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Sustained quality-of-life gains following nurse-led cardiac rehabilitation: A longitudinal study to support nursing practice

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ABSTRACT

Background: Cardiac rehabilitation (CR) is a key component of secondary prevention in cardiovascular care. While its effects on clinical outcomes are well established, the long-term impact on health-related quality of life (HRQoL) and the specific contribution of nurse-led care remain underexplored in real-world settings.
Aims: To evaluate longitudinal changes in HRQoL among patients who completed a structured nurse-led CR program, and to identify subgroup differences and predictors of sustained improvement.
Methods: A prospective cohort study was conducted with 181 patients following myocardial infarction or cardiac surgery. HRQoL was assessed using the SF-36 questionnaire at four time points: baseline, discharge, 6 months, and 12 months. Sociodemographic, clinical, and psychosocial variables were analyzed. Nurse-led interventions were guided by standardized NIC classifications, including health education (NIC 5240), cardiac rehabilitation (NIC 5246), and emotional support (NIC 5270).
Results: HRQoL improved significantly across all SF-36 domains over 12 months ($p < 0.001$), especially in physical functioning, vitality, and general health. Women, patients with low education, and those with baseline anxiety showed lower initial scores but meaningful gains. Adherence to the full program was strongly associated with sustained improvements.
Conclusions: Nurse-led CR is effective in promoting sustained HRQoL gains across physical and emotional domains. Standardized interventions based on NIC contribute to structured, person-centered care delivery, especially in vulnerable populations.
Implications for nursing practice
Monitoring HRQoL through validated tools and NIC-guided nursing plans enhances long-term cardiovascular recovery. Integration of psychosocial assessment and extended follow-up may improve equity and personalization in post-cardiac care.

Summary statement

What is already known about the topic:

- Cardiac rehabilitation (CR) improves clinical outcomes after acute cardiac events.
- Health-related quality of life (HRQoL) is increasingly recognized as a key indicator of patient recovery.
- Nurse-led interventions contribute to secondary prevention, yet their long-term impact on HRQoL is less documented.

What this paper adds:

- This study shows that nurse-led CR can lead to sustained HRQoL improvements across physical, emotional, and social domains.
- It highlights the role of nurses in identifying vulnerable subgroups (women, low education, anxiety) and adapting care accordingly.
- Standardized NIC-based interventions supported structured follow-up and continuity of care over 12 months.

Implications for clinical practice:

- Longitudinal HRQoL monitoring can guide person-centered interventions and improve outcomes in cardiac nursing.
- Nurse-led care models are feasible, scalable, and essential for optimizing adherence, recovery, and quality of life.

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- Findings support integrating nursing classifications and HRQoL indicators into post-cardiac care pathways.

1. Introduction

Cardiovascular disease (CVD) remains the leading cause of death globally, accounting for nearly 18 million deaths each year (World Health Organization, 2023). Cardiac rehabilitation (CR) programs are clinically effective in reducing mortality and hospital readmissions and are widely recommended in international guidelines. However, their long-term impact on health-related quality of life (HRQoL), particularly from a nursing perspective, remains underexplored (Anderson et al., 2016; Rumsfeld et al., 2013).

HRQoL is now recognized as a key outcome in cardiovascular recovery. It captures physical functioning, emotional well-being, and social integration, dimensions that nurses routinely influence through direct care, education, and behavioral support (Ghisi et al., 2020). Nurse-led CR interventions have shown benefits in adherence, psychosocial recovery, and risk reduction, especially when sustained through follow-up beyond the acute phase (Berg et al., 2015; Buck & Riegel, 2011). However, disparities persist in CR outcomes. Previous studies have documented that women, patients with lower educational attainment, and individuals with baseline anxiety often experience lower gains in HRQoL compared to their counterparts (Brown et al., 2017; Norris et al., 2022). These characteristics, however, are not exhaustive, as other factors such as socioeconomic status, comorbidities, and cultural or linguistic diversity may also influence participation and benefit.

This study evaluates the impact of a structured nurse-led CR program on HRQoL over a 12-month period, using a longitudinal cohort design. It also explores how patient characteristics influence outcomes and highlights the feasibility of integrating standardized nursing interventions, guided by the Nursing Interventions Classification (NIC), into long-term recovery plans. The findings aim to support the implementation of person-centered, nurse-led models of care in secondary prevention.

While nurse-led CR programs have shown clinical effectiveness, they are seldom reported using standardized nursing languages such as the NANDA International classification (NANDA-I, Nursing Diagnoses), the Nursing Interventions Classification (NIC), or the Nursing Outcomes Classification (NOC). Incorporating these taxonomies supports reproducibility, facilitates interdisciplinary communication, and strengthens the visibility and professional identity of nursing care within multidisciplinary cardiovascular teams (Butcher et al., 2021).

2. Methods

2.1. Study design

A prospective, observational cohort study was conducted to evaluate changes in health-related quality of life (HRQoL) in patients participating in a nurse-led cardiac rehabilitation (CR) program. The study followed the *Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)* guidelines for reporting observational research (von Elm et al., 2007).

2.2. Setting and participants

The study took place in the cardiac rehabilitation unit of a tertiary university hospital in northwestern Spain, with 1200 beds and serving a catchment area of approximately 500,000 inhabitants. Eligible participants were adults (≥18 years) recently discharged after an acute myocardial infarction, percutaneous coronary intervention (PCI), or cardiac surgery. The diagnostic distribution at program entry was as follows: 47.0 % post–acute myocardial infarction, 32.0 % post-–percutaneous coronary intervention, and 21.0 % following open-heart surgery (coronary artery bypass or valve replacement). Patients were included if they were clinically stable, able to participate in exercise training, and willing to complete follow-up assessments. Exclusion criteria included cognitive impairment, severe psychiatric illness, or terminal disease.

A total of 181 patients were enrolled. Of these, 156 (86.2 %) completed the 8-week CR program. Follow-up retention was 94 % at discharge ($n = 170$), 83 % at 6 months ($n = 150$), and 76 % at 12 months ($n = 138$). Reasons for attrition included medical complications, personal constraints, and loss to follow-up.

2.3. Intervention

The CR program lasted 8 weeks and was delivered by a multidisciplinary team including cardiologists, nurses, physiotherapists, dietitians, and psychologists. Nurses coordinated individualized care plans and led health education, medication adherence support, psychosocial screening, and structured follow-up. Interventions were guided by standardized NIC codes, including:

- 5240: Health Education
- 5246: Cardiac Rehabilitation
- 5270: Emotional Support
- 4490: Medication Management
- 4360: Behavior Modification.

These interventions were tailored to individual needs based on initial assessment and adjusted during follow-up encounters.

2.4. Data collection and outcomes

HRQoL was measured using the Spanish validated version of the 36-Item Short Form Health Survey (SF-36 v2), which evaluates eight domains of physical and mental health (Ware & Sherbourne, 1992). The instrument has shown high reliability (Cronbach's $\alpha > 0.80$ across domains) and good construct validity in cardiac populations (Vilagut et al., 2005). Assessments were conducted at four time points:

- T1: Program entry
- T2: Program discharge
- T3: 6 months post-discharge
- T4: 12 months post-discharge.

Sociodemographic and clinical data (age, sex, education, comorbidities, smoking status, and baseline anxiety) were also collected. Data were obtained during **face-to-face visits (65 %) and structured telephone calls (35 %)**, depending on pandemic-related restrictions. No virtual videoconferencing was used.

2.5. Ethical considerations

The study was approved by the Regional Research Ethics Committee of Santiago-Lugo (approval number: 2019/011). All participants provided informed consent, and data collection complied with the principles of the Declaration of Helsinki and with the General Data Protection Regulation (EU 2016/679).

2.6. Statistical analysis

Descriptive statistics were used to characterize the sample. HRQoL changes across time points were analyzed using repeated measures ANOVA. Subgroup comparisons were conducted using Bonferroni-adjusted post hoc tests. Statistical significance was set at $p < 0.05$. All analyses were performed using IBM SPSS Statistics, version 26.0 (IBM Corp, 2019).

3. Results

3.1. Sample characteristics

Baseline characteristics of the study participants are presented in Table 1. The cohort included 181 patients (mean age = 61.2 ± 10.4 years; 26.5 % women). Most participants had only completed primary education (68.5 %), and common comorbidities included hypertension (44.8 %) and diabetes (27.1 %). Nearly one in five participants reported symptoms of anxiety at baseline. Tobacco use was reported by 40.8 % of participants, while 35.4 % were former smokers and 23.8 % had never smoked. Adherence to medication was very high (98.3 %).

Of the 181 patients enrolled, 156 (86.2 %) completed the 8-week cardiac rehabilitation (CR) program. Follow-up retention was 170 patients (94.0 %) at discharge, 150 (83.0 %) at 6 months, and 138 (76.0 %) at 12 months. Attrition was mainly due to medical complications, personal constraints, or loss to follow-up.

3.2. Health-related quality of life outcomes

Health-related quality of life (HRQoL) significantly improved across all SF-36 domains between baseline and 12 months ($p < 0.001$). The most notable improvements were observed in general health, physical functioning, and vitality. The largest gains occurred during the supervised phase (T1–T2), with improvements maintained at 6 and 12 months (T3–T4), indicating the impact of structured follow-up.

Table 2 summarizes the evolution of SF-36 scores across the four assessment points. Improvements were consistent and statistically significant across all domains ($p < 0.001$), with physical functioning, general health, and vitality showing the highest gains.

Fig. 1 illustrates the progressive improvement in general health and physical functioning scores across the four time points. Both indicators showed statistically significant increases from baseline to 12 months ($p < 0.001$), reflecting the sustained impact of nurse-led cardiac rehabilitation on patient-perceived outcomes.

Table 1
Baseline characteristics of study participants ($n = 181$).

Variable	Value
Age, mean ± SD (years)	61.2 ± 10.4
Women	48 (26.5 %)
Marital status	Married 138 (76.2 %); divorced 15 (8.3 %); single 26 (14.4 %); widow 2 (1.1 %)
Living with another person	167 (92.3 %)
Educational level	Primary 124 (68.5 %); secondary 45 (24.9 %); university 12 (6.6 %)
Diagnostic group	
Acute myocardial infarction (AMI)	85 (47.0 %)
Percutaneous coronary intervention (PCI)	58 (32.0 %)
Post–open-heart surgery (CABG/valve)	38 (21.0 %)
Hypertension	81 (44.8 %)
Diabetes	49 (27.1 %)
Symptoms of anxiety	33 (18.2 %)
Depression	17 (9.4 %)
Tobacco use	Current smoker 74 (40.8 %); former smoker 64 (35.4 %); never 43 (23.8 %)
Alcohol use	51 (28.2 %)
Overweight/obesity	92 (51.1 %)
Adherence to medication	178 (98.3 %)

Note. Data are presented as mean ± standard deviation or number (percentage). Percentages may not total 100 % due to rounding. Diagnostic groups refer to the index cardiac event at program entry.

3.3. Subgroup differences

- **Sex**: Women reported lower baseline HRQoL scores in nearly all domains. Although they achieved meaningful gains, their scores remained lower than those of men at all time points ($p < 0.05$ for vitality, general health, and mental health).
- **Educational level**: Patients with only primary education showed less improvement in role emotional and social functioning at 12 months ($p < 0.05$).
- **Baseline anxiety**: Patients with anxiety had lower HRQoL scores throughout the study but demonstrated the largest relative improvement in emotional domains between T1 and T2 ($p < 0.001$).

The differential response to CR observed in subgroups such as women, patients with low education, and those with baseline anxiety highlights the need for personalized nursing interventions. These findings align with prior evidence showing that gender, health literacy, and psychosocial vulnerability significantly influence both participation and perceived benefit in CR (Brown et al., 2017; Kachur et al., 2017). Nurses are uniquely positioned to tailor interventions, reinforce engagement, and address emotional or informational gaps that may otherwise hinder recovery.

3.4. Program adherence and follow-up

Completion of the entire CR program was associated with higher sustained HRQoL at 12 months. Follow-up retention was 94 % at discharge, 83 % at 6 months, and 76 % at 12 months. Patients who received ongoing nurse-led contact (telephone or in-person) showed better outcomes in vitality and social functioning.

Continuity of care extended beyond program discharge through structured follow-up led by the nursing team. Scheduled telephone contacts at 6 and 12 months enabled nurses to monitor adherence, reinforce self-care behaviors, and provide emotional reassurance. This sustained relationship fostered trust and accountability, contributing to maintenance of HRQoL gains over time. Such longitudinal nursing follow-up reflects best practices in person-centered secondary prevention (Buck & Riegel, 2011).

4. Discussion

This study provides evidence that a structured nurse-led cardiac rehabilitation (CR) program can produce sustained improvements in health-related quality of life (HRQoL) over a 12-month follow-up. In addition to improvements in physical domains such as functioning and vitality, patients reported meaningful gains in emotional and social well-being. Importantly, these benefits were maintained beyond the supervised phase of CR, highlighting the value of extended nursing contact after program completion.

Our findings are consistent with previous systematic reviews demonstrating that CR improves clinical outcomes and HRQoL in patients with coronary disease (Anderson et al., 2016). Similar to prior research, the largest gains were observed in physical functioning and vitality, domains strongly influenced by exercise training and lifestyle modification (Rumsfeld et al., 2013). However, our study extends this evidence by showing that structured nurse-led follow-up contributes to maintaining these improvements up to one year, even during the disruptive context of the COVID-19 pandemic.

Subgroup analyses revealed disparities in outcomes. Women, patients with lower education, and those reporting baseline anxiety experienced lower initial HRQoL scores and reduced overall gains, echoing findings from other cohorts (Brown et al., 2017; Norris et al., 2022; Supervía et al., 2017). These results reinforce the importance of tailoring interventions to vulnerable subgroups, addressing barriers related to gender, health literacy, and psychosocial vulnerability. Nurses are uniquely positioned to respond to these needs, combining clinical

Table 2
Mean SF-36 scores across four time points (n = 181).

Domain	Baseline (T1)	Discharge (T2)	6 months (T3)	12 months (T4)	*p* value
Physical functioning	72.7 (20.3)	79.2 (17.6)	82.7 (15.3)	79.0 (17.7)	<0.001
Role – physical	37.7 (40.6)	57.8 (44.0)	31.8 (29.0)	54.7 (43.4)	<0.001
Bodily pain	61.7 (25.1)	67.2 (24.4)	75.9 (20.3)	69.0 (25.1)	<0.001
General health	51.8 (30.9)	56.1 (19.8)	57.0 (20.7)	55.2 (20.4)	<0.001
Vitality	57.4 (23.1)	65.5 (24.0)	73.2 (21.5)	63.7 (22.6)	<0.001
Social functioning	74.5 (25.6)	79.5 (22.5)	82.9 (19.5)	81.9 (19.5)	<0.001
Role – emotional	70.3 (42.0)	77.1 (37.7)	59.3 (20.0)	75.1 (39.9)	<0.001
Mental health	69.9 (22.8)	77.1 (19.2)	82.9 (15.5)	76.2 (19.4)	<0.001

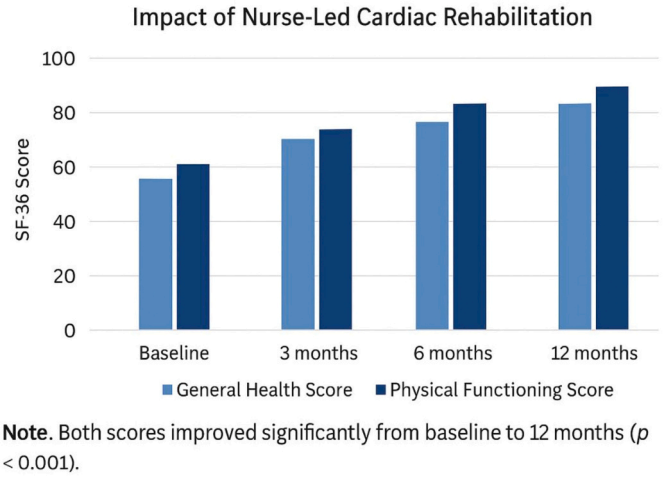

Fig. 1. Impact of nurse-led cardiac rehabilitation.
Note. Both scores improved significantly from baseline to 12 months ($p < 0.001$).

education with behavioral and emotional support.

The role of nursing follow-up is further underscored by the strong association between program adherence and long-term HRQoL outcomes. Previous studies have shown that continuous nurse-patient engagement enhances adherence, self-care, and emotional recovery (Buck & Riegel, 2011; Ghisi et al., 2020). In our study, structured telephone contacts and personalized education were critical in maintaining patient motivation and reinforcing healthy behaviors. These elements highlight the scalability of nurse-led longitudinal models in secondary prevention.

A notable contribution of this study is the explicit use of standardized nursing classifications—NANDA-I, NIC, and NOC—in documenting CR interventions. Few cardiac rehabilitation trials have reported nursing care using these taxonomies, which limits replication and recognition of nursing contributions in multidisciplinary settings. By framing interventions through standardized languages, our study adds conceptual clarity and supports the professional identity of nursing in cardiovascular care.

The strengths of this study include its longitudinal design, high retention rates despite pandemic-related constraints, and the integration of nursing taxonomies into program delivery. Nevertheless, several limitations must be acknowledged. The study was conducted in a single center, which may affect generalizability. The absence of a control group prevents causal inference, and some attrition occurred across the follow-up period. Moreover, the COVID-19 pandemic may have influenced both physical and emotional outcomes.

Future research should aim to replicate these findings in multicenter settings, including non-urban and underrepresented populations. Randomized controlled trials could further clarify the causal impact of NIC-guided interventions on HRQoL. Extending the follow-up period beyond one year and incorporating mixed-methods designs may also help capture the long-term psychosocial and experiential dimensions of recovery.

4.1. Implications for nursing practice

This study reinforces the strategic role of nurses in delivering, monitoring, and sustaining the impact of cardiac rehabilitation (CR) beyond its immediate completion. The structured use of standardized interventions, such as health education (NIC 5240), cardiac rehabilitation (NIC 5246), and emotional support (NIC 5270), allowed for consistent, person-centered care planning and follow-up throughout the recovery trajectory (Butcher et al., 2021).

These results align with broader evidence from Cochrane reviews indicating that structured, nurse-delivered educational and self-management interventions are effective in improving patient outcomes across chronic conditions. Embedding such interventions in routine nursing care strengthens the consistency, replicability, and long-term impact of rehabilitation programs (Coster et al., 2020).

Findings suggest that nurse-led programs not only improve adherence but also contribute to long-term quality-of-life gains in vulnerable subgroups. Monitoring patient-reported outcomes like HRQoL enables early detection of psychosocial barriers and supports timely, targeted nursing responses (Buck & Riegel, 2011; Rumsfeld et al., 2013). The greater adherence to medication compared to lifestyle change highlights the need for targeted educational efforts by nurses, who act as behavioral facilitators and health coaches beyond pharmacologic compliance.

Moreover, high adherence and follow-up rates observed in this cohort indicate the feasibility of nurse-led longitudinal models in clinical settings. Nurses are uniquely positioned to sustain motivation, reinforce self-care, and deliver equity-oriented care through structured, NIC-guided interventions (Ghisi et al., 2020; Norris et al., 2022).

Future programs should prioritize extended nursing contact after discharge and integrate HRQoL monitoring into standard cardiovascular nursing protocols to maximize long-term recovery and reduce disparities in outcomes.

Educational nursing interventions in this program extended beyond physical recovery. Patients received structured guidance on topics such as return to driving, resumption of sexual activity, and dietary adaptation, areas often overlooked in standard rehabilitation models but central to patients' daily lives post-discharge. These components, led by nurses, addressed frequently overlooked topics such as return to sexual activity and reintegration into work life, issues that commonly generate anxiety post-MI and are seldom included in standard protocols. By responding to these unmet informational and emotional needs, nurses reinforced patients' autonomy and confidence in lifestyle reintegration (Schopfer & Forman, 2016).

This study demonstrates not only the effectiveness of nurse-led CR in improving HRQoL, but also the value of documenting care using the Nursing Interventions Classification (NIC). Few cardiac rehabilitation programs explicitly frame nursing interventions in standardized taxonomies, limiting replication, interdisciplinary communication, and recognition of nursing contributions.

5. Conclusions

This study demonstrates that nurse-led cardiac rehabilitation (CR) contributes to sustained improvements in health-related quality of life (HRQoL) across physical, emotional, and social domains. Beyond exercise supervision, the program's success relied on structured health education and psychosocial support—areas where nurses provided essential, person-centered guidance on topics such as return to driving, sexual health, and dietary changes.

Longitudinal follow-up, including nurse-led phone contact at 6 and 12 months, proved effective in maintaining patient engagement and promoting adherence to self-care. This continuity of care reinforces the value of nursing-led models that extend beyond hospital discharge, fostering trust and long-term recovery.

The differential outcomes observed among women, individuals with low educational attainment, and patients with baseline anxiety highlight the need for personalized, equity-oriented nursing strategies. When guided by standardized classifications such as NIC and informed by HRQoL monitoring, nursing interventions can be adapted to the specific needs of vulnerable subgroups.

The 12-month follow-up with structured nursing contact, including psychosocial and behavioral reinforcement, is a rarely documented element in cardiac rehabilitation programs, especially in single-center, nurse-led settings. Incorporating sustained nursing follow-up and individualized education into routine secondary prevention may enhance the replicability and scalability of CR programs. These findings support the integration of structured nursing care as a central pillar in the design of cardiac rehabilitation pathways.

As nurse-led rehabilitation programs continue to evolve, incorporating standardized nursing languages such as NIC, NANDA-I, and NOC is essential to strengthen documentation, replicability, and the visibility of nursing contributions. Beyond clinical effectiveness, this linguistic and conceptual framework reaffirms the identity of nursing within interdisciplinary cardiovascular care. We believe it is time for cardiac rehabilitation units to adopt and speak the language of nursing—clearly, confidently, and institutionally.

CRediT authorship contribution statement

María José Ferreira Díaz: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethical approval

The study was approved by the Regional Research Ethics Committee of Santiago-Lugo (Spain). All procedures were conducted in accordance with the Declaration of Helsinki and complied with Law 14/2007 on biomedical research and other relevant Spanish and European regulations. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed. Data collection and management were carried out in a pseudonymized manner, in full compliance with Regulation (EU) 2016/679 on the protection of personal data (GDPR).

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Declaration of competing interest

The author declares no conflicts of interest.

Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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