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Original article

Cardiac telerehabilitation in times of pandemic. Experience at the Instituto Nacional Cardiovascular - INCOR in Lima-Peru

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RESUMEN

Objective. Cardiac Rehabilitation (CR) programs based on telehealth are an alternative in the context of a pandemic and represent an opportunity to continue in the cardiovascular diseases (CVD) intervention. The present study aims to evaluate the effect of a Cardiac Telerehabilitation (CTR) program on quality of life, anxiety/depression index, exercise safety and disease awareness level in patients discharged from a national referral institute during pandemic. **Materials and methods**. A pre-experimental study in cardiac patients admitted to the cardiac rehabilitation program at INCOR from August to December 2020. The study included low-risk patients who were administered a questionnaire (on cardiovascular disease, exercise safety, anxiety/depression, and quality of life) at the beginning and end of the program, which was applied through a virtual platform. Descriptive and comparative before-after analysis was used through hypothesis testing. **Results.** Sixty-four patients were included (71.9% male). The mean age was 63.6 ± 11.1 years. Regarding exercise safety, an increase in the mean score was found after the application of the program (3.06 ± 0.8 to 3.18 ± 0.7, p=0.324). As for anxiety, the mean score was decreased from 8.61 to 4.75, whereas depression, there was a decreased from 7.27 to 2.92. When it comes to the quality-of-life score, the global component increased from 111.48 to 127.92. **Conclusions.** The CTR program implemented through a virtual platform during the COVID-19 pandemic enhanced quality of life and decreased stress and depression in cardiac patients discharged from a national cardiovascular referral center.

Keywords: Cardiac Rehabilitation; Coronavirus Infections; Telemedicine; Cardiovascular Diseases (source: MeSH-NLM).

Introduction

Cardiovascular diseases (CVD) are a global public health problem; the World Health Organization (WHO) estimates that they are responsible for 17.9 million deaths per year, with an upward trend in mortality and morbidity due to these diseases in developing countries [1].

Cardiac rehabilitation (CR) is an important pillar of tertiary prevention measures in patients with CVD [2], since it reduces mortality, readmissions, and recurrence of major cardiovascular events [3]. Despite this, there is an inverse relationship between the existing disease burden and the availability and utilization of CR [4]. A complete CR program has four phases: phase I (corresponds to the in-hospital phase, which concludes with discharge); phase II (active or actively supervised exercise phase in the multidisciplinary program); phase III (outpatient or independent support); and phase IV (maintenance phase). Classically, phase II is performed in a gymnasium with adequate equipment, safety measures and a regimen of three weekly sessions with a duration of 45 min to 1 h, three times a week. Given its comprehensive approach, CR includes educational activities, nutritional counseling and support, and psychological intervention to help patients understand their disease and reduce their cardiovascular risk by improving their lifestyle [4].

Besides the COVID-19 pandemic becomes a global health problem, it also forced the national health system to prioritize the patients care affected by the virus to the detriment of regular healthcare services. Health facilities were converted into COVID-19 care centers; consequently, space for regular patient care was reduced, not only because of the transformation described above, but also because of the capacity reduction imposed in all healthcare settings [5].

Telehealth is composed of mobile technologies, the use of remote medical measurement and evaluation devices, and synchronous and asynchronous interactive sessions, which has allowed its application in CR. For example, the Ramón y Cajal University Hospital in Madrid, through its Digital Health Research Unit, implemented the HAZLO program, whose mobile application with digital content on CR, aimed at Phase II patients at low and medium risk. It included content on physical and psychological rehabilitation and education on cardiovascular risk factors control, as well as tools for interaction between patients and professionals. The clinical trial evaluation of its application showed, as preliminary results, that none of the participants dropped out of the program [6,7]. Other similar extra-mural and distance initiatives, such as the Fit@ Home study and Telerehab III, have shown not only similar efficacy to intra-mural programs, but also greater cost-effectiveness of telerehabilitation compared to classic CR [8].

In Peru, there have been telehealth projects aimed at maternal and child health, infectious diseases, and other health problems [9], but no telehealth-based CR programs have been implemented. Thus, the context of the pandemic represented an opportunity to implement a program of this type, whose effectiveness in positively modifying the history of CVD has already been demonstrated. Therefore, the aim of the present study was to evaluate the impact of a cardiac telerehabilitation (CTR) program implementation (which seeks to achieve physical and psychological reconditioning, as well as self-management of cardiovascular risk factors, through educational and training sessions guided and supervised remotely, by professionals from the INCOR Cardiac Rehabilitation Unit) on quality of life, anxiety/depression, exercise safety and disease knowledge of CVD patients treated at a Peruvian national cardiovascular referral center during the COVID-19 pandemic.

Materials and Methods

Design and study population

A pre-experimental design with convenience sampling was used to enroll 64 patients aged 18 years or older, discharged from hospitalization at the Instituto Nacional Cardiovascular - INCOR in the city of Lima, Peru, after receiving treatment for their cardiovascular problem.

Inclusion criteria: patients of both sexes, aged 18 years or older, discharged from hospitalization at INCOR due to surgical or non-surgical pathology. Patients were initially included (August-October) after risk stratification and previous CR experience (considering that this group was composed of patients who had interrupted their CR early due to the pandemic). Patients enrolled between October and December 2020 followed the same protocol. The only difference between both groups was the lack of prior experience in any CR program. In both groups, the mandatory condition was to have the family member or caregiver support to accompany them during the sessions.

Exclusion criteria: patients without adequate family support, without required technologies access, left ventricular ejection fraction (LVEF) less than 40% measured by echocardiography, New York Heart Association (NYHA) functional class III or IV, complex ventricular arrhythmias or uncontrolled atrial fibrillation, decompensated heart failure, cardiac device carriers (pacemakers, defibrillators, resynchronizers), severe pulmonary hypertension, complications after cardiac surgery, and decompensated diabetes mellitus.

Variables

At the initial consultation, the patients' personal, anthropometric, medical, clinical and treatment data were recorded, which

allowed to establish the risk of each patient and specific training plan. All variables were measured at the beginning and end of the study. The questionnaires were validated in previous studies in the CR program. For each patient, questionnaires were applied to determine quality of life (MacNew Quality of Life after Myocardial Infarction-2 [QLMI-2] questionnaire) [10], anxiety and depression levels (Hospital Anxiety and Depression Scale [HAD57]) [11-14], exercise safety (Bandura's Exercise Self-efficacy) [15] and level of knowledge about their disease (Coronary Artery Disease Education Questionnaire - Short Version [CADE-Q SV PL]) [16].

Procedures and interventions

After establishing their aptitude to participate in CTR, patients were contacted by telephone to obtain their commitment and acceptance. The program was developed three times a week with a total of 24 sessions. Each session consisted of 30 min of education and 40 min of physical training, which were conducted by INCOR's multidisciplinary CR team (cardiac rehabilitation cardiologist, rehabilitation medicine physician, nurse educator, nutritionist, psychologist and physiotherapist). Each session was developed for groups of eight patients and began with a screening to detect any contraindication to training and thus avoid complications, in order to adapt the safety protocols that were performed face-to-face at the INCOR Cardiac Rehabilitation Unit. For the synchronous sessions (live intervention), the Zoom® platform was used, which allowed patient attendance control and participation. The scheme of the entire process can be seen in **Figure 1.**

The educational intervention consisted of twelve lectures and psychology workshops. Material such as videos and brochures were distributed to reinforce content.

The results of the CTR effects were measured by improving exercise safety and self-efficacy, psychometric tests of anxiety and depression. The quality of life's change and the level of knowledge about their disease and care were also measured.

Ethical aspects

The study followed the standards required by the Declaration of Helsinki and was approved by the Specific Research Ethics Committee for COVID-19 created by resolution No. 42-IETSI-EsSalud-2020.

Statistical analysis

Means, medians and their dispersion measures, frequency distribution and percentages were used according to the type of variable. The associations were made on the basis of hypothesis tests such as the chi-square test and Student's t-test for related samples and correlation tests, according to the type of variables and sense of hypothesis. The value of $p<0.05$ was considered statistically significant. All the analysis was performed using IBM SPSS® Statistics, version 22.

Results

Sixty-four patients completed the CTR program; 71.9% were male. The mean age was 63.6 ± 11.1 years (range: 23 - 82 years), higher in males (64.4 years) than females (61.3 years). The baseline characteristics of the population are shown in **Table 1.**

Exercise safety, measured by Bandura's self-efficacy scale, showed a non-significant increase at the end of the program (3.065 ± 0.859 at admission vs. 3.181 ± 0.747 at discharge, p=0.324) **(Figure 2).**

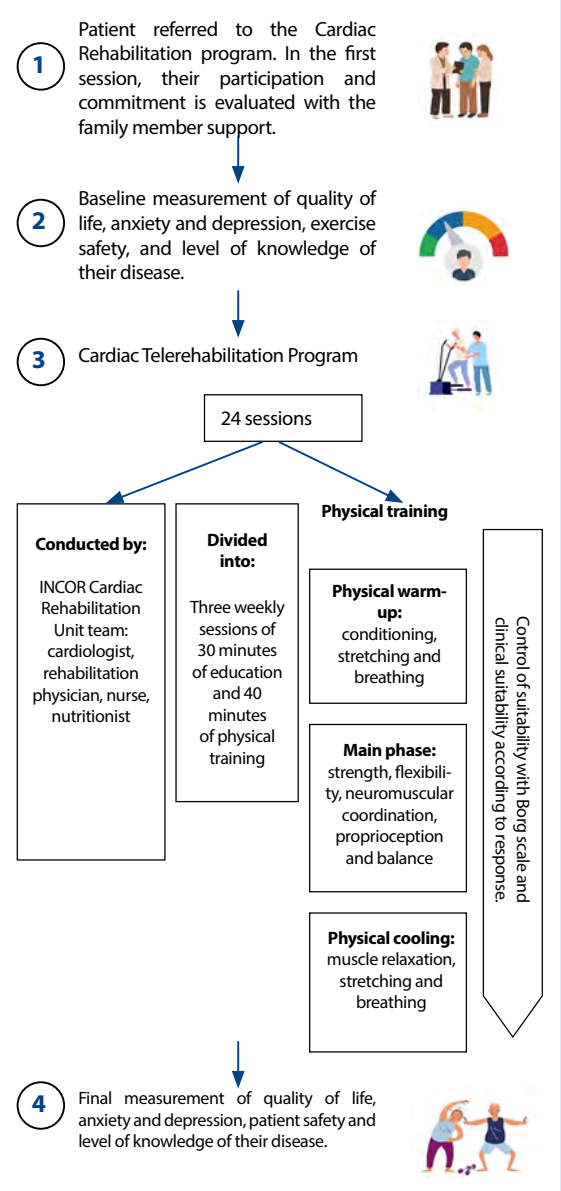

Figure 1. Diagram of the development of the physical training sessions.

Tabla 1. Características basales de los pacientes que ingresaron al programa de TRC

Risk Factors	n	%
Dyslipidemia	44	68.8
Obesity	42	66.7
Hypertension	40	62.5
Diabetes mellitus	14	21.9
Smoking	11	17.2
Drug	**n**	**%**
Beta-blockers	59	93.7
Acetylsalicylic acid	50	79.4
Atorvastatin	49	77.8
Angiotensin II receptor blockers	31	49.2
Clopidogrel	30	47.6
Anticoagulants	16	25.4
Antidiabetics	16	25.4
Diuretics	13	20.6
Calcium antagonists	12	19.1
Angiotensin converting enzyme inhibitor	9	14.3

In the mental health aspect, the anxiety and depression levels decreased dramatically, as shown by the baseline and final means of the applied HAD57 scale. In the first case, there was a decrease of four points in the mean, from 8.61 at baseline to 4.75 in the final measurement. For depression, there was a decreased by almost five points, from 7.27 at baseline to 2.92 in the final measurement. In both cases, the difference was statistically significant as shown in **Figure 3**. The decrease observed in the HAD57 scale levels correlates with the reduction in the patients' anxiety level, which decreased from 82.2% at the beginning of the CTR program to 20.3%. In the case of depression, 64.1% who had some degree of depression at baseline decreased only to 10.9% at discharge.

Quality of life also improved significantly in the four components: emotional, physical, social, and global. For the emotional component, the mean increased from 42.7 at baseline to 47.6 at discharge. This difference was statistically significant **(Figure 4A)**. These results showed that 17.2% of patients with a good emotional level at baseline increased to 76.6% at discharge.

For the physical component, the mean increased from 39.0 to 47.1 between discharge and the end of the program. This difference, which was also statistically significant **(Figure 4B).** Qualitatively, the good physical level increased from 10.9% to 89.1% between baseline and discharge from the CTR program.

The social component also showed a positive change. The mean has an increased from 29.8 at the beginning to 33.2 at the end or discharge; this difference was also statistically significant **(Figure 4C)**. Considering the category levels as in the previous cases, the good social level increased from 18.8% at the beginning to 81.3% at the end of the program.

The quality of life's global assessment with the MacNew QLMI-2, consequently, had the same performance observed in its components, which had an increased from 111.5 at baseline to 127.9 at the end; this increase was statistically significant **(Figure 4D)**. As a result of these values, it was observed that 12.5% with a good quality of life level at the beginning increased to 87.5% at the end.

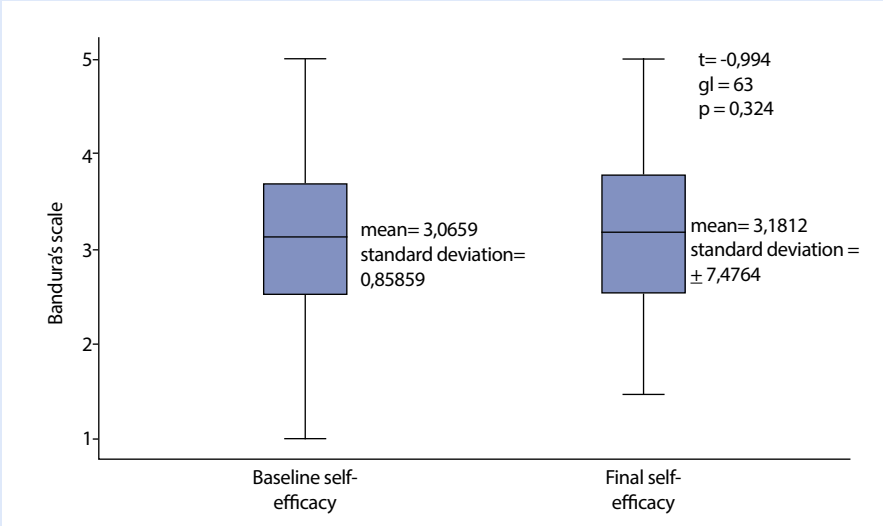

Figure 2. Baseline and final comparison of exercise safety measured by the Bandura's self-efficacy scale.

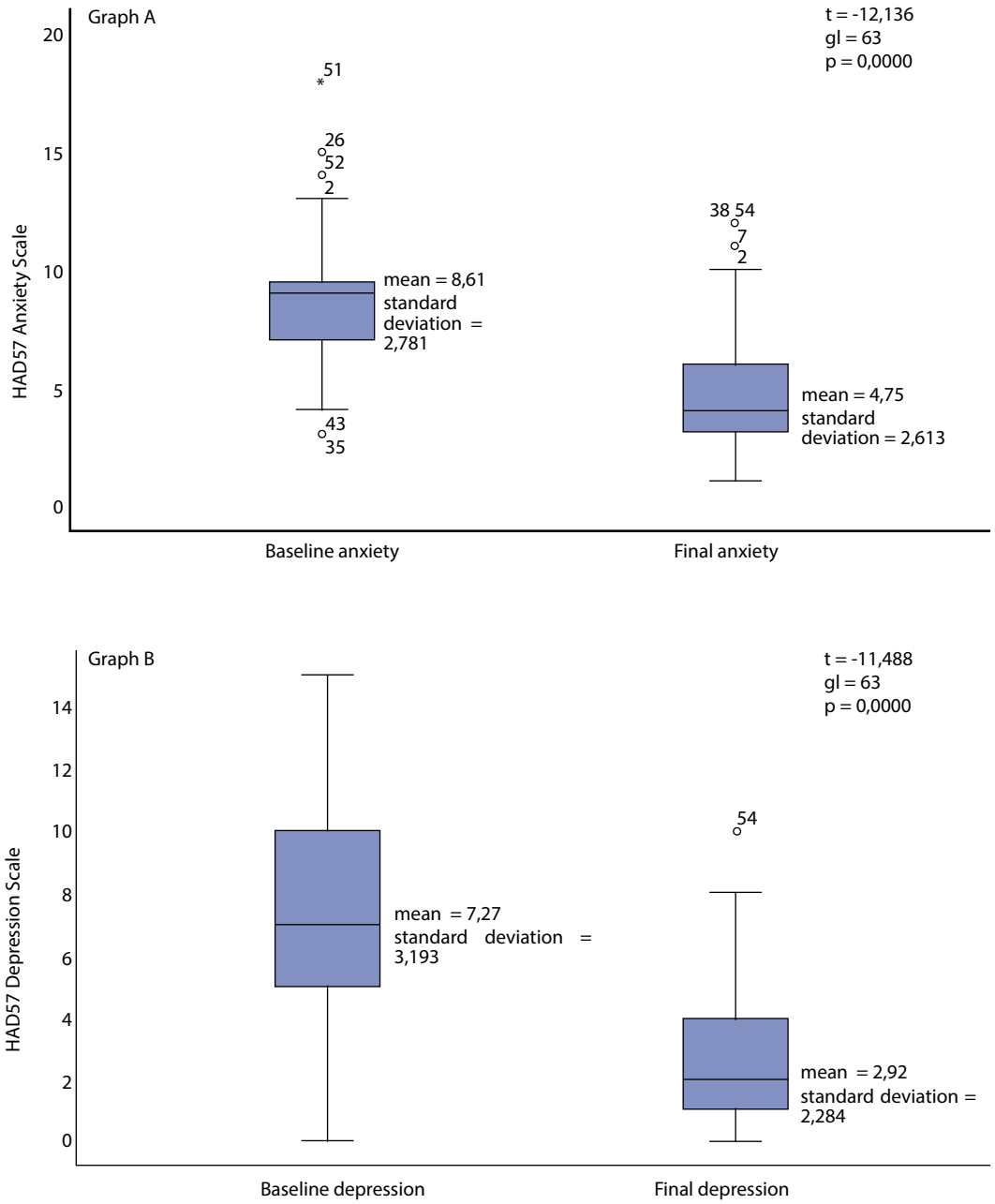

Figure 3. Baseline and final comparison of the anxiety (Graph A) and depression level (Graph B) measured by the HAD57 scale.

Discussion

In this pre-experimental study, the results clearly demonstrate that the cardiac telerehabilitation program was effective for the improvement of anxiety, depression and quality of life with their respective components.

CTR programs are an option to prevent the transfer of patients to hospital facilities several times a week for a few months, which increases social contacts and, consequently, the risk of COVID-19 infection. Efficient use of virtual tools and human resources makes close monitoring possible [17]. Two of the fundamental pillars of CR are education and physical training, which have a significant impact on recovery, reduction of hospital admissions, improvement of the quality of life and functional status of these patients when they are applied in a complete and systematic manner.

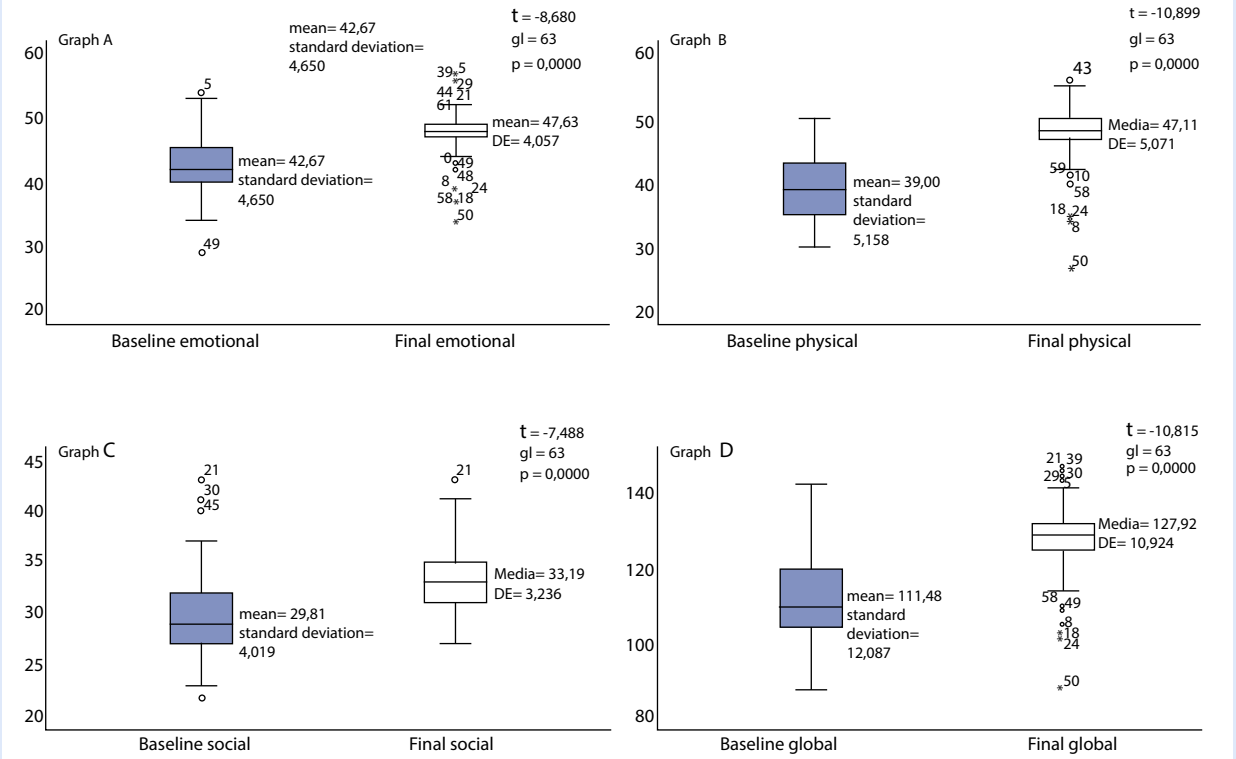

Figure 4. Baseline and final comparison of the quality-of-life levels and its components, according to the MacNew QLMI-2 scale. Emotional (Graph A); physical (Graph B); social (Graph C) and global (Graph D) components.

When it comes to measurement scales, Bandura's [18] exercise self-efficacy or self-efficacy, which measures the ability to initiate and maintain regular physical activity. Meland *et al.* reported that people's scores increase as they become more active (Odds Ratio [OR] = 1.4; 95% confidence interval [CI]: 1.0-1.9; p=0.04) [19]. Bandura noted that perceived self-efficacy influences one's thoughts, emotional arousal and actions, and the more perceived efficacy of a behavior is, the more its achievement, as demonstrated by Shin *et al.* [20]. These authors showed high scores related to highly self-efficacious individuals, reflected in making greater efforts to master health-promoting behaviors and persisting longer with the behaviors. Although there was an increase in the mean of this variable in our study, it was not statistically significant, possibly due to the sample size.

As for anxiety and depression scores, there was a significant decrease, similar to that reported by Lavie *et al.* [21,22], where the prevalence of anxiety, after psychoeducational interventions within CR programs, was decreased from 56 to 27%. Similar result was reported by Yesim *et al.* [23], where the discharge education group of cardiac surgery patients had a significantly fewer depression score than the standard care group ($p < 0.01$). In addition, the literature reports that anxiety and depression symptoms are reduced, when physical exercise is included; Matthew *et al.* [24] demonstrated that exercise training significantly decreased anxiety symptoms with a mean Delta (d) effect of 0.29 (95% CI: 0.23-0.36). Menárguez *et al.* [25] reported that patients with acute myocardial infarction or unstable angina referred to the program showed a statistically significant decrease after the intervention in most of the risk factors, such as anxiety ($d = 0.38$, $p < 0.001$), depression ($d = 0.25$, $p < 0.005$) and anger ($d = 0.35$, $p < 0.005$).

One of the main objectives of the CR program is to improve quality of life, benefits that are based on acquiring or maintaining good physical capacity, the disappearance of clinical symptoms, the control of psychological alterations, and the maintenance of an active sexual life, which facilitates the patient's reincorporation into an autonomous life. This is demonstrated by Peixoto *et al.* [26] in their study of 45 acute myocardial infarction (AMI) patients who underwent a supervised in-hospital exercise program with early mobilization starting 12 h after AMI, noting that physical and emotional domain scores were significantly higher in the intervention group ($p< 0.001$). Multimedia education and telephone follow-up has been shown to improve quality of life,

as demonstrated by Madadkar *et al.* [27] who followed discharge myocardial infarction patients for one month, where mean quality of life and self-efficacy scores of 4.86 +/- 0.43 were obtained after the intervention, being significant in the intervention group ($P \leq 0.001$). These data are similar in our study with significant levels both globally and in each of its components: physical and emotional. The lower change in the emotional component could be associated with the context of the pandemic and the social confinement imposed.

Studies have shown that cardiac patient education can influence them to make healthier decisions in daily life, better control their disease and avoid adverse outcomes, and have even been associated with coronary artery disease regression. Gis *et al.* [28] conducted a pilot study in 50 coronary patients, the work included educational sessions and lectures; as a result, a significant improvement in heart disease related knowledge was observed before and after CR, with a mean total score of 41.85 which is classified as "good" and is positively related to the fact that participants received information from the CR program.

Among the study limitations are the small number of patients considered in the study, the number of sessions, the lack of follow-up of the patients after the completion of the sessions, and the fact that the relationship between education and economic variables was not included.

This study is part of a clear line of research on the effectiveness of a CTR program for improving cardiovascular health in heart disease patients.

In conclusion, a CTR program improves quality of life, decreases stress and depression, even though the intervention in heart disease education had a significant increase.

Author contributions

All authors have participated in the study design, review and/or drafting and approval of the final version of the manuscript.

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