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Psychometric Testing of the Mutuality Scale in Patients and Caregiver Dyads After the Onset of Coronary Heart Disease

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ABSTRACT

This study investigates the psychometric properties of the Mutuality Scale in a sample of patient-caregiver dyads following a recent episode of coronary heart disease. A cross-sectional analysis was conducted. Factorial validity was tested with confirmatory factory analysis. Internal consistency reliability was investigated with the model-based internal consistency reliability index. Pearson's correlation coefficient was used to test convergent validity between mutuality and other theoretical and empirical variables associated with it. We included 150 patient-caregiver dyads (patient: mean age 65 years, 77% males, 71% married; caregiver: mean age 54 years, 21% males, 71% married). The CFA testing the theoretical four-factors (love, shared pleasurable activities, shared values, and reciprocity) of mutuality demonstrated adequate fit to the data in both the patient and caregiver version of the scale. Reliability estimates were adequate for the whole scale (model-based internal consistency index = 0.95). Significant positive correlations were observed between mutuality and self-care behaviors, and caregiver preparedness, supporting convergent validity. The Mutuality Scale demonstrated satisfactory structural and convergent validity and reliability in patient-caregiver dyads after the onset of a coronary heart disease event.

1 | Introduction

With an estimated 17 million deaths annually, coronary heart disease (CHD) represents the third major cause of mortality worldwide (Timmis et al. 2022). In Europe 5.8 million new cases of CHD were diagnosed in 2019 (Timmis et al. 2022), and, according to the American Heart Association, in 2018 about 16.5 million people in USA had CHD, of which 55% were male (Benjamin et al. 2018).

Following a cardiac event, patients are expected to strictly perform self-care behaviors to avoid relapses and promote functional status (Rad et al. 2021). There is evidence that proper engagement in self-care activities leads to lower mortality and better quality of life in patients with CHD (Rad et al. 2021). However, these patients generally struggle to adhere to lifestyle recommendations (De Bacquer et al. 2022; Stewart et al. 2017).

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Caregivers play a fundamental role in the self-care process because these individuals can help facilitate the recovery and adjustment after an acute cardiac event (Randall et al. 2009). The involvement of the caregivers in the care of patients with CHD leads to better diet and medication adherence, and increased follow-up visits (Mosca et al. 2011). Conversely, the absence of a caregiver was found to be associated with poor patient engagement (Salari et al. 2018). The caregiving process can often be demanding because of the care of these patients (Golics et al. 2013); for instance, in a study by Subih et al. (Subih et al. 2020), moderate levels of caregiving burden were found. A recent systematic review in this population found a wide range of proportions experiencing significant distress (6%–67%) with more severe distress during the acute phase of the illness (Bouchard et al. 2022).

Recently, more attention has been paid to the study of the relationship quality between patient and caregiver to counteract the poor health outcomes of both members. The literature defines this relationship as mutuality (Archbold et al. 1990), which consists of four dimensions: love and affection, reciprocity, shared pleasurable activities, and shared values. In chronic illness, mutuality is associated with better outcomes for both members of the dyad (Hooker et al. 2018; Park and Schumacher 2014). In patients, mutuality leads to faster recovery processes (Park and Schumacher 2014), increased resilience (Gibbons et al. 2019) and improved self-care (Vellone et al. 2018). In caregivers, mutuality leads to lower burden (Park and Schumacher 2014), lower stress (Godwin et al. 2013), improvement in physical and mental health (Halm and Bakas 2007), increased preparedness for care (Archbold et al. 1990), and gratification of care (Shyu et al. 2010).

Mutuality is measured in patient-caregiver dyads with different instruments. Archbold et al. (Archbold et al. 1990) constructed the 15-item Mutuality Scale (MS) based on their conceptualization of mutuality in the dimensions of love, shared pleasurable activities, shared values, and reciprocity. The authors did not analyze the factor structure but only the internal consistency, resulting in a Cronbach's alpha of > 0.90 . Several studies examining the Mutuality Scale in different populations, did not uncover the same theoretical structure postulated by Archbold; Kao et al. (Kao et al. 2013) tested the MS in a caregiver sample of older individuals and extracted two factors, labeled as "interaction between caregiving dyads" and "respondent reaction," excluding five items. Karlstedt et al. (2017) tested the MS in a sample of patients with Parkinson's Disease and their caregivers. In patients, the authors extracted two factors, including all 15 items, classified as "agreement and interaction" and "attachment and support." In caregivers, they extracted two factors classified as "appreciation and support" and "attachment and affection," and three items were excluded (Karlstedt et al. 2017). These mixed psychometric results are most likely due to the different methods used for analyses; in the aforementioned studies, the factors were extracted using principal component analysis. Pucciarelli et al. (2016) and Dellafiore et al. (2018) tested the Mutuality Scale with a confirmatory factor analysis according to Archbold's theory (Dellafiore et al. 2018; Pucciarelli et al. 2016). Both the authors demonstrated satisfactory validity and reliability of the instrument in stroke and heart failure patients, respectively.

To our knowledge, the MS scale has never been validated in patients with coronary disease and their caregivers at the onset of the disease trajectory. The introduction of such an instrument in this population would offer the opportunity to study how the affective relations of both members of the dyad function at the onset of the disease and the beginning of the caregiving process. It is well known that the onset of an acute cardiac event is one of the most traumatic moments across the illness trajectory, which entails the reorganization of the family system, redistribution of responsibilities, and ultimately a series of emotional processes of dyadic coping (Brisini and Solomon 2020; Pauly et al. 2023). More research is needed to describe the relationship constructs and processes of the dyad in cardiac disease, and more research is needed at the start of the disease trajectory (Choi et al. 2021). Therefore, the aim of this study was to test the validity and reliability of the MS in sample of patient and caregiver dyads in the context of a CHD onset.

2 | Methods

2.1 | Study Design

We conducted a secondary analysis of data from the "Self-care in coronary heart disease patient and caregiver dyads (HEARTS-IN-DYADS)," a longitudinal, multicenter study designed to describe the self-care of people with CHD and the contribution of their caregivers to this self-care (Simonelli et al. 2023). For this secondary analysis, we used baseline data from the longitudinal study.

The parent study enrolled a convenience sample of 150 patients with CHD admitted to acute care units of five Italian hospital centers and 150 caregivers. Patients met the following criteria: be over 18 years old, have a confirmed diagnosis of coronary heart disease for less than 12 months, be proficient in Italian language, and be ready to provide their signature on the informed consent form. Exclusion criteria were presence of heart failure, cardiomyopathy, stroke, and severe cognitive impairment. Inclusion criteria for caregivers were being at least 18 years of age and being identified as the main person responsible for the patients' care.

2.2 | Instruments

In the HEARTS IN DYADS study, multiple tools were administered to CHD patients and caregivers; however, for this psychometric analysis, we collected data from the following instruments.

2.2.1 | Mutuality Scale

The Mutuality Scale (MS) comprises two instruments, one for the patient and one for the caregiver, both including 15 items. Possible answers are on a five-point Likert scale, ranging from "not at all" (0) to "very" (4). The total score is obtained by averaging the scores of each item and varies from 0 to 4, where higher scores correspond to greater mutuality (Dellafiore

et al. 2018; Karlstedt et al. 2017; Pucciarelli et al. 2016). The instrument was administered in Italian. The process of translating the MS from English to Italian was published in a previous study and involved translation of the instrument from English to Italian by two nurses with PhDs and expertise in medical English, followed by back-translation from Italian to English by a bilingual English-Italian teacher with PhDs and expertise in medical terminology, who had not seen the original version (Pucciarelli et al. 2016). The back-translated version of the MS was evaluated and approved by the developer of the scale (Dr. P. Archbold).

2.2.2 | Patient Health Questionnaire 9

The Patient Health Questionnaire 9 (PHQ9) is a 9-item instrument used to measure depression. Total score in the scale ranges from 0 to 27, where a score ≥ 10 denotes depressive symptoms. The PHQ-9 demonstrated satisfactory validity and reliability in different populations (Cronbach's alpha between 0.85 and 0.87) (Haddad et al. 2013; Urtasun et al. 2019). In this study, the PHQ-9 was used to test the convergent validity of the MS, under the hypothesis that individuals with higher mutuality exhibit lower depressive symptoms (Hooker et al. 2018). The Cronbach's alpha for this study was 0.83.

2.2.3 | Generalized Anxiety Disorder Scale 7

The Generalized Anxiety Disorder Scale-7 (GAD-7) is a 7-item instrument used to measure anxiety. Total score ranges from 0 to 21, with higher scores indicating higher anxiety severity. GAD-7 demonstrated good validity and reliability across different studies (Bolgeo et al. 2023; Byrd-Bredbenner et al. 2020; Sun et al. 2021). In this study, the GAD-7 was used to test the convergent validity of the MS, under the hypothesis that individuals with higher mutuality exhibit lower anxiety symptoms (Hooker et al. 2018). The Cronbach's alpha for this study was 0.90.

2.2.4 | Self-Care of Coronary Heart Disease Inventory

The Self-Care of Coronary Heart Disease Inventory (Dickson et al. 2023) is an instrument used to measure patient self-care in the three dimensions of self-care maintenance, monitoring, and management. The self-care maintenance scale includes nine items, the self-care monitoring scale includes seven items, and the self-care management scale includes five items. All the items are formulated on a 5-point Likert scale and the total scores per dimension are standardized 0–100, with higher scores corresponding to greater frequency of self-care behaviors. Satisfactory validity and reliability of this tool was recently demonstrated on a sample of patients with CHD (Dickson et al. 2023). In this study, the Self-Care of Coronary Heart Disease Inventory was used to test the convergent validity of the MS under the hypothesis that individuals with higher mutuality exhibit higher self-care (Hooker et al. 2018; Sterling et al. 2022; Vellone et al. 2018). The Cronbach's alpha for the self-care maintenance, monitoring, and management was 0.77, 0.92, and 0.77, respectively.

2.2.5 | Caregiver Preparedness

The Caregiver Preparedness Scale (CPS) is an 8-item instrument to measure the perceived preparation of caregivers to care (Archbold et al. 1990). Total score in this scale ranges from 0 to 32, with higher scores indicating a greater perception of being prepared for caregiving role. In this study, the CPS was used to assess the convergent validity of the MS, under the hypothesis that caregivers with higher mutuality exhibit higher preparedness (Archbold et al. 1990). The CPS demonstrated satisfactory validity and reliability in studies conducted across different populations, with Cronbach's alpha ranging from 0.72 to 0.94 (Henriksson et al. 2012; Pucciarelli et al. 2014). The Cronbach's alpha for this study was 0.92.

2.2.6 | Self-Report Questionnaire

A self-report questionnaire was developed ad hoc to collect data relating to the sociodemographic characteristics of patients and caregivers and clinical characteristics of patients.

2.3 | Data Collection

Data were collected by trained nurses at the respective enrolling centers. The training included both an explanation of all the tools to be administered and possible responses in case of any doubt expressed by the participants. Patients and caregivers completed the questionnaires separately. Participants (both patients and caregivers) were observed while completing the questionnaires and the administrator remained available in the room to answer any questions. The data were collected on paper and subsequently entered REDCap® platform version 12.2.6 (Harris et al. 2019).

2.4 | Sample Size

According to the rule of thumb of 10 individuals per each item, a sample size of at least 150 participants was deemed sufficient to test dimensionality and internal consistency (de Vet et al. 2011). To confirm the adequacy of the sample, we also conducted a post-hoc power analysis with a Monte Carlo simulation analysis with 5000 repetitions (Muthén and Muthén 2002). The following criteria were assessed to judge the performance of the model estimator: parameter biases (values less than 10% are supportive), estimation error biases (values less than 5% are supportive), and covariance coverage (values above 0.90 are supportive). We also reported the population RMSEA mean and its standard deviation. Values lower than those obtained by the CFAs are supportive (Muthén and Muthén 2002).

2.5 | Statistical Analysis

Descriptive statistics were used to analyze patient and caregiver sociodemographic and clinical characteristics. Specifically, we used means, standard deviations, frequencies, and percentages. The items of the patient and caregiver versions of the MS were analyzed with descriptive statistics and skewness and kurtosis

indices. The construct validity of the MS scale was investigated with confirmatory factor analysis (CFA) and hypothesis testing. The CFA was initially specified with a four-factor structure that reflects the dimensions of love, shared pleasurable activities, shared values, and reciprocity (Archbold et al. 1990). A second-order model was then tested to confirm the presence of a conceptualized overarching second-order factor. A robust estimator (MLMV) was used since the items were slightly skewed and kurtotic. The models were evaluated with the following fit indices: (a) χ^2 test, (b) comparative fit index (CFI): values greater than 0.90 are supportive of good fit, (c) Tucker and Lewis incremental Index (TLI): values greater than 0.90 are supportive of good fit, (d) root mean square error of approximation (RMSEA) with its 90% confidence intervals and test of close fit: values lower than 0.06 are indicative of good fit approximation, and (e) standardized root mean square residual (SRMR): values lower than 0.80 are indicative of good fit (Hu and Bentler 1999). Convergent validity was tested via hypothesis testing by correlating the total scores of the MS with the scores of the PHQ-9, GAD-7, Self-care of Coronary Heart Disease Inventory, and CPS. We used Cohen's recommendations to judge the effect size of the correlations (Cohen 2013). Briefly, correlation coefficients ranging from 0.1 to 0.3 represent a weak strength, and coefficients between 0.3 and 0.5 indicate a moderate strength. Finally, coefficients and higher than 0.5 indicate a large strength of relationship between the variables (Cohen 2013).

Internal consistency of the MS factors was computed with Cronbach's alpha and the model based internal consistency index (Bentler 2009). The first was used for each of the four latent factors, whereas the second was used to compute the reliability of the whole scale.

The analyses are presented separately for patients and caregivers. IBM SPSS® Statistics v.25 and MPLUS® 8.9 (Muthén and Muthén 2017) were used to conduct the analyses. A *p*-value lower than 0.05 was considered statistically significant.

2.6 | Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. The Institutional Review Board of each participating center approved the study. All patients and caregivers provided verbal and written informed consent before enrollment.

3 | Results

The Monte Carlo simulation showed that the analyses had a power of more than 90% to reject the null hypothesis that all the estimated parameters were zero. The population RMSEA value was 0.018 (SD = 0.017), which was less than the value of the original CFA models. Specifically, in more than 97% of the simulation replication values, the RMSEA did not exceed 0.05. Moreover, the covariance coverage was higher than 0.92 (range: 0.921–1.000), parameter biases were less than 10% (range: 5.1%–5.8%) and estimation error biases were less than 5% (range: 2.5%–4.9%) (Muthén and Muthén 2017).

3.1 | Characteristics of the Sample

Patients (*n* = 150) were 65.33 years old and predominately males (76.7%). About two thirds of them were married (71.3%) and 44.7% had a high school education. The caregivers (*n* = 150) had a mean age of 54.07 years and were predominantly women (78.7%). Over two thirds of them were married (70.7%) and 46.7% had a high school education. More than a half of them were the partners (61.3%) and lived with the patients (74.7%). Table 1 shows the sociodemographic characteristics of patients and caregivers.

3.2 | Characteristics of the Items of the Mutuality Scale

No excessive skewness and kurtosis were present for most items. The highest score of the patient scale was on the item 5 “How attached are you to him or her,” whereas the highest score on the caregiver version was item 8 “How much love do you feel for him or her.” Both patients and caregivers scored lowest on the item 11 “How often do the two of you laugh together.” Table 2 shows the means, standard deviations, skewness, and kurtosis of the Mutuality scale in its patient and caregiver version.

3.3 | Factorial Structure of the Mutuality Scale

3.3.1 | Patient Version

The initial model, which was specified with the four factors as per the theoretical framework of the mutuality construct, yielded adequate fit indices: χ^2 (84, *N* = 150) = 115.09, *p* = 0.014; RMSEA = 0.050 (90% confidence interval [CI] = [0.023, 0.071]; *p* (RMSEA < 0.05) = 0.49); CFI = 0.94; TLI = 0.92; SRMR = 0.054. All the factor loadings were greater than 0.50 and significant (Figure 1). An inspection of the correlation matrix indicated correlations between the factors > 0.80; accordingly, a second order CFA was also specified, which yielded the following fit indices: χ^2 (89, *N* = 150) = 125.02, *p* < 0.007; RMSEA = 0.052 (90% confidence interval [CI] = [0.028, 0.072]; *p*(RMSEA < 0.05) = 0.42); CFI = 0.92; TLI = 0.91; SRMR = 0.056. Figure 1 shows the results of the CFA for the patient version of the MS.

3.3.2 | Caregiver Version

The initial model, which was specified with the four factors as per the theoretical framework of the mutuality construct, yielded adequate fit indices: χ^2 (84, *N* = 150) = 114.50, *p* = 0.015; RMSEA = 0.049 (90% confidence interval [CI] = [0.023, 0.070]; *p* (RMSEA < 0.05) = 0.51); CFI = 0.95; TLI = 0.94; SRMR = 0.062. All the factor loadings were greater than 0.60 and significant (Figure 1). An inspection of the correlation matrix indicated correlations between the factors > 0.80; accordingly, a second order CFA was also specified, which yielded the following fit indices: χ^2 (86, *N* = 150) = 119.35, *p* < 0.01; RMSEA = 0.051 (90% confidence interval [CI] = [0.026, 0.072];

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

| | Patients (n = 150) | Caregivers (n = 150) |
|---|-------------------------------|---------------------------------|
| Age (years), mean, SD | 65.33 (11.04) | 54.07 (13.82) |
| Gender (male), n (%) | 115 (76.7) | 32 (21.3) |
| Marital status, n (%) | | |
| <i>Married</i> | 107 (71.3) | 106 (70.7) |
| <i>Widowed</i> | 17 (11.3) | 1 (0.7) |
| <i>Single</i> | 3 (2.0) | 22 (14.7) |
| <i>Divorced</i> | 5 (3.3) | 3 (2.9) |
| Education, n (%) | | |
| <i>No formal education</i> | 0 (0.00) | 0 (0.00) |
| <i>Elementary school</i> | 19 (12.7) | 6 (4.0) |
| <i>Middle school</i> | 50 (33.3) | 35 (23.3) |
| <i>High school</i> | 67 (44.7) | 70 (46.7) |
| <i>University degree</i> | 12 (8.0) | 34 (22.7) |
| <i>Post-university degree</i> | 2 (1.3) | 5n (3.3) |
| Relationship with the patient, n (%) | | |
| <i>Partner</i> | | 92 (61.3) |
| <i>Son or daughter</i> | | 39 (26.0) |
| <i>Friend</i> | | 1 (0.7) |
| <i>Health professional</i> | | 6 (4.0) |
| <i>Other</i> | | 12 (8.0) |
| Live with patient (yes), n (%) | | 112 (74.7) |
| Charlson Comorbidity Index | 1.64 (1.76) | |
| Number of medications, mean, SD | 5.30 (2.94) | |
| Pacemaker (yes), n (%) | 11 (7.3) | |
| Defibrillator (yes), n (%) | 5 (3.3) | |

Abbreviations: n, absolute number; SD, standard deviation.

p (RMSEA < 0.05) = 0.46; CFI = 0.95; TLI = 0.93; SRMR = 0.062. Figure 2 shows the results of the CFA for the caregiver version of the MS.

3.4 | Hypothesis Testing

Almost all patient and caregiver MS scores were significantly correlated with self-care behaviors, although the effect size estimates were weak. The scores of the caregiver MS were significantly correlated with the scores of their preparedness,

mostly with a moderate effect size. Neither the caregiver nor the patient version of the MS correlated significantly with the score of anxiety or depression. Table 3 reports the correlations between the total scores of both the patient and caregiver version of the MS, and the other variables linked to the mutuality construct.

3.5 | Internal Reliability and Item Analysis of the Mutuality Scale

Cronbach's alphas were satisfactory except for the factor "shared values," which showed an index of 0.53 for the patient version. The model-based internal consistency index for the whole scale was excellent for the two versions, supporting the use of a total score for the scale. Corrected item total correlations ranged from 0.49 to 0.68 for patients, and from 0.48 to 0.74 for caregivers. Table 4 shows the reliability indices of the first and second order factors of the MS.

4 | Discussion

The aim of this study was to psychometrically test the MS in a sample of newly diagnosed CHD patients and their caregivers. The analysis provided evidence of satisfactory validity and reliability of this instrument. To the best of our knowledge this is the first study to test the MS on CHD dyads, which fills an important gap because CHD, like other chronic conditions, requires from the early phases of the disease's trajectory constant and long-term self-care and support by caregiving. Exploration of the quality of the relationship within the dyad is necessary, given that this variable has constantly been linked to positive health outcomes in both members (Hooker et al. 2018; Magasi et al. 2019).

The distribution of answers highlights the characteristic of mutuality as a dyadic concept, with the highest scores in the dyad obtained for the same dimension (love and affection), and the lowest score obtained for the dimension "shared pleasurable activities" and item 11 "How often do the two of you laugh together." Like a previous study, this item obtained low scores (Cilluffo et al. 2021); laughter sharing might be difficult considering the stage of the disease. Further studies could evaluate whether the scores are higher in populations with more stable clinical conditions and not hospitalized.

Our theoretically driven approach, which implied specification of a CFA, confirms the original dimensions postulated by Archbold et al. (Archbold et al. 1990) in our sample of CHD patients and caregivers. This finding is important because it means that in the CHD context, a few days after acute coronary event, the dyad members are likely to recognize the dimensions of love, shared pleasurable activities, shared values, and reciprocity. Our findings can provide future conceptual frameworks of studies where predictors and outcomes of mutuality can be investigated during this disease onset.

Hypothesis testing demonstrated supportive convergent validity of the MS; in fact, the patient's and caregiver's MS factor scores

TABLE 2 | Descriptive analysis of the items of the Mutuality Scale.

| | Patients (n = 150) | | | Caregivers (n = 150) | | |
|--|--------------------|------|----------|----------------------|------|----------|
| | M | SD | Kurtosis | M | SD | Kurtosis |
| Item 1. How often do the two of you see eye to eye? | 3.17 | 0.81 | -0.62 | 2.99 | 0.95 | -0.60 |
| Item 2. How often do you feel physically close to him or her? | 3.47 | 0.73 | -1.20 | 3.49 | 0.75 | -1.37 |
| Item 3. How often do you enjoy sharing past experiences with him or her? | 3.21 | 0.87 | -0.92 | 3.15 | 0.92 | -0.79 |
| Item 4. How often does he or she express feelings of appreciation for you and the things you do? | 3.21 | 0.89 | -0.95 | 3.00 | 1.04 | -0.88 |
| Item 5. How attached are you to him or her? | 3.61 | 0.66 | -1.44 | 3.62 | 0.65 | -1.63 |
| Item 6. How often does he or she helps you? | 3.31 | 0.90 | -1.42 | 3.08 | 1.10 | -1.09 |
| Item 7. How often do you like to sit and talk to him or her? | 3.22 | 0.96 | -1.19 | 3.17 | 0.93 | -1.11 |
| Item 8. How much love do you feel for him or her? | 3.55 | 0.72 | -1.80 | 3.63 | 0.70 | -2.22 |
| Item 9. To what extent do the two of you share the same values? | 3.21 | 0.94 | -1.20 | 3.15 | 1.06 | -1.16 |
| Item 10. When you really need it, how much does he or she comfort you? | 3.31 | 0.91 | -1.19 | 3.09 | 1.06 | -0.88 |
| Item 11. How often do the two of you laugh together? | 2.97 | 0.99 | -0.81 | 2.89 | 1.14 | -0.76 |
| Item 12. How often do you confide in him or her? | 3.09 | 0.97 | -0.80 | 2.91 | 1.10 | -0.81 |
| Item 13. How much emotional support does he or she give to you? | 3.19 | 1.02 | -1.20 | 2.96 | 1.14 | -1.02 |
| Item 14. To what extent do you enjoy the time the two of you spend together? | 3.29 | 0.89 | -1.08 | 3.20 | 0.99 | -1.04 |
| Item 15. How often does he or she express feelings of warmth toward you? | 3.13 | 0.95 | -0.93 | 3.05 | 1.10 | -1.00 |

Abbreviations: M, mean; SD, standard deviation.

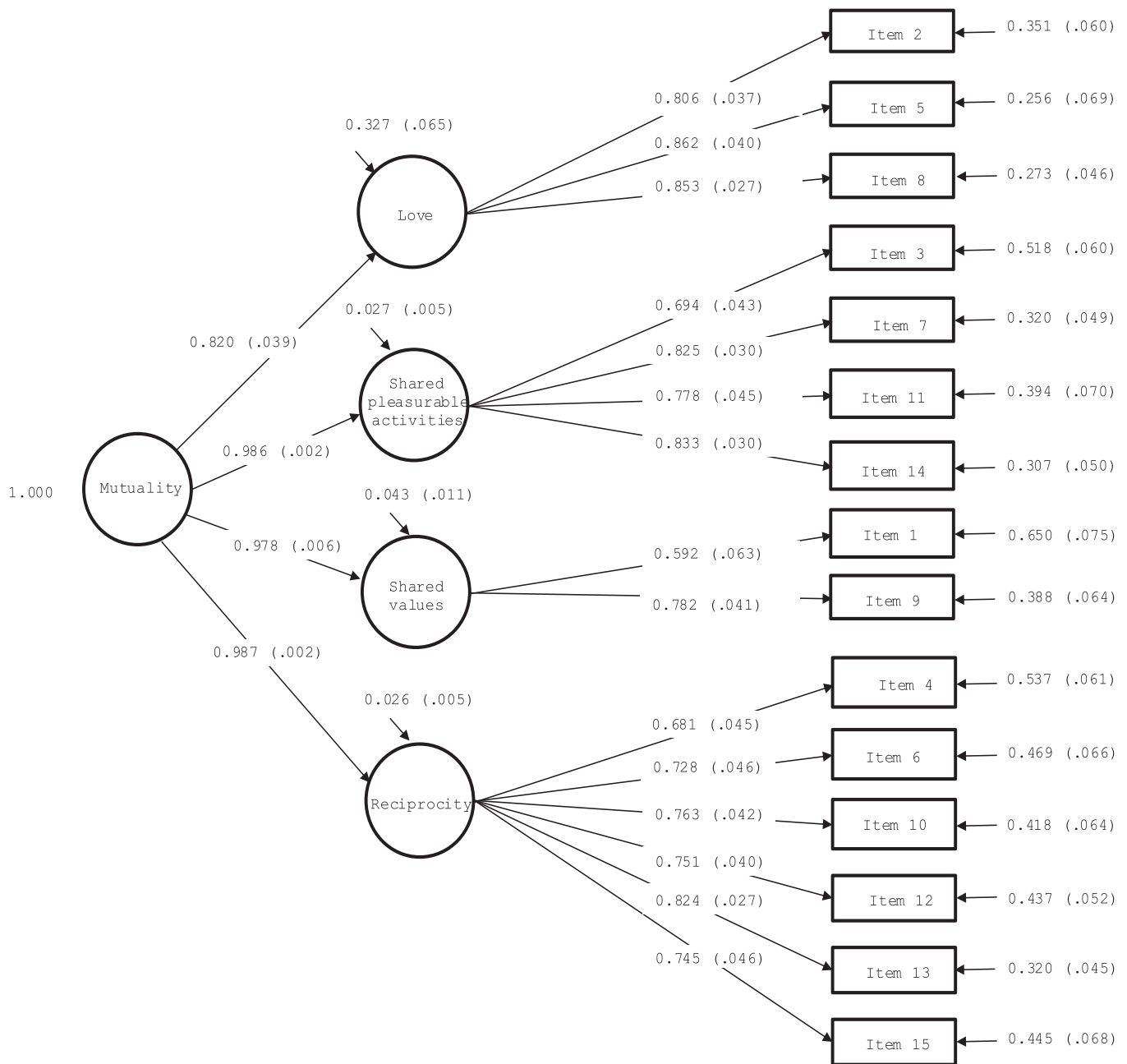


FIGURE 1 | Confirmatory factor analysis of the patient version of the Mutuality Scale.

and total score correlated significantly with self-care. These results confirm the literature relating to other populations, in which both an association between total mutuality score and self-care dimensions and an association between mutuality dimensions and self-care dimensions was demonstrated (Hooker et al. 2018; Sterling et al. 2022; Vellone et al. 2018). This is very important because it means that working on the relationship between the patient with CHD and the caregiver and increasing the level of mutuality in this dyad can have positive effects on the patient's self-care, and therefore promote positive health outcomes. These propositions can be tested in the future with clinical trials. The relationship between the patient with CHD and the caregiver is likely to be quite well-established. However, a previous study in a population with dementia showed that interventions aimed at behaviors included in mutuality such as increasing communication

between the patient and the caregiver, making daily activities more enjoyable, and increasing enjoyable activities with patients influence the quality of the relationship between patient and caregiver (Kunik et al. 2017). A study in heart failure also suggests behaviors to increase reciprocity and collaboration between patient and caregiver to increase mutuality (Vellone et al. 2018).

Caregiver's MS factor scores and total scores correlated significantly with their preparedness. This is consistent with the first studies on mutuality, where an association with preparation has been confirmed (Archbold et al. 1990). Family care is complex and mutuality when combined with good preparation works best in reducing negative outcomes for the caregiver (Magasi et al. 2019; Shyu et al. 2010; Sterling et al. 2022).

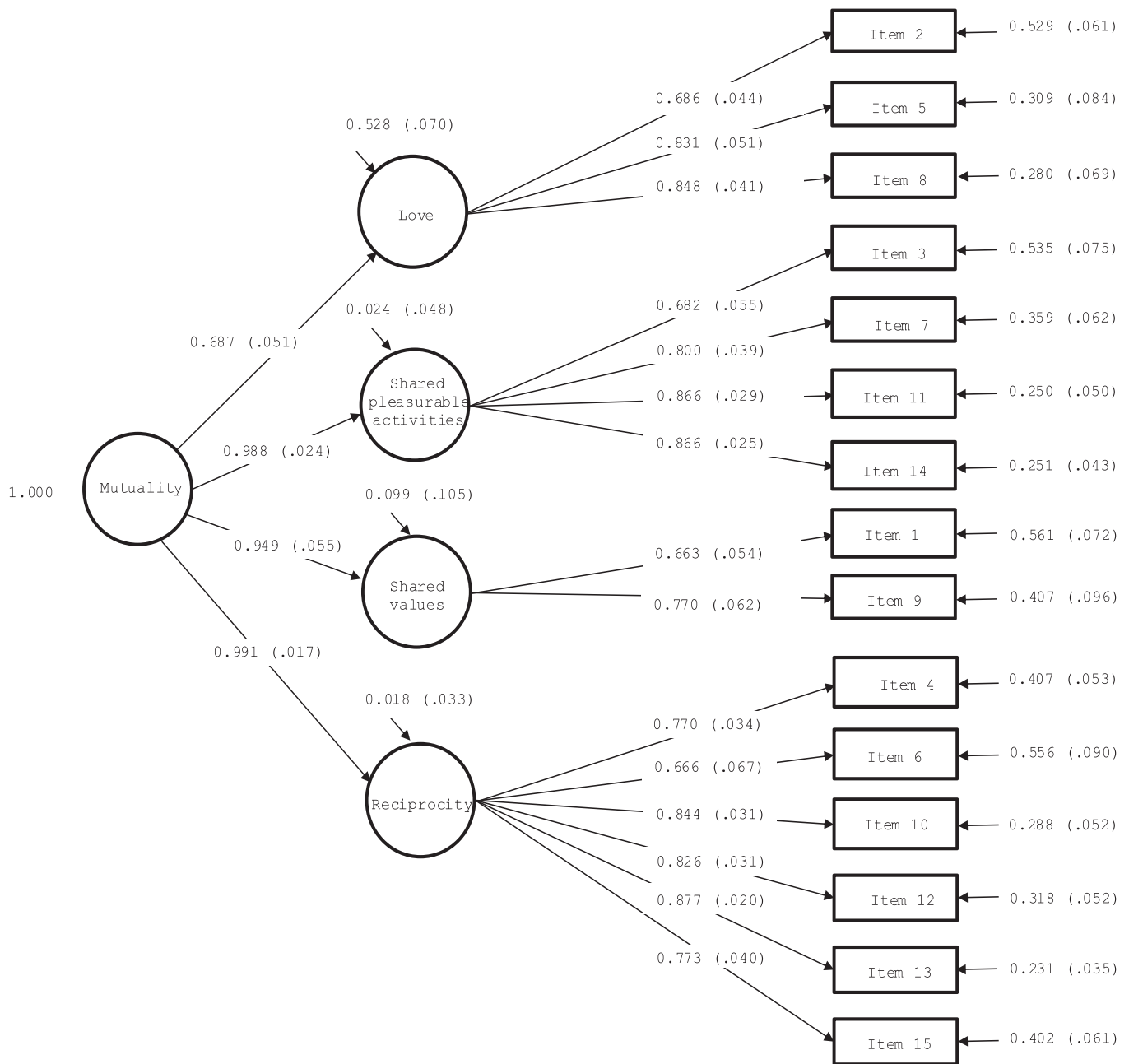


FIGURE 2 | Confirmatory factor analysis of the caregiver version of the Mutuality Scale.

In our sample, MS was not associated with depression and anxiety unlike in other populations (Dellafiore et al. 2018; Pucciarelli et al. 2016). Our sample consisted of patients with CHD admitted to acute care units. During a hospitalization, levels of stress, fear of dying and depression can change dramatically; patients and their caregivers can experience severe stress, anxiety, depression, and uncertainty about the future (Mosca et al. 2011; Randall et al. 2009). We believe the acute event may have led to repeated and sudden fluctuations of anxiety and depression in the dyad, but stable levels of mutuality, hence explaining the relative independence of this construct from psychological states. It would be interesting to study the association between mutuality and anxiety and depression when the disease is stable, in outpatient samples.

For reliability testing we tested each MS dimension with Cronbach's alpha, which led to satisfactory coefficients for all factors (> 0.70) except for "shared values," which in the patient showed an index of 0.53. The model-based internal consistency score for the entire scale was excellent for the two versions, supporting the use of a total score for the MS scale. Total correlations of corrected items were good for both the patient and caregiver version of the scale. These different approaches confirm the reliability of the tool in its total scores and single factors. Further studies will need to confirm the "shared value" dimension which has not demonstrated acceptable internal consistency. If dimensions are used individually, the results of this subscale should be carefully examined, and an analysis of the responses should be evaluated for possible bias. However,

TABLE 3 | Correlations with the scores of the Mutuality Scale patient and caregiver version.

| | GAD-7 | PHQ-9 | CPS | Self-care maintenance | Self-care monitoring | Self-care management |
|--------------------------------------|----------------|----------------|-------------------|-----------------------|----------------------|----------------------|
| MS patient version | | | | | | |
| <i>Love</i> | 0.108 (0.187) | -0.104 (0.207) | — | 0.201 (0.014) | 0.278 (0.001) | 0.209 (0.001) |
| <i>Shared pleasurable activities</i> | 0.046 (0.573) | -0.118 (0.152) | — | 0.189 (0.021) | 0.235 (0.004) | 0.221 (0.007) |
| <i>Shared values</i> | -0.050 (0.540) | -0.100 (0.226) | — | 0.159 (0.052) | 0.203 (0.013) | 0.177 (0.030) |
| <i>Reciprocity</i> | 0.018 (0.827) | -0.077 (0.347) | — | 0.228 (0.005) | 0.260 (0.001) | 0.236 (0.004) |
| <i>Total score</i> | 0.035 (0.673) | -0.103 (0.208) | — | 0.218 (0.007) | 0.267 (0.001) | 0.236 (0.004) |
| MS caregiver version | | | | | | |
| <i>Love</i> | 0.087 (0.288) | -0.038 (0.646) | 0.246 (0.002) | 0.240 (0.003) | 0.174 (0.033) | 0.155 (0.058) |
| <i>Shared pleasurable activities</i> | -0.035 (0.670) | -0.110 (0.181) | 0.479 (< 0.001) | 0.250 (0.002) | 0.192 (0.019) | 0.207 (0.011) |
| <i>Shared values</i> | -0.009 (0.914) | -0.092 (0.261) | 0.444 8 (< 0.001) | 0.185 (0.023) | 0.166 (0.042) | 0.125 (0.127) |
| <i>Reciprocity</i> | -0.022 (0.789) | -0.130 (0.114) | 0.536 (< 0.001) | 0.281 (< 0.001) | 0.249 (0.002) | 0.224 (0.006) |
| <i>Total score</i> | -0.009 (0.914) | -0.116 (0.158) | 0.510 (< 0.001) | 0.277 (0.001) | 0.231 (0.004) | 0.214 (0.008) |

Note: *p*-values are in brackets.

Abbreviations: CPS, Caregiver Preparedness Scale; GAD-7, Generalized Anxiety Disorder-7; MS, Mutuality Scale; PHQ-9, Patient Health Questionnaire-9.

TABLE 4 | Reliability indices of the Mutuality Scale in patients and caregivers.

| | Patients (<i>n</i> = 150) | Caregivers (<i>n</i> = 150) |
|--|-------------------------------|---------------------------------|
| Cronbach's alpha | | |
| <i>Love</i> | 0.73 | 0.82 |
| <i>Shared pleasurable activities</i> | 0.83 | 0.88 |
| <i>Shared values</i> | 0.53 | 0.67 |
| <i>Reciprocity</i> | 0.88 | 0.91 |
| Model-based internal consistency index | | |
| <i>Total scale</i> | 0.95 | 0.95 |
| Factor score determinacy index | | |
| <i>Total scale</i> | 0.97 | 0.97 |

the possibility of using the tool in its distinct dimensions has not yet been carried out in the literature, and it would be interesting to measure how the single dimensions unfold with respect to predictors and outcomes. This approach calls for future studies both in people with CHD and in other populations.

4.1 | Implications

Having a validated tool available in the setting of CHD patients and caregivers may have repercussions both in research and clinical practice. In research, it will be possible to design studies that measure mutuality in CHD both as a concept and as a variable influencing other constructs, such as self-care behaviors or the caregiver preparation.

In clinical practice, the MS tool can be incorporated into health records and used to measure the patient-caregiver relationship. Specific interventions can be planned in case of poor mutuality to avoid negative consequences on both the patient and caregiver (Bassola et al. 2021; Cilluffo et al. 2021). It can be difficult to increase the level of some aspects of mutuality in dyads, but recognition of situations with low levels of mutuality allows us to act to ensure better outcomes. For example, one strategy to indirectly promote love and affection could be educating the dyad members about the importance of engaging in pleasurable activities and showing appreciation for each other as they navigate the illness together.

4.2 | Limitations and Strengths

This study has some limitations. First, although the study was multicentric, recruitment was conducted in one European country; thus, the results may not be fully generalizable to other countries and cultures. Furthermore, we relied on a convenience sample with uneven sex distributions for both patients (mostly male) and caregivers (mostly female). It is possible that

the results might be different in a sample with different sex distributions. However, this demographic distribution reflects the population of patients in Italy with CHD and their caregivers.

It was not possible to assess stability of the MS over time because study instruments were administered at one point in time. Another limitation is inherent to the scale, which is the presence of a factor with only two items (i.e., shared values). This is against the general psychometric recommendations, which argue that there should be at least three items per factor, to cover an adequate content of the construct of interest and ensure stability of model estimations (Kline 2023). Despite this, we do not deem this issue of particular concern, because all the factors of the scale, including shared values, are theoretically derived.

5 | Conclusion

The presence of the caregivers alongside patients with coronary artery disease and their involvement in the care leads to better adherence to treatment plans and greater patient involvement. The quality of the relationship between the patient and the caregiver can determine positive outcomes. This study provides evidence that the MS has adequate structural and convergent validity and reliability in caregivers and in patients at the onset of a coronary heart disease. Hence, the MS has the potential to be a valuable instrument for assessing the quality of the relationship within CHD dyads.

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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