fraction [EF] (normal, moderately reduced, severely reduced), body mass index [BMI] (underweight, normal weight, overweight, obesity), the type of cardiovascular disease (acute coronary syndrome [ACS], heart failure [HF], programmed cardiac surgery [CS]), and the type of comorbidity (cardiac, psychological, and physical). The demographic characteristics of the sample are reported in Table 1. Because of difficulties encountered in the second phase of data collection (T1), mainly related to patients' reluctance to continue contributing to the study or organizational problems, the total number of participants decreased from 181 at T0 to 151 at T1, with a participation rate of 83.43 %.

### 2.3. Procedure

To explore psychological factors and illness perception in CVD patients, a paper-based questionnaire using a non-probabilistic sampling method was administered from 18/01/2023 to 27/08/2023. Participants were recruited upon admission to the CR Unit at Bolognini Hospital in Seriate, following acute cardiac events, heart failure, or cardiac surgery. Cardiologists explained the study's objectives and participation procedures to the patients, obtained informed consent, and ensured confidentiality. Subsequently, patients completed a questionnaire that included self-report scales for assessing anxiety, depression, and illness perception. In the first part of the study (T0), a total of 181 participants were involved, forming the initial reference sample. After completing for the first time the self-administered battery of questionnaires, patients began a multidisciplinary rehabilitation program, which included pharmacological treatment, dietary education, physical exercise, and three different psychological treatments (psychoeducational groups, relaxation training, and individual counseling). Patients were assigned

**Table 1**  
Sociodemographic characteristics of participants.

	N	%
<b>GENDER</b>		
Male	130	71.8
Female	51	28.2
<b>RELATIONSHIP STATUS</b>		
Married	108	71.1
Divorced	7	4.6
Single	7	4.6
Widowed	10	6.6
Other	20	13.2
<b>EDUCATIONAL LEVEL</b>		
Mandatory schooling (8 years)	76	42
Post-mandatory schooling (>8 years)	105	58
<b>EF</b>		
>50 (Normal)	93	51.4
40–50 (Moderately reduced)	45	24.9
<40 (Severely reduced)	41	22.7
<b>BMI</b>		
<18 (Underweight)	1	0.6
19–24 (Normal weight)	88	49.7
25–29 (Overweight)	62	35.0
≥30 (Obesity)	26	14.7
<b>PATHOLOGY</b>		
Acute coronary syndrome [ACS]	36	19.9
Heart failure [HF]	25	13.8
Cardiac surgery [CS]	120	66.3
<b>COMORBIDITY</b>		
Cardiac	6	3.3
Psychological	23	14.0
Physical	24	14.9

Note. N=181. Participants were on average 65.96 years old ( $SD=11.90$ , range 21–85).

to one (or more) of these treatments based on specific conditions evaluated by the multidisciplinary team. All patients, except those with mobility or language issues or those who declined, attended the psychoeducational group. Progressive muscle relaxation training was provided to patients with borderline or pathological anxiety or depression (HADS scores  $\geq 8$  in at least one dimension) and to those who were recommended by cardiologists. Lastly, individual counseling was offered to patients with pathological anxiety or depression (HADS scores  $\geq 11$ ); patients with no pathological levels could request individual counseling based on a cardiologist's, psychologist's or other cardiac unit's healthcare operator's recommendation or personal preference, but the availability was limited, due to the psychologists' scheduling constraints. The rehabilitation program lasted about two weeks, according to the Hospital's protocol – which has provided this time frame for the implementation of clinical activity aimed at optimizing drug therapy, physiotherapy activity, activity carried out by Psychologists and Dietitians, and nursing and medical education activity. We have added this explanation in the article pages, in the methodology section – with a follow-up assessment (T1) conducted the day before discharge.

#### 2.4. Measures

The paper-based questionnaires used in this study included, in addition to sociodemographic (age, sex, cohabitation, schooling) and clinical characteristics (BMI, FE, cardiovascular disease, cardiac comorbidity, psychological comorbidity, and physical comorbidity), two measurement tools: the Hospital Anxiety and Depression Scale [HADS] [19] and the Brief Illness Perception Questionnaire [B-IPQ] [20,21]. Both assessment tools were administered at T0 and T1. The language was Italian. The two instruments, in the Italian version, have been added to [appendices A](#) (HADS) and [B](#) (B-IPQ).

##### 2.4.1. The Hospital Anxiety and Depression Scale [HADS] [19]

The HADS is a self-report questionnaire administered to hospitalized patients that assesses both generalized anxiety and depression. It consists of 14 items for evaluating both anxiety (7 items) and depressive (7 items) symptoms. Each question is rated by the patient using a 4-point Likert scale (from 0 to 3), with a range score from 0 to 21 for both the psychological dimensions. Responses are analyzed to classify total scores as normal (0–7), borderline (8–10), or pathological (11 or higher).

##### 2.4.2. Brief Illness Perception Questionnaire [B-IPQ] [20,21]

The B-IPQ is an 8-item questionnaire used to evaluate cognitive (5 items), and emotional (2 items) representations, and understanding (1 item) of illness, on a 0-10-point scale. Since specific scores for illness perception are not provided in the literature, this study used z-scores for analysis, to indicate a lower and inadequate perception (above 0.5), a higher (over average) perception (below  $-0.5$ ), and an average perception (between  $-0.5$  and  $0.5$ ) of illness.

#### 2.5. Statistical analysis

All variables are normally distributed so parametric analyses were conducted using SPSS software (v. 29.0.1.0). General linear models were carried out to test the trends of three psychological factors (depression, anxiety, and illness perception) at two detection times (T0 and T1) for patients participating in one or more of three psychological interventions (psychoeducational group, relaxation training, individual counseling). To assess the impact of the different types of psychological treatment on changes in depression, anxiety, and illness perception between T0 and T1, all relevant variables, such as sociodemographic and clinical factors (time, sex, age, cohabitation, schooling, BMI, cardiovascular disease, cardiac comorbidity, psychological comorbidity, and physical comorbidity) were included in the model to account for potential confounding effects.

### 3. Results

A significant decrease in anxiety along the two times T0 and T1 was predicted by the following variables: cardiac pathology ( $F(2,179)=3.13$ ,  $p=.048$ ), physical comorbidity ( $F(1,179)=7.60$ ,  $p=.007$ ) and, among psychological treatments, individual counseling ( $F(1,179)=11.01$ ,  $p=.001$ ).

Specifically, as shown in [Fig. 1a](#), patients who had undergone cardiac surgery [CS] or experienced heart failure [HF] at T0 exhibited higher anxiety levels compared to those with acute coronary syndrome [ACS]; following psychological and cardiovascular rehabilitation (T1), mean anxiety scores risen in patients with ACS and fall in patients with CS. Regarding physical comorbidity ([Fig. 1b](#)), at T0 mean anxiety scores are higher in those who do not have a physical comorbidity, but at T1 in those who do.

As illustrated in [Fig. 2a](#), patients who participated in individual counseling at T0 (access condition for psychological treatment) show higher mean anxiety levels than those who did not participate in individual counseling. However, this trend reversed by the end of rehabilitation (T1), where patients who participated in individual counseling demonstrated lower mean anxiety levels than those who did not. Additionally, individual counseling was a significant predictor of a reduction in depression ( $F(1,179)=5.70$ ,  $p=.019$ ) levels ([Fig. 2b](#)) and of an increase in illness perception<sup>1</sup> ( $F(1,179)=6.14$ ,  $p=.015$ ) scores ([Fig. 2c](#)). Patients who participated in individual counseling at T0 (access condition for psychological treatment) showed higher mean values of depression than those who did not participate, and at the end of rehabilitation (T1) they showed a significant decrease while those who did not participate saw a slight increase in mean levels of depression. Regarding the illness perception dimension, we found that patients who participated in individual counseling at T0 showed lower illness perceptions (higher mean scores in B-IPQ) than those who did not participate, but at the end of rehabilitation (T1) both showed the same level of illness perception, that is better than they started the rehabilitation treatment.

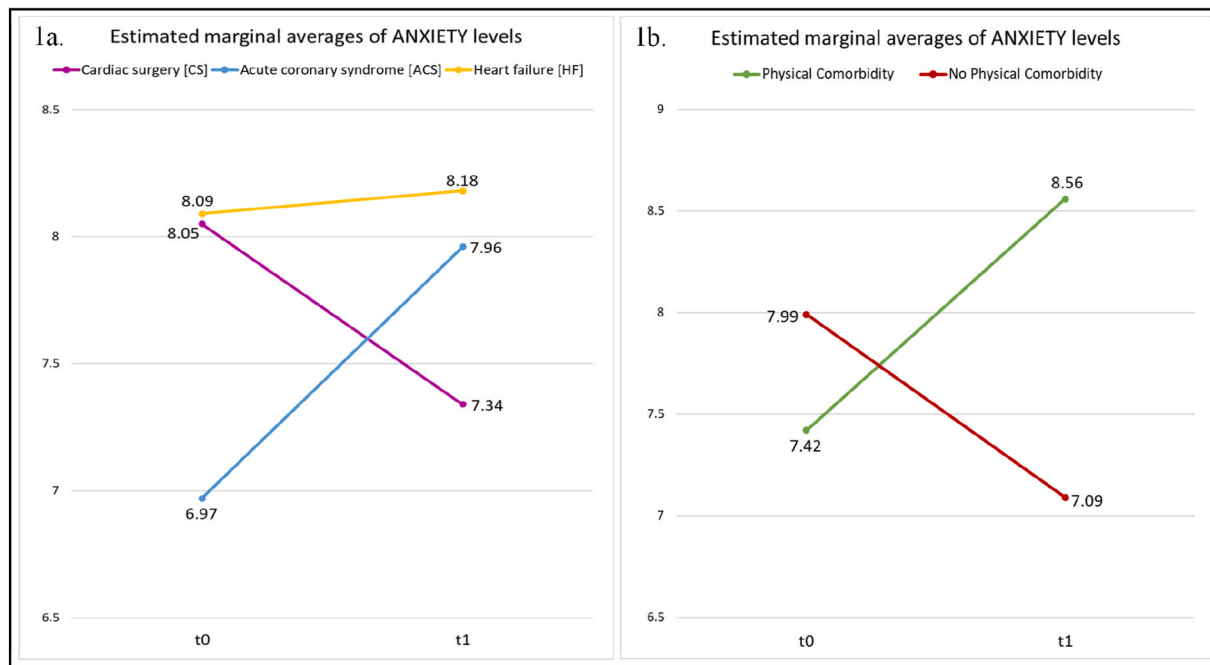
The other variables in the analysis models – gender, living status, level of education, different types of comorbidities, age, and BMI – did not significantly predict the levels of anxiety, depression, and illness perception.

### 4. Discussion

This research attempted to contribute to the answer to the question, “Does participation in psychological and cardiovascular rehabilitation have any effects on the mean levels of anxiety, depression, and illness perception of patients with cardiovascular disease?” by comparing these psychological variables at baseline (T0) and at the end of the rehabilitation program (T1).

The results show that CVD patients who participate in a multidisciplinary cardiological rehabilitation pathway integrated with different psychological interventions (especially individual counseling) show improvements in levels of anxiety, depression, and illness perception. These results are in line with previous ones [4,22,23] reported the effectiveness of psychological treatments in cardiology rehabilitation, not only in decreasing patients' psychological symptoms but also in promoting and adopting healthy behaviors, reducing risk behaviors (e.g. smoking, sedentariness, poor diets, and stress). Specifically, the results highlight the strong positive role of individual counseling, which is found to be the psychological treatment that predicts a greater decrease in levels of depression and anxiety and a greater increase in illness perception. This could result from the reason that this type of psychological intervention focuses on the needs of the person, with an in-depth look at emotional issues concerning the cardiac disease condition, and a

<sup>1</sup> Low illness perception scores indicate better levels of this dimension.



**Fig. 1.** Estimated marginal averages of anxiety levels based on cardiac pathology (Fig. 1a) and the presence or absence of physical comorbidity (Fig. 1b). Note. socio-demographic and clinical factors (time, sex, age, cohabitation, schooling, BMI, cardiovascular disease, cardiac comorbidity, psychological comorbidity, and physical comorbidity) were included in the model to account for potential confounding effects.

look at promoting positive behavioral changes and adherence to therapy, which may allow prevention of risk behaviors and greater control by patients to modifiable risk factors of CVD [4,16,23–25]. Anxiety levels are also influenced by the type of cardiovascular disease (cardiac surgery, heart failure, or acute coronary syndrome): surgical patients, although they reported the highest levels of anxiety at the time of hospital admission (T0), together with heart failure patients, they showed the lowest levels of anxiety at the end of the multidisciplinary rehabilitation program (T1). This finding is interesting, as it highlights the individuality of each patient who, depending on the cardiac disease experienced, may manifest different levels of worry and anxiety. For instance, a patient with heart failure may have developed psychological adaptation mechanisms to cope with their cardiovascular condition, which may be absent in a patient with acute coronary syndrome, who may not yet have had the opportunity to process their situation cognitively [16].

The relationship between physical comorbidities and CVD outcomes has been extensively documented in the literature. Multimorbidity, the coexistence of two or more chronic diseases, adds complexity to both diagnosis and treatment [26]. Patients with CVD often experience conditions such as chronic kidney disease [CKD], diabetes, and chronic obstructive pulmonary disease, which exacerbate heart failure symptoms and contribute to increased morbidity and mortality [26]. For instance, the interaction between CVD and comorbidities like CKD leads to a vicious cycle, often referred to as cardiorenal syndrome, where both organ systems deteriorate progressively [26]. The findings from our data analysis align with these conclusions, demonstrating that physical comorbidity was a significant predictor of anxiety reduction among CVD patients during the rehabilitation process. This suggests that addressing physical comorbidities can enhance psychological well-being, potentially by alleviating some of the physiological burden that exacerbates anxiety. This finding is particularly relevant given that patients with multimorbidity, especially those with HF, often report high levels of psychological distress, including depression and anxiety, which are linked to poorer health outcomes and quality of life [27]. In addition, in a large-scale study involving over 10,000 HF patients, it was found that comorbidities like CKD and diabetes were associated with a greater

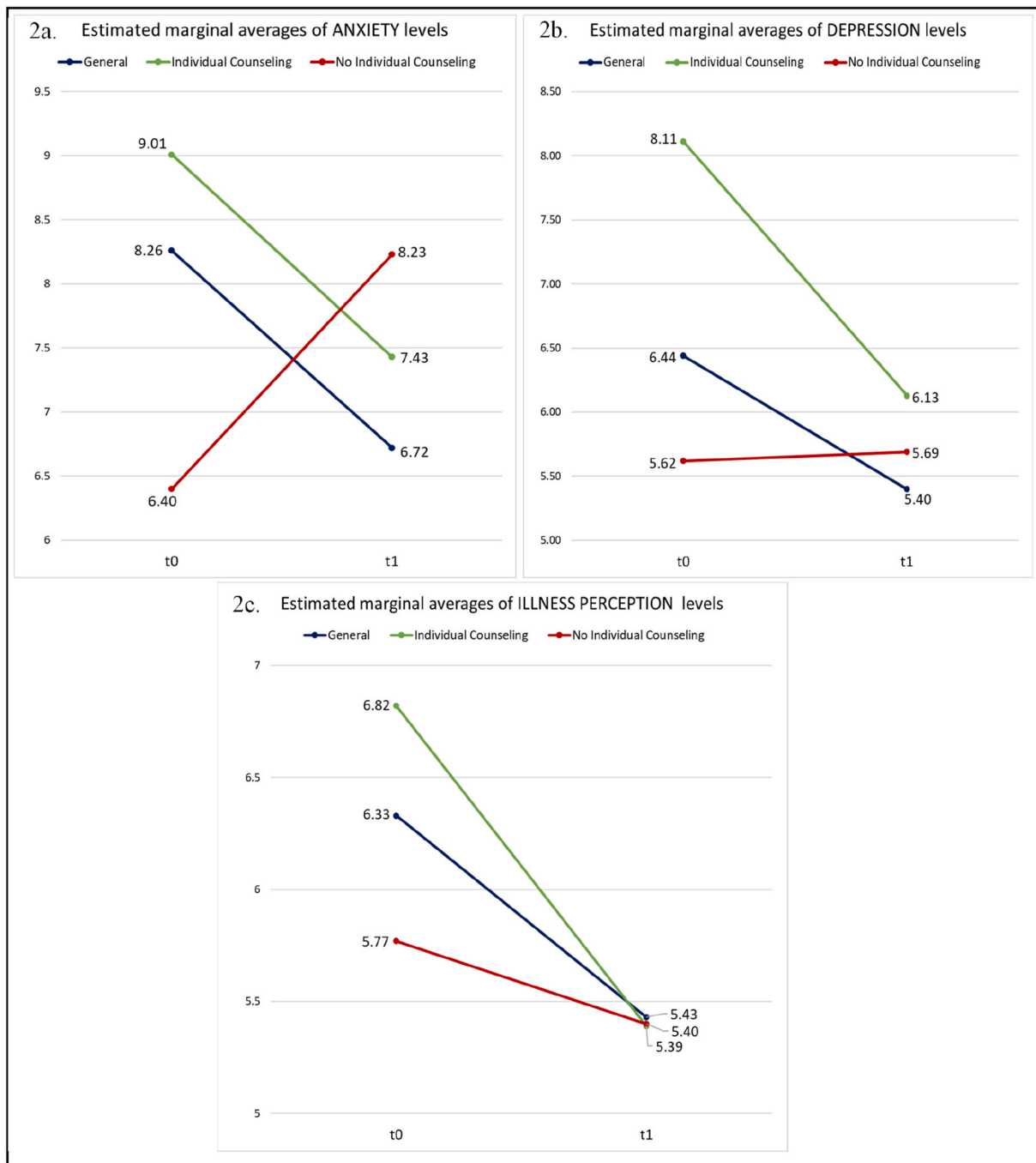
symptom burden and a lower patient-rated quality of life [28].

Furthermore, the results of this study emphasize the importance of multidisciplinary care in managing CVD with comorbid conditions. Individual counseling emerged as a key psychological intervention, significantly reducing anxiety and depression levels among participants. This reinforces previous research showing that psychological support, particularly when integrated with medical treatments, can improve both mental and physical health outcomes in CVD patients [4,23]. Given the substantial burden posed by multimorbidity in CVD, tailored interventions that address both physical and psychological factors are essential for optimizing patient care and improving overall quality of life.

This study presents several strengths that enhance its credibility and significance. Firstly, the sample size is large and representative, increasing the generalizability of the results to the wider population. Various assessment measures, including questionnaires and interviews, provide a comprehensive and multidimensional view of the phenomenon under investigation. Furthermore, conducting this research in a natural setting enhances the ecological validity of the findings. A particularly notable strength is the extended follow-up period, which allowed observing long-term effects and changes over time. Additionally, appropriate statistical analyses were conducted, aided by interdisciplinary collaborations among researchers with diverse expertise, enriching the study and enabling a more thorough analysis of the issues addressed.

In contrast, this study primarily relates to missing data resulting from the loss of some questionnaires from T1; nonetheless, the dropout rate is lower than the average seen in longitudinal studies. The study also employed a convenience sample from a single hospital unit, which may limit the generalizability of the findings. The lack of randomization to intervention groups also limits the ability to draw causal inferences. Lastly, self-reported measures may also cause subject response biases, like social desirability.

As a future direction, there is an interest in focusing on specific heart diseases and patients in acute phases rather than chronic ones, allowing for a more in-depth analysis of psychological experiences. In addition, future studies could consider the effects of other variables, such as



**Fig. 2.** Estimated marginal averages of anxiety (Fig. 2a), depression (Fig. 2b), and illness perception (Fig. 2c) levels based on participating or not in individual counseling

Note. sociodemographic and clinical factors (time, sex, age, cohabitation, schooling, BMI, cardiovascular disease, cardiac comorbidity, psychological comorbidity, and physical comorbidity) were included in the model to account for potential confounding effects.

loneliness, eventual recovery in the intensive care unit [ICU], financial background, previous hospitalization, the severity of the illness, NYHA symptoms at admission, and functional status after recovery. Other aspects that may be considered in future studies involve the investigation of comorbidities such as DM and CKD, to analyze their possible effect on the psycho-physical rehabilitation pathway.

Finally, it is important to emphasize that the study’s results have significant practical implications, contributing to the improvement of clinical practices and health policies.

Patients will be re-tested with the battery of questionnaires as follow-up about 3 months after hospital discharge (t2) to check if the changes

have been maintained over time. We expect a later publication in which we will discuss these results.

In conclusion, further studies are expected to provide new tools to expand knowledge in this field and continue this research, confirming more thoroughly the initial hypotheses of this empirical contribution. We also hope that in the future, more rehabilitation cardiology departments that treat patients with CVDs will include multidisciplinary rehabilitation (both cardiac and psychological) to promote health and well-being.

## 5. Conclusion

Considering the study's results, the different types of psychological treatment – mainly individual counseling – during cardiac rehabilitation appears to have a significant impact on patients' psychological well-being, and disease management. It is essential to emphasize the importance of psychological interventions as an important part in cardiovascular rehabilitation settings, especially to promote patients' psycho-physical health and well-being.

## CRedit authorship contribution statement

**Elisa Zambetti:** Writing – review & editing, Writing – original draft, Formal analysis. **Maura Crepaldi:** Writing – review & editing, Formal analysis. **Fiorella Lanfranchi:** Writing – review & editing, Project administration, Conceptualization. **Emanuela Zenoni:** Data curation, Conceptualization. **Irene Bariletti:** Data curation, Conceptualization. **Francesco Quarenghi:** Data curation, Conceptualization. **Luigina Viscardi:** Data curation, Conceptualization. **Ginevra Rizzola:** Data curation, Conceptualization. **Valentina Regazzoni:** Data curation, Conceptualization. **Alessandra Bigoni:** Formal analysis. **Francesca Brivio:** Methodology. **Irma Maria Soddu:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Massimiliano Anselmi Kaiser:** Writing – review & editing, Formal analysis, Data curation. **Vittorio Giudici:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization. **Andrea Greco:** Writing – review & editing, Supervision, Project administration, Methodology, Formal analysis, Conceptualization.

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## Declaration of competing of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

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