

EMPIRICAL RESEARCH QUANTITATIVE OPEN ACCESS

# Mutuality and Self-Care in the Patient–Caregiver Dyads in the Context of Coronary Heart Disease: An Exploration of the Mediating Role of Self-Efficacy

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## ABSTRACT

**Aims:** To evaluate the effect of mutuality on self-care in people with CHD and the contribution of their caregivers, and whether such relationships can be mediated by self-efficacy.

**Design:** Secondary analysis of baseline data from a multi-centre longitudinal study.

**Methods:** Patients at the onset of coronary artery disease who underwent angioplasty, along with their caregivers, were included in the sample. Data from 136 patients and 136 caregivers were used for the analysis. Mutuality between patients and caregivers was measured using the Mutuality Scale. Self-care was measured using the Self-Care of Coronary Heart Disease Index and the Caregiver Contribution to Self-Care of Coronary Heart Disease Index. The actor–partner interdependence mediation models were used to assess the mediating role of self-efficacy for self-care between perceived mutuality and self-care behaviours.

**Results:** An actor indirect effect was found between patient mutuality and their self-care maintenance, self-care monitoring, and self-care management, through the mediation of their self-efficacy. Caregiver mutuality had a positive indirect effect on their contribution to self-care maintenance, self-care monitoring, and self-care management, through the mediation of their self-efficacy. Caregiver mutuality had a positive indirect effect on patient self-care maintenance and on patient self-care monitoring, through the mediation of patient self-efficacy. All models demonstrated satisfactory fit to the data.

**Conclusions:** Mutuality between patients and caregivers enhances self-care behaviours in patients with coronary heart disease, and self-efficacy is a crucial mediator in this relationship. Interventions targeting both mutuality and self-efficacy within patient–caregiver dyads may improve self-care outcomes.

**Reporting Method:** We adhered to STROBE guidelines.

The authors have checked to make sure that our submission conforms, as applicable, to the Journal's statistical guidelines described here.

There is a statistician on the author team; the author is Paolo Iovino.

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**Patient or Public Contribution:** Patients and members of the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

## 1 | Introduction

Cardiovascular diseases are the leading cause of death globally. The World Health Organisation estimated that 17.9 million people died from cardiovascular diseases in 2019 (World Health Organisation 2021). Among cardiovascular diseases, it is estimated that, in the United States, 20.1 million people have coronary heart disease (CHD). CHD is responsible for approximately one million myocardial infarctions each year, and approximately 14% of patients died as a result in 2019 (Tsao et al. 2022). CHD is also a major cause of morbidity throughout the developed world (DiNicolantonio et al. 2016).

People with CHD must follow recommendations regarding a diet low in saturated fats and processed foods, smoking cessation, and physical activity; they must adhere to therapies (DiNicolantonio et al. 2016). With an increasing number of people affected by CHD, the World Health Organisation supports greater attention to self-care as a global priority to improve population health at sustainable costs (World Health Organisation 2022).

## 2 | Background

Self-care is defined as a ‘process of maintaining health through health promotion and disease management practices’ (Riegel et al. 2012). People who adopt self-care behaviours in chronic disease have better health outcomes. Self-care reduces mortality, reduces hospitalizations and improves quality of life (Lee et al. 2022; Rad et al. 2021).

Self-care behaviours in CHD are described as those practices regarding nutrition, lifestyle, and therapeutic adherence (i.e., self-care maintenance), self-vigilance to detect signs and symptoms of the disease (i.e., self-care monitoring), and changes in diet and therapy, and actions of seeking healthcare when signs and symptoms exacerbate (i.e., self-care management) (Dickson et al. 2023).

Self-care is a complex activity and requires knowledge, skills, and motivation (Riegel et al. 2012). Factors such as age (Dawkes et al. 2016), number of illnesses and medications (Riegel et al. 2017), and level of education influence self-care (RobotSarpoooshi et al. 2020). Self-efficacy is considered a mediator for producing self-care behavioural changes (Tharek et al. 2018; Yu et al. 2021). Self-efficacy is defined as the self-perceived capability to carry out a target behaviour (Bandura et al. 1982) and is theorised to enhance task motivation and the intention to perform self-care behaviours (Bandura et al. 1982).

Informal caregivers play an important role in self-care (Bouchard et al. 2022; O’Conor et al. 2021). In chronic illness, self-care is increasingly viewed as a dyadic phenomenon, with the theory of dyadic illness management emphasising the shared responsibility between patients and caregivers (Lyons et al. 2015; Lyons and Lee 2018). Caregiver contribution to self-care has been studied

extensively in heart failure and has been defined as ‘the provision of time, effort, and support on behalf of another person who needs to perform heart failure self-care’ (Vellone et al. 2019). Several studies have analysed the caregiver contribution to self-care and examined how patient self-care influences caregiver contribution to self-care, and vice versa (Iovino et al. 2021; Zhao et al. 2022).

Mutuality has been defined by Archbold et al. (1990) as the positive relationship between an informal caregiver (e.g., family member, friend) and the care receiver (Archbold et al. 1990). Mutuality has four dimensions: affection and love, sharing values, sharing pleasant activities and reciprocity (Archbold et al. 1990). The presence of mutuality between caregiver and patient has been studied in various chronic diseases and has been found to be associated with positive outcomes both for the caregiver, as it reduces the perception of burden and stress (Hooker et al. 2018; Pan et al. 2017; Park and Schumacher 2014), and for the patient, resulting in an improvement in self-care (Hooker et al. 2018; Sterling et al. 2022; Vellone et al. 2018). Given the dyadic nature of mutuality, the effect of mutuality on self-care has been investigated in heart failure with the actor-partner interdependence model (Hooker et al. 2018; Uchmanowicz et al. 2022; Vellone et al. 2018); but to our knowledge, the association between mutuality and self-care in CHD and the mediating effect of self-efficacy in this association have not been investigated.

## 3 | The Study

### 3.1 | Aim

The aim of this study is to evaluate the effect of mutuality on self-care in people with CHD and the contribution of their caregivers, as well as whether such relationships can be mediated by self-efficacy.

## 4 | Methods

### 4.1 | Design

This study was conducted using the baseline data of the HEARTS-IN-DYADS, a multi-centre longitudinal study designed to investigate the self-care of patients affected by CHD and the caregiver contribution to self-care (Simonelli et al. 2023). We adhered to Strengthening the Reporting of Observational Studies in Epidemiology—STROBE guidelines (File S1).

### 4.2 | Study Setting and Sampling

Patients and their caregivers admitted to Italian hospitals for the onset of CHD and undergoing percutaneous transluminal coronary angioplasty (PTCA) during hospitalisation were enrolled in the HEARTS IN DYADS study. Sampling was conducted using a convenience approach. The initial sample comprised 457

## Summary

- Implications for the profession and/or patient care
  - These findings highlight the importance of assessing and supporting mutuality within patient–caregiver dyads as part of routine care for individuals with coronary heart disease.
  - Interventions aimed at strengthening the quality of the patient–caregiver relationship and enhancing self-efficacy may lead to improved self-care behaviours and better clinical outcomes.
  - Nurses and other healthcare professionals should consider implementing screening tools, such as the Mutuality Scale, to identify dyads who may benefit from targeted psychosocial support.
- Impact
  - Mutuality between patients and caregivers is a key indicator of relationship quality and is positively associated with better self-care behaviours in the context of coronary heart disease.
  - Self-care remains a crucial outcome during the trajectory of chronic illness and represents an important target for nursing interventions.
  - Mutuality has an actor effect on patient self-care and caregiver contribution to self-care; this relationship is mediated by self-efficacy, highlighting the importance of psychosocial mechanisms in dyadic disease management.
  - Caregiver mutuality has a significant positive effect on patient self-care, underscoring the need for interventions that target the dyad as a unit rather than the individual alone.
- Highlights
  - People who adopt self-care behaviours in chronic disease have better health outcomes.
  - Greater patient mutuality appears to be associated with improved self-care maintenance, monitoring, and management; this association is mediated by self-efficacy.
  - Patients who feel a good quality relationship with their caregivers tend to have high self-efficacy levels and engagement in self-care.

patients. Of these, only those who declared having an informal caregiver were considered eligible for this analysis. After applying this criterion, a total of 136 patient–caregiver dyads were included.

A priori sample size estimation was not conducted for this study, as it represents a secondary analysis of data collected within the HEARTS-IN-DYADS study. Accordingly, the analytic sample was determined by the number of eligible and consenting dyads available from the parent cohort.

## 4.3 | Inclusion and Exclusion Criteria

Inclusion criteria for patients were age over 18 years, ability to read and write in Italian, and cognitive integrity. Patients with major cardiovascular diseases such as congestive heart failure, cardiomyopathy, or unstable clinical conditions at the

time of study enrollment were excluded. Eligible caregivers were informal (unpaid) and recognised by the patient as the primary provider of informal care. Both patients and caregivers were informed about the study and provided written informed consent.

## 4.4 | Instruments

Among the variables measured in the HEARTS IN DYADS study, the following were included in the present study.

### 4.4.1 | Mutuality

Mutuality between patient and caregiver was measured using the Mutuality Scale (MS) (Archbold et al. 1990). This is an instrument available in two versions, one for the patient and one for the caregiver, and includes the dimensions of love and affection, shared pleasurable activities, shared values, and reciprocity. The MS is composed of 15 items, each formulated on a 5-point Likert-type scale (where 0 = not at all and 4 = a great deal). The total score of the scale ranges from 0 to 4, where higher scores indicate better mutuality in the dyad. The MS has been recently validated in a sample of patient and caregiver dyads in the context of CHD (Bassola et al. 2025). Reliability for both the patient and caregiver's versions was adequate, with a model-based internal consistency index of 0.95.

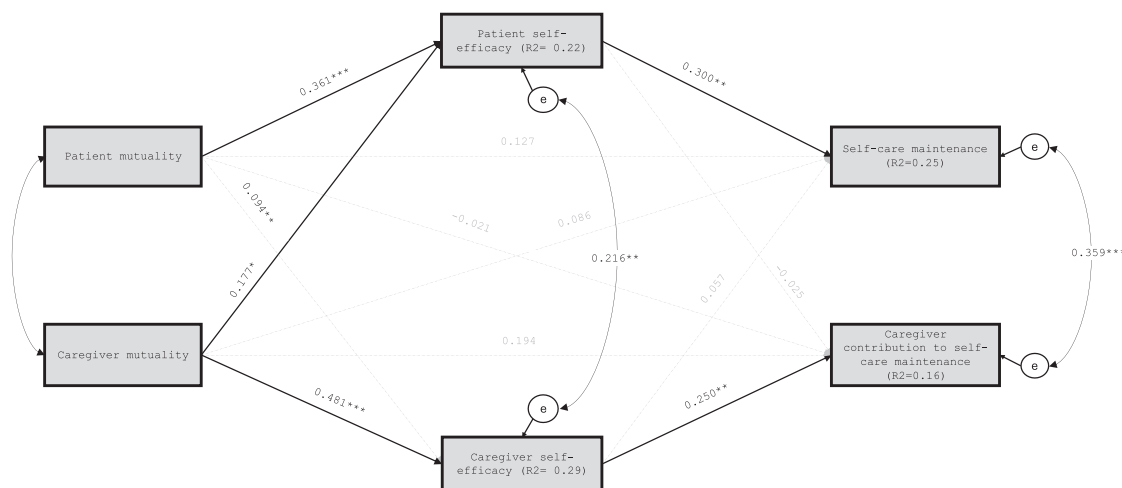
### 4.4.2 | Self-Care

Patient self-care and caregiver contribution to self-care were measured using the Self-Care of Coronary Heart Disease Index (Dickson et al. 2023) and Caregiver Contribution to Self-Care of Coronary Heart Disease Index (Bolgeo et al. 2024), respectively. The two instruments measure self-care and the contribution to self-care in the three dimensions of self-care maintenance, self-care monitoring, and self-care management. Both instruments have a standardised score ranging from 0 to 100 for each dimension, with higher scores indicating greater self-care. Both tools have been validated in an Italian sample of patients with CHD and caregivers (Bolgeo et al. 2024; Dickson et al. 2023).

Reliability estimates for the Self-Care of Coronary Heart Disease Index were  $\geq 0.80$  for all scales (Dickson et al. 2023). Reliability estimates for the Caregiver Contribution to Self-Care of Coronary Heart Disease Index were adequate for each scale (Cronbach's alpha ranging from 0.73 to 0.90) (Bolgeo et al. 2024).

### 4.4.3 | Self-Care Self-Efficacy

Self-efficacy was measured using the Self-Care Self-Efficacy Scale (SC-SES) (Yu et al. 2021) and the Caregiver Self-Efficacy in Contributing to Patient Self-Care (CSE-CSC) (De Maria et al. 2021). Both instruments include 10 items rated on a 5-point scale from 1 to 5, with a higher score indicating a higher level of self-efficacy. The instrument has a standardised score ranging



**FIGURE 1** | Actor-partner interdependence mediation model predicting self-care maintenance behaviours from mutuality and self-efficacy. Double-headed arrows entries are correlation coefficients. Single-headed arrows entries are standardised regression coefficients. Dotted lines indicate nonsignificant direct paths. Solid lines indicate statistically significant direct paths. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

from 0 to 100, with higher scores indicating greater self-efficacy. The SC-SES and the CSE-CSC showed adequate reliability in Italian samples with multiple chronic conditions (Cronbach's alpha coefficient was 0.92 and 0.94 respectively) (De Maria et al. 2021; Yu et al. 2021).

#### 4.4.4 | Sociodemographic and Clinical Questionnaire

A questionnaire developed ad hoc by the research team to collect sociodemographic data, including age, gender, marital status, education, type of relationship between patient and caregiver, caregiving time, and clinical data, including comorbidity and medications.

## 4.5 | Data Collection

Patients and caregivers were surveyed in five Italian hospitals. The data collectors were exclusively nurses trained for this purpose. After patients and caregivers who wanted to participate in the study were identified, potential participants were informed about the study and asked to sign the informed consent form. Data were collected in the cardiology department through face-to-face interviews, directly at the patients' bedsides and in designated rooms for the caregivers.

## 4.6 | Data Analysis

The actor-partner interdependence mediation models (APIMeMs) were conducted to assess the mediating role of self-care self-efficacy in the relationship between perceived mutuality and self-care behaviours. The APIMeM simultaneously tests whether one dyad member predictor (mutuality) could influence their own (actor effect) and their partner member (partner effect) outcomes (self-care) as well as the mediating effects which lie within this dyadic relationship (Figure 1). This approach is increasingly being adopted in the social and psychological sciences to test dyadic mediation

mechanisms—for example, in studies on financial toxicity and fear of cancer recurrence in patient-caregiver dyads (Li et al. 2024), and in relationship-focused mediation studies across health and interpersonal domains (Ymamgulyeva et al. 2024).

The APIMeM was specifically chosen over traditional approaches such as multiple regression or standard SEM because it accounts for the inherent interdependence within dyads, which standard models assume to be independent. By simultaneously estimating both actor and partner effects, the APIMeM provides a more accurate and nuanced understanding of how mutuality and self-efficacy operate within patient-caregiver relationships. This analytic strategy is particularly appropriate in the context of chronic illness, where self-care and mutuality are inherently reciprocal and dyadic phenomena (Kenny et al. 2006; Ledermann et al. 2011).

Before fitting the APIMeM, a series of preliminary analyses were performed. First, we performed data screening and cleaning and tested the model assumptions (i.e., normality, linearity and multicollinearity). Second, descriptive statistics were derived to describe the sample of patients and their caregivers, separately. Third, to determine the inclusion of confounding variables, we performed a series of bivariate correlational analyses between the measures which are known to be associated with self-care and self-efficacy in the literature. Fourth, we conducted Pearson's product moment correlation coefficients to test the nonindependence assumption of the dyad members across the main measures. Finally, we tested whether the dyad would be empirically distinguishable by comparing the saturated APIMeM model with a model in which the actor and partner effects, intercepts, and variances were constrained to be equal across the patient and caregiver measures.

Three final adjusted APIMeMs for each self-care subscale were finally specified. Common fit indices were used to judge the fit of the models: chi square ( $\chi^2$ ), root mean square error of approximation (RMSEA), comparative fit index (CFI),

**TABLE 1** | Sociodemographic and clinical characteristics of patients and their caregivers.

Characteristic	Patients ( <i>n</i> = 136)	Caregivers ( <i>n</i> = 136)
Age (years), mean (SD)	65.30 (11.11)	54.23 (13.73)
Gender (male), <i>n</i> (%)	102 (75)	95 (77.9)
Marital status (married), <i>n</i> (%)	93 (68.4)	95 (69.9)
Education, <i>n</i> (%)		
Elementary school	18 (13.2)	5 (3.7)
Middle school	40 (29.4)	30 (22.1)
High school	65 (47.8)	66 (48.5)
University degree	11 (8.1)	29 (21.3)
Post-university degree	2 (1.5)	6 (4.4)
Relationship with the patient, <i>n</i> (%)		
Partner	—	81 (59.6)
Son or daughter	—	34 (25)
Other	—	21 (15.5)
Live with patient (yes), <i>n</i> (%)	—	102 (75)
Caregiving hours declared (1–3 h), <i>n</i> (%)	—	87 (64)
Charlson Comorbidity Index, mean (SD)	1.64 (1.76)	—
Number of medications (0–5), <i>n</i> (%)	82 (60.4)	—

Abbreviations: *n*, sample size; SD, standard deviation.

Tucker–Lewis index (TLI), and standardised root mean square residual (SRMR). A satisfactory model is indicated by a RMSEA smaller than 0.06, a CFI and TLI above 0.90, and a SRMR below 0.06 (Hu and Bentler 1999). The bias-corrected 95% bootstrapped CIs based on 5000 replications were used to estimate the mediation effects. A *p*-value < 0.05 (two-tailed) was chosen to indicate statistically significant relationships. To assess the adequacy of the sample size for detecting indirect effects, we performed a post hoc power analysis for each mediation pathway using the standard formula for the Sobel test, as recommended by Fritz and MacKinnon (2007). The analysis was based on the observed standardised path coefficients, their standard errors, and the sample size. Statistical power was interpreted according to conventional thresholds (adequate:  $\geq 0.80$ ; moderate: 0.60–0.79; limited: < 0.60). The statistical software SPSS v.25 was used for descriptive and correlational statistics. MPLUS v.8.9 was used to specify the APIMeMs.

#### 4.7 | Ethical Considerations

Hearts and Dyads study received ethical approval from Institutional Review Boards of the coordinating centre (Protocol number: 0016832/20). The study was conducted in line with the general ethical standards and in accordance with the Helsinki principles (World Medical Association 2024). Participants were informed of the nature of the study and its purpose. Anonymity and the possibility of withdrawing from the study were also guaranteed at any time.

## 5 | Results

### 5.1 | Characteristics of the Sample

Table 1 presents the sociodemographic and clinical characteristics of the participants. In total, complete data from 136 patients and 136 caregivers were used for the analysis. Briefly, patients were on average 65.30 years old (SD = 11.11), were mostly male (75%), married (68.4%) and had attended high school (47.8%). 75% of them declared living with the caregiver. Caregivers were on average 54.23 years old (SD = 13.73), were mostly female (77.9%), married (69.9%), partners of the patients (59.6%), and 64% declared 1–3 h of caregiving care.

Table 2 presents the means, SD and range of the study variables. Self-care behaviours were all below the recommended cut-off for adequacy (< 70). Self-efficacy and mutuality levels were satisfactory. All the measures did not significantly differ across the dyad members. Normality and multicollinearity were not issues, as skewness and kurtosis values did not exceed |3|, and intercorrelations did not exceed |0.70|. According to the results of the bivariate correlations, we found that age, educational attainment and depression were associated with self-care; thus, these covariates were included as candidate confounders in the final models. Specifically, age was included as a continuous variable; educational attainment was dichotomized as > 9 years versus  $\leq 9$  years of education, in line with common epidemiological practice in Italy to distinguish individuals with at least some upper secondary education from those with lower educational levels; and depression was

**TABLE 2** | Descriptive statistics of mutuality, self-efficacy, and self-care behaviours in patients and their caregivers.

Variable	Patients (n = 136)			Caregivers (n = 136)			t	p
	Mean	SD	Range	Mean	SD	Range		
Self-care maintenance	63.32	21.38	2.78–100	60.42	25.78	0–100	1.302	0.195
Self-care monitoring	50.00	28.21	0–100	54.86	27.41	0–100	−1.862	0.065
Self-care management	63.61	23.43	0–100	59.80	24.87	0–100	1.591	0.114
Self-efficacy	72.10	22.10	2.50–100	71.08	24.34	0–100	0.454	0.651
Mutuality	3.23	0.71	0.80–4.00	3.19	0.77	0.67–4.00	0.589	0.557

Note: Higher scores on mutuality, self-efficacy, and self-care scales indicate greater levels of the respective construct. Abbreviations: M, mean; n, sample size; SD, standard deviation.

included as a continuous variable based on the Patient Health Questionnaire-9 total score. The tests of nonindependence of the dyad members confirmed this assumption because the Pearson's correlation coefficients between the main study variables all ranged between 0.32 and 0.49 and were statistically significant ( $p < 0.001$ ). Distinguishability of the dyad members was also confirmed empirically because the chi-square difference test indicated that the models with the parameters constrained to be equal across the dyad members fit significantly worse than the model allowing such parameters to be freely estimated (data not reported).

## 5.2 | Main Results

Table 3 reports the results of the APIMeMs. In Model 1 (Self-care Maintenance) we found that patient perceived mutuality had a positive indirect effect on their self-care maintenance through the mediation of their self-efficacy ( $\beta = 0.11$ , 95% CI: 0.035, 0.229). Caregivers' mutuality had a positive indirect effect on their contribution to self-care maintenance through the mediation of their self-efficacy ( $\beta = 0.12$ , 95% CI: 0.025, 0.267). In addition, caregiver mutuality had a positive indirect effect on patient self-care maintenance through the mediation of patient self-efficacy ( $\beta = 0.05$ , 95% CI: 0.007, 0.139) and a significant direct effect on patient self-efficacy ( $\beta = 0.12$ ,  $p = 0.044$ ) (see Figure 1).

In the second APIMeM model (Self-care Monitoring) we found that patient perceived mutuality had a positive indirect effect on their self-care monitoring through the mediation of their self-efficacy ( $\beta = 0.11$ , 95% CI: 0.035, 0.229). Caregiver mutuality had a positive indirect effect on their contribution to self-care through the mediation of their self-efficacy ( $\beta = 0.18$ , 95% CI: 0.075, 0.337). In addition, caregiver mutuality had a positive effect on patient self-care monitoring through the mediation of patient self-efficacy ( $\beta = 0.05$ , 95% CI: 0.001, 0.120) (see Figure 2).

In the third APIMeM model (Self-care Management) we found that patient perceived mutuality had a positive indirect effect on their self-care management through the mediation of their self-efficacy ( $\beta = 0.23$ , 95% CI: 0.110, 0.377). Caregiver mutuality had a positive indirect effect on their contribution to self-care through the mediation of their self-efficacy ( $\beta = 0.19$ , 95% CI: 0.088, 0.330) (see Figure 3).

As summarised in Table 4, all three APIMeM models demonstrated an overall good fit to the data. The chi-square tests were non-significant for all models, suggesting no substantial misfit. RMSEA values ranged from 0.031 to 0.055, with upper confidence limits below the conventional cutoff of 0.10. CFI values ranged from 0.953 to 0.984, and TLI values from 0.901 to 0.967, both well above the recommended threshold of 0.90. SRMR values were consistently low ( $\leq 0.057$ ), further indicating acceptable model fit across all three analyses.

## 5.3 | Power Analysis for Mediation Effects

For the mediation effect of patient mutuality on self-care maintenance via patient self-efficacy, the estimated statistical power was 0.68, based on standardised path coefficients of 0.374 (SE = 0.095) and 0.301 (SE = 0.097). For the analogous pathway with caregiver mutuality, power was 0.34. For self-care monitoring, the mediation effect of patient mutuality showed a power of 0.75 (coefficients: 0.285, SE = 0.081; 0.374, SE = 0.095), while the corresponding caregiver pathway had a power of 0.34. For self-care management, the mediation effect of patient mutuality yielded a power of 0.94 (coefficients: 0.614, SE = 0.078; 0.374, SE = 0.095).

For the mediation effect of caregiver mutuality on caregiver contribution to self-care, the estimated statistical power was 0.49 for maintenance (coefficients: 0.237, SE = 0.109; 0.484, SE = 0.097), 0.81 for monitoring (coefficients: 0.374, SE = 0.109; 0.484, SE = 0.097), and 0.90 for management (coefficients: 0.382, SE = 0.090; 0.484, SE = 0.097). These findings indicate adequate power to detect medium to large indirect effects, while the probability of detecting smaller effects was limited.

## 6 | Discussion

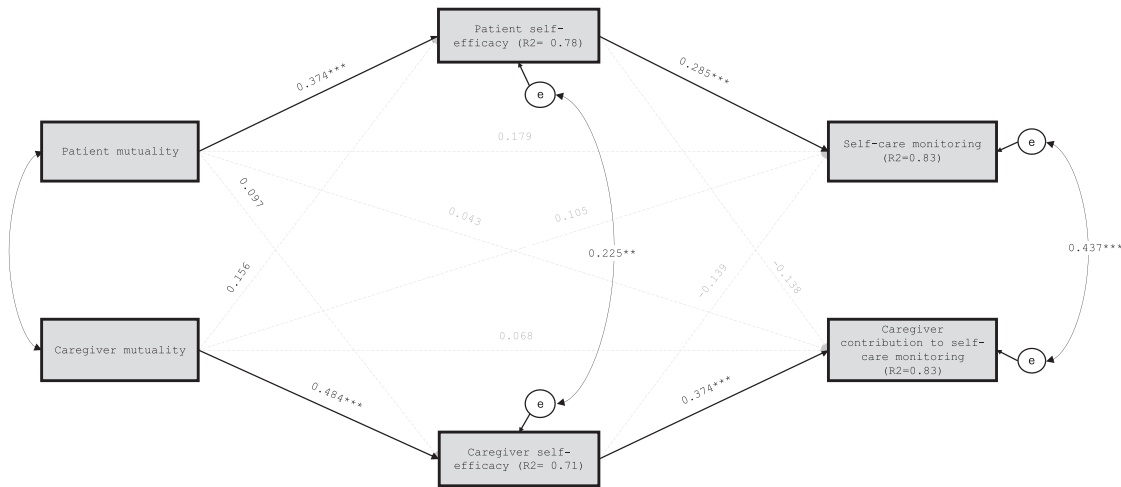
The aim of this study was to evaluate the association between mutuality and self-care in patients with CHD and the contribution of their caregivers and whether these relationships could be mediated by self-efficacy. To our knowledge, this is the first study to investigate such a relationship at the level of the dyad. In the context of chronic illness care, patients and their caregivers are widely studied as dyads. Indeed, the theory of dyadic management of chronic diseases suggests that

**TABLE 3** | Actor-partner interdependence mediation model results: Total, direct, and indirect effects of mutuality on self-care and caregiver contribution, mediated by self-efficacy.

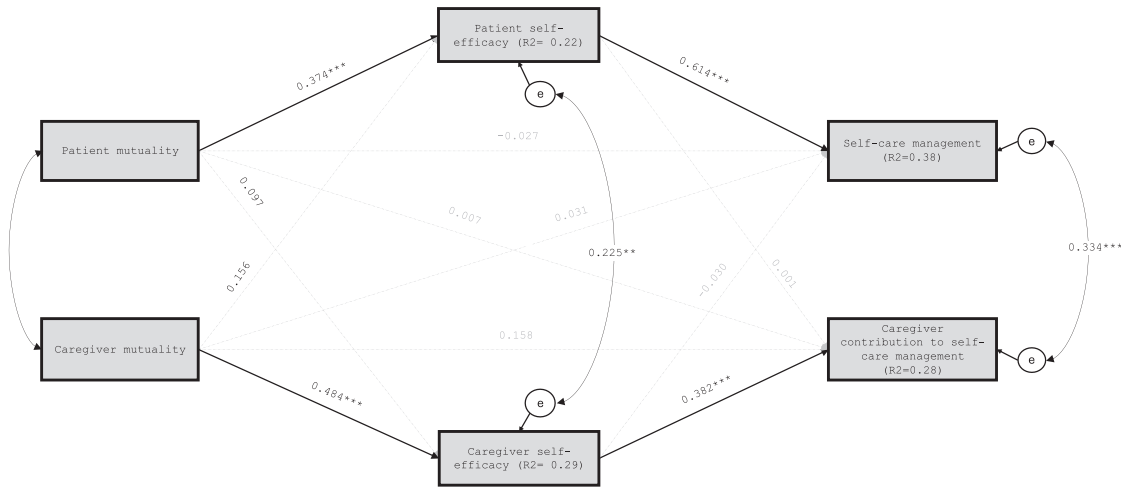
Effect	Model 1 – Self-care maintenance		Model 2 – Self-care monitoring		Model 3 – Self-care management	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Patient mutuality → patient self-care						
Total effect	<b>0.241</b>	<b>0.039, 0.439</b>	<b>0.272</b>	<b>0.099, 0.445</b>	0.200	−0.004, 0.386
Total indirect effect	<b>0.114</b>	<b>0.035, 0.229</b>	<b>0.093</b>	<b>0.020, 0.203</b>	<b>0.226</b>	<b>0.105, 0.377</b>
Patient mutuality → patient self-efficacy → patient self-care	<b>0.108</b>	<b>0.035, 0.229</b>	<b>0.106</b>	<b>0.042, 0.216</b>	<b>0.229</b>	<b>0.110, 0.377</b>
Patient mutuality → caregiver self-efficacy → patient self-care	0.005	−0.018, 0.067	−0.014	−0.089, 0.011	−0.003	−0.056, 0.018
Patient mutuality → self-care	0.127	−0.080, 0.332	0.179	−0.017, 0.359	−0.027	−0.187, 0.155
Caregiver mutuality → patient self-care						
Total effect	0.167	−0.055, 0.373	0.082	−0.125, 0.276	0.112	−0.065, 0.301
Total indirect effect	0.081	−0.051, 0.223	−0.023	−0.153, 0.088	0.081	−0.076, 0.241
Caregiver mutuality → patient self-efficacy → patient self-care	<b>0.053</b>	<b>0.007, 0.139</b>	<b>0.045</b>	<b>0.001, 0.120</b>	0.096	−0.008, 0.214
Caregiver mutuality → caregiver self-efficacy → patient self-care	0.028	−0.090, 0.146	−0.068	−0.191, 0.025	−0.015	−0.128, 0.086
Caregiver mutuality → patient self-care	0.086	−0.138, 0.297	0.105	−0.092, 0.289	0.031	−0.149, 0.193
Patient mutuality → caregiver contribution to self-care						
Total effect	−0.007	−0.178, 0.170	0.028	−0.156, 0.204	0.045	−0.136, 0.246
Total indirect effect	0.015	−0.077, 0.103	−0.015	−0.125, 0.084	0.037	−0.058, 0.134
Patient mutuality → patient self-efficacy → cc to self-care	−0.009	−0.096, 0.050	−0.052	−0.143, 0.006	0.000	−0.069, 0.054
Patient mutuality → caregiver self-efficacy → cc to self-care	0.024	−0.023, 0.100	0.036	−0.041, 0.124	0.037	−0.040, 0.125
Patient mutuality → cc to self-care	−0.021	−0.203, 0.161	0.043	−0.137, 0.221	0.007	−0.157, 0.173
Caregiver mutuality → cc to self-care						
Total effect	<b>0.310</b>	<b>0.108, 0.484</b>	<b>0.227</b>	<b>0.026, 0.420</b>	<b>0.343</b>	<b>0.135, 0.533</b>
Total indirect effect	<b>0.116</b>	<b>0.020, 0.251</b>	<b>0.160</b>	<b>0.052, 0.303</b>	<b>0.185</b>	<b>0.090, 0.320</b>
Caregiver mutuality → patient self-efficacy → cc to self-care	−0.004	−0.050, 0.027	−0.022	−0.073, 0.002	0.000	−0.028, 0.032
Caregiver mutuality → caregiver self-efficacy → cc to self-care	<b>0.120</b>	<b>0.025, 0.267</b>	<b>0.181</b>	<b>0.075, 0.337</b>	<b>0.185</b>	<b>0.088, 0.330</b>
Caregiver mutuality → cc to self-care	0.194	−0.021, 0.401	0.068	−0.128, 0.274	0.158	−0.026, 0.358

Note: Standardised coefficients are reported for all effects. Indirect effects represent mediation pathways through self-efficacy. Bootstrap standard errors and bias-corrected 95% confidence intervals are provided. Bold values indicate statistically significant indirect (mediated) effects (95% CI does not include zero). Patient and caregiver effects refer, respectively, to actor and partner influences within the dyad.

Abbreviations: APIMeM, actor-partner interdependence mediation model; *B*, standardised regression coefficient; CI, confidence interval; SE, standard error.



**FIGURE 2** | Actor-partner interdependence mediation model predicting self-care monitoring behaviours from mutuality and self-efficacy. Double-headed arrows entries are correlation coefficients. Single-headed arrows entries are standardised regression coefficients. Dotted lines indicate nonsignificant direct paths. Solid lines indicate statistically significant direct paths.



**FIGURE 3** | Actor-partner interdependence mediation model predicting self-care management behaviours from mutuality and self-efficacy. Double-headed arrows entries are correlation coefficients. Single-headed arrows entries are standardised regression coefficients. Dotted lines indicate nonsignificant direct paths. Solid lines indicate statistically significant direct paths.

the process of care is dyadic in nature and should be studied as such (Lyons and Lee 2018). Mutuality between patients and their caregivers is also a dyadic phenomenon, because a close relationship unfolds between the two members and can develop as they manage the patient’s health together as an interdependent team.

In our study, we found that greater patient mutuality was associated with better self-care maintenance, self-care monitoring, and self-care management; this relationship was fully mediated by self-efficacy. These results suggest that patients who perceive a high-quality relationship with their caregivers tend to have high self-efficacy levels and greater engagement in self-care. The perception of a quality relationship may provide greater family and social support and may give patients reasons or extrinsic motivation to engage in recommended self-care behaviours (Graven and Grant 2014; Hooker et al. 2018). Extrinsic motivation and support from others are strong factors influencing self-care (Riegel et al. 2012). It is worth noting

that we did not find a direct effect of mutuality on self-care, suggesting that these two constructs are linked by complex psychosocial dynamics, for which self-efficacy may not be the only contributor. Unfortunately, studies investigating the mediating role of self-efficacy in the mutuality-self-care relationship are currently not available. The most important studies in the field have certain limitations (Hooker et al. 2018; Vellone et al. 2018); for example, Vellone et al. (2018) studied 366 heart failure dyads and found that mutuality had several effects both on patient self-care and their caregiver contribution (Vellone et al. 2018). However, they did not investigate self-efficacy as a mediator in the models. Hooker et al. (2018) confirmed similar results on 99 heart failure dyads, and although the authors included the self-efficacy construct in the models, unfortunately mediation effects were not tested (Hooker et al. 2018).

We also found that better caregiver mutuality was associated with better self-care contribution in the dimensions of

**TABLE 4** | Model fit indices for the three actor–partner interdependence mediation models.

Fit index	Model 1 – Self-care maintenance	Model 2 – Self-care monitoring	Model 3 – Self-care management
Number of free parameters	28	28	28
Loglikelihood (H0)	–2399.745	–2445.394	–2386.611
Loglikelihood (H1)	–2389.565	–2432.743	–2374.537
AIC	4855.491	4946.788	4829.222
BIC	4937.045	5028.342	4910.777
Adjusted BIC	4848.468	4939.765	4822.200
Chi-square (df)	20.361 (18)	25.301 (18)	24.148 (18)
<i>p</i>	0.313	0.117	0.150
RMSEA (90% CI)	0.031 (0.000–0.085)	0.055 (0.000–0.100)	0.050 (0.000–0.097)
Pr(RMSEA ≤ 0.05)	0.657	0.400	0.457
CFI	0.984	0.953	0.968
TLI	0.967	0.901	0.933
SRMR	0.049	0.057	0.053

Note: Lower values of AIC, BIC, RMSEA, and SRMR and higher values of CFI and TLI indicate better model fit.

Abbreviations: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardised root mean square residual; TLI, Tucker–Lewis index.

self-care maintenance, self-care monitoring, and self-care management; this relationship was fully mediated by self-efficacy. In other words, those who perceive a better mutuality relationship tend to also perceive better self-efficacy, and this can influence their contribution to the patient's self-care. These results suggest that caregivers' dynamics work similarly to those of the patients at the onset of CHD and are consistent with previous studies on heart failure, where results revealed that mutuality mediated by self-efficacy influenced caregiver contribution to self-care maintenance and self-care management (Zhao et al. 2022).

Finally, we found that caregivers perceiving higher mutuality were more likely to improve patient self-efficacy, which in turn leads to better self-care maintenance and monitoring. This is consistent with a previous study on heart failure, where higher scores in caregivers' shared pleasurable activities directly predicted better self-care maintenance in patients, and higher scores in caregivers' reciprocity predicted higher patient self-care maintenance and management (Vellone et al. 2018). Another finding is that patient mutuality also influenced caregiver contribution to self-care (Vellone et al. 2018); in our study, this partner effect was not found. This seems to confirm what Hooker stated in their study on heart failure, namely that the way in which the caregiver perceives the quality of the relationship is more important for their self-efficacy than the way in which the patient perceives it (Hooker et al. 2018). Another hypothesis is that in the period following the onset of CHD, the caregiver is very focused on ensuring constant care for their loved one to avoid further serious complications. This may result in a relatively independent contribution from mutuality aspects, which may become of secondary importance in that life-threatening scenario.

## 7 | Implications for Policy and Practice

The findings of our study have meaningful clinical implications for the management of patients with CHD and their caregivers. Although the effect sizes observed in our models were modest, evidence from meta-analyses indicates that even small improvements in self-efficacy and self-care behaviours can produce significant benefits, such as fewer hospital readmissions and improved psychological and physical well-being (Brady et al. 2013; Caggianelli et al. 2022). This underscores the practical value of interventions that support incremental improvements in these areas, especially when implemented across large patient populations.

Interventions designed to enhance mutuality between patients and caregivers, as well as to strengthen self-efficacy, should be prioritised in clinical practice. While modifying the quality of the patient–caregiver relationship can be challenging, studies have shown that interventions focused on improving communication and fostering positive shared activities can enhance mutuality (Kunik et al. 2017; Vellone et al. 2018). Additionally, routine use of relationship quality screening tools, such as the Mutuality Scale, may help clinicians identify dyads at risk and provide targeted support to optimise self-care outcomes.

## 8 | Recommendations for Further Research

Our results strengthen the theory of dyadic disease management (Lyons and Lee 2018) and further advance the theories of self-care (Riegel et al. 2012) and caregiver contribution to self-care (Vellone et al. 2019). The quality of the caregiver–patient relationship improves self-care in the dyad in CHD, and the mediating effect of self-efficacy is crucial in disease management.

Further studies testing interventions aimed at enhancing mutuality and self-efficacy in this dyad are needed, with the goal of promoting better self-care.

## 9 | Limitations of the Work

This is a secondary analysis of data collected for another purpose, which has limited the selection of more targeted variables. The use of convenience sampling method further limits the generalisability of the findings. Additionally, although the sample was multicentric, all participants were recruited in a single country in southern Europe. The cultural context and intrinsic characteristics of the Italian population may have influenced the results. For example, in Italy, family members are commonly expected to play an active and ongoing role in caregiving, resulting in strong emotional bonds and frequent cohabitation between patients and caregivers. The Italian healthcare system also places significant emphasis on informal care, and patients often rely on their families rather than formal healthcare services for support with daily self-care activities (Gagliardi et al. 2022). These characteristics may result in higher levels of mutuality and caregiver involvement compared to countries where independent living or reliance on professional caregivers is more common.

It is also important to acknowledge that the cross-sectional nature of this secondary analysis precludes any inference of causality. The observed associations between mutuality, self-efficacy, and self-care should therefore be interpreted as correlational rather than causal. Furthermore, all main variables were assessed through self-report instruments, which may be subject to measurement bias, including social desirability and recall bias. The influence of these biases cannot be excluded and may have affected the accuracy of the findings.

Finally, unmeasured confounding may be present, as not all relevant variables (such as personality traits, cognitive status, or the quality of the healthcare environment) could be included in the analysis. The post-acute condition of the patients may have also influenced the emotions and experiences of both patients and caregivers, potentially affecting their responses, particularly regarding mutuality. Future research employing prospective designs and more comprehensive data collection is warranted to confirm and extend these findings.

## 10 | Conclusion

Mutuality between caregivers and patients improves self-care in CHD, and the mediating effect of self-efficacy is crucial in this relationship. Mutuality is a dyadic phenomenon, and targeting interventions aimed at mutuality within the dyad can have important effects on self-care and health.

### Author Contributions

Barbara Bassola: conceptualisation, data curation, formal analysis, resources, writing – original draft, writing – review and editing. Silvia Cilluffo: data curation, formal analysis, writing – original draft, writing – review and editing. Roberta Di Matteo: conceptualisation, data

curation, resources, project administration, writing – original draft, writing – review and editing. Tatiana Bolgeo: conceptualisation, data curation, resources, project administration, writing – review and editing. Niccolò Simonelli: conceptualisation, data curation, formal analysis, project administration, supervision, writing – review and editing. Alberto Dal Molin: data curation, resources, project administration, writing – review and editing. Laura Rasero: supervision, writing – review and editing. Ercole Vellone: conceptualisation, data curation, formal analysis, supervision, writing – review and editing. Maura Lusignani: conceptualisation, supervision, writing – review and editing. Paolo Iovino: conceptualisation, formal analysis, supervision, writing – original draft.

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### Ethics Statement

We confirm that all data used in the submitted manuscript were acquired legally in accordance with the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation, to the Convention on Biological Diversity. This study is a secondary analysis of data obtained in the Hearts in Dyads study, which received Ethics Committee approval.

### Conflicts of Interest

The authors declare no conflicts of interest.

### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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### Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** jocn70076-sup-0001-supinfo.docx.