

EMPIRICAL RESEARCH QUANTITATIVE

Self-Care of Older Patients Affected by at Least Two Chronic Conditions Between Heart Failure, Diabetes Mellitus and Chronic Obstructive Pulmonary Disease: A Comparative Study

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ABSTRACT

Aims: This study aims to describe disease-specific self-care behaviours in patients with heart failure (HF), diabetes mellitus (DM) and chronic obstructive pulmonary disease (COPD) in various combinations; to compare these self-care behaviours within patient groups; and to evaluate differences across these groups.

Design: Cross-sectional study.

Methods: A total sample of 1079 older patients was recruited from outpatient clinics and home settings. Eligible patients were aged ≥ 65 years and had a diagnosis of HF and/or DM, and/or COPD, along with at least one additional chronic condition. Data were collected using validated tools: the Self-Care of Heart Failure Index, Self-Care of Diabetes Inventory and Self-Care of Chronic Obstructive Pulmonary Disease Inventory. Descriptive statistics were used to analyse disease-specific self-care behaviours. Group comparisons were performed using Student's t-test and univariate, followed by multivariate analyses of variance.

Results: The analysis focused on a subset of 223 patients who had a combination of at least two chronic conditions between HF, DM and/or COPD. The mean age of participants was 77.3 (SD 7.5) years, with a majority being female (53.4%). Self-care maintenance, monitoring and management for HF and COPD were found to be inadequate across all patient groups. Adequate self-care was only observed in DM management among those with HF and DM and in DM maintenance for those with DM and COPD treated with insulin. Significant differences in all self-care dimensions were observed across groups, particularly in patients managing all three conditions (HF, DM and COPD).

Conclusions: The findings provide valuable insights into the complexities of self-care in patients with multiple chronic conditions, underscoring the need for tailored, integrated and patient-centred interventions. Healthcare strategies should focus on enhancing patient education and developing personalised approaches to improve health outcomes and quality of life in this population.

Reporting Method: All the authors have adhered to the EQUATOR guidelines STROBE Statement.

Patient or Public Contribution: A convenience sample of patients was recruited in outpatient clinics and their homes. Data were collected between March 2017 and August 2022, by face-to-face during routine outpatient visits or directly at the patient's home.

1 | Introduction

Ageing is a global phenomenon and the proportion of people over 60-years old will double between 2015 and 2050 (World Health Organization 2023a). Nearly 95% of older adults have at least one chronic condition, while 80% have two or more (The National Council on Aging 2023). Chronic conditions defined as those non-communicable conditions with slow progression and long duration (Reynolds et al. 2018), cause every year 41 million deaths worldwide (World Health Organization 2023b). In older adults, the most frequent chronic conditions are heart failure (HF), diabetes mellitus (DM) and chronic obstructive pulmonary disease (COPD) (World Health Organization 2023c), with a prevalence of 57% (Sidney et al. 2019), 33% (Diabetes and Older Adults. Endocrine Society January 24 2022) and 14%, respectively (El Moselhy and Abdel Hay 2016). Often, two or more of them are present together, resulting in a state of multiple chronic conditions (MCCs) (Wang et al. 2017; Panuccio 2011; Vogeli et al. 2007). MCCs affects more than half of the older population worldwide (Hajat and Stein 2018; Marengoni et al. 2011). The prevalence of MCCs in older adults is 76,9% in the United States (Boersma 2020) and 37% in Europe (OECD, European Union n.d.), and it is expected to increase due to ageing populations (World Health Organization 2023a). MCCs represent a challenge worldwide due to its negative impact on health outcomes (Tisminetzky et al. 2017), such as decline in physical functioning, quality of life and survival (Aubert et al. 2022; Makovski et al. 2019; DuGoff et al. 2014). Effective management of MCCs requires complex strategies (Diederichs, Berger, and Bartels 2011; Tinetti and Basu 2014) as primary care (Wolff, Starfield, and Anderson 2002), person-centred measures (Tinetti and Basu 2014; Vermunt et al. 2017) and the implementation of self-care behaviours. This study focuses self-care ability on groups of patients with combinations of HF, DM and COPD, specifically on combinations of HF + DM, HF + COPD, DM + COPD and HF + DM + COPD.

2 | Background

Self-care is defined as the process of maintaining health through health-promoting practices and managing illness. It is crucial for older adults with MCCs as it helps manage complex health needs, reduces healthcare costs and improves quality of life by empowering individuals to take control of their health through behavioural strategies, medication adherence and lifestyle changes (Garnett et al. 2018). It comprises three dimensions: self-care maintenance, self-care monitoring and self-care management (Riegel, Jaarsma, and Strömberg 2012). Self-care maintenance comprehends all those activities to improve well-being, preserve health and maintain physical and emotional stability. Self-care monitoring is the process of vigilant body listening, and signs and

symptoms checking. Self-care management is the ability to recognise signs and symptoms and to manage health problems if they occur (Riegel, Jaarsma, and Strömberg 2012). These three dimensions of self-care are crucial for elderly patients, as they help detect and respond to health changes, ensuring continuous and effective management of chronic conditions (Riegel et al. 2021). Self-care was shown to be essential in single chronic conditions (Riegel, Jaarsma, and Strömberg 2012). In HF, higher self-care was associated with fewer access to emergency department, reduced hospitalisations and death (Jaarsma et al. 2021). In DM, higher self-care was associated with better glycaemic control and fewer diabetes complications (Shrivastava, Shrivastava, and Ramasamy 2013). In COPD, higher self-care was associated with an improvement of the quality of life and with a reduction of hospital re-admission (Khan et al. 2017). All together, these results suggest that self-care might be relevant to improve health outcomes also in MCCs.

Only a few studies considered self-care in MCCs. Socio-demographic and clinical determinants of self-care such as age, family income, number of medications (Ausili et al. 2016) and cognitive impairment (Keirns et al. 2023) were identified in patients with HF and DM but not in COPD. These patients were also shown to be particularly vulnerable to poor self-care (Dickson, Buck, and Riegel 2011, 2013), and lower self-care was associated with poorer glycaemic control (Aga et al. 2020). Also, it was explored the impact of integrated educational intervention on health outcomes (Cha et al. 2012; Dunbar et al. 2014, 2015) and healthcare cost (Reilly et al. 2015) in patients with HF and DM. No studies considered disease-specific self-care behaviours in patients that simultaneously were affected by HF and COPD or DM and COPD or by the three conditions together. Knowing how self-care works in MCCs could be useful for several reasons. First, it could help to understand which condition patients manage as a priority. Second, patients at risk of poor self-care in one or more coexisting conditions could be identified. Third, specific educational interventions could be developed to improve self-care in patients with MCCs. Finally, having this knowledge could be useful to enrich theoretical comprehension of self-care in MCCs.

3 | The Study

3.1 | Aims

The aim of this study was to analyse self-care behaviours in groups of patients with combination of chronic conditions, specifically heart failure, diabetes mellitus and chronic obstructive pulmonary disease. The study seeks to achieve the following objectives: (1) to describe HF self-care behaviours, DM self-care behaviours and COPD self-care behaviours in

Summary

- Implications for the profession and/or patient care
 - To raise awareness in healthcare professionals of self-care detection through specific instruments, and to address patient education, by developing of integrated, patient-centred and personalised interventions.
- What problem did the study address?
 - Previous studies have identified socio-demographic and clinical determinants of self-care in single conditions like heart failure and diabetes mellitus but have not extensively explored self-care in patients with coexisting heart failure, diabetes mellitus and chronic obstructive pulmonary disease.
- What were the main findings?
 - The findings reveal that patients with multiple chronic conditions tend to prioritise self-care behaviours for one condition over others, often leading to inadequate self-care for the less prioritised conditions
- Where and on whom will the research have an impact?
 - Since this is a first attempt to investigate how self-care works in multiple chronic conditions when two or more specific pathologies coexist, results of this research represent a starting point to orient towards even more specific themes in the investigation of self-care in multiple chronic conditions.
- What does this paper contribute to the wider global clinical community?
 - This study is the first to investigate disease-specific self-care behaviours in patients with coexisting heart failure, diabetes mellitus and chronic obstructive pulmonary disease, providing new insights into the complexities and inadequacies of self-care in multiple chronic conditions.
 - The findings reveal that patients with multiple chronic conditions tend to prioritise self-care behaviours for one condition over others, often leading to inadequate self-care for the less prioritised conditions.
 - The study highlights significant challenges in maintaining and monitoring self-care across different chronic conditions and suggests that the complexity of managing multiple conditions can overwhelm patients, affecting their overall self-care effectiveness.

groups of patients affected by HF and DM (HF + DM), HF and COPD (HF + COPD), DM and COPD (DM + COPD) or by all three conditions (HF + DM + COPD); (2) to compare HF, DM and COPD self-care behaviours within the same group of patients affected by the combinations of diseases seen in the previous point (e.g., to compare HF self-care behaviour with DM self-care behaviours in the group of patients with HF + DM); (3) to compare HF, DM and COPD self-care behaviours among groups of patients affect by different combination of diseases (seen at the point 1) with at least one in common (e.g., to compare HF self-care behaviours between groups of patients with HF + DM and HF + COPD).

4 | Methods

4.1 | Design

This study is part of a multi-centred longitudinal study aimed to describe generic and specific self-care in older patients with MCCs and their informal caregivers. The details of this study has been published elsewhere (De Maria et al. 2019). The present analysis focuses on baseline cross-sectional data, which have not been previously analysed for specific self-care behaviours. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were applied to outline our study (Vandenbroucke 2007) (Table S1).

4.2 | Study Setting and Sampling

A convenience sample of patients was recruited in outpatient clinics and their homes.

4.3 | Inclusion and Exclusion Criteria

Inclusion criteria were as follows: participants were required to be aged 65 years or older, and to have at least a combination of two chronic conditions between heart failure, diabetes mellitus (Type 2 only) and chronic obstructive pulmonary disease. Patients with cancer were excluded because of the specific medical and surgical treatments for cancer which have a dominant effect on health-related quality of life (Huang et al. 2017). Patients with dementia were also excluded because the presence of cognitive deficits could have made responses to self-reported questionnaires unreliable (Tourangeau, Rips, and Rasinski 2000). Participants were enrolled across outpatient and community settings.

4.4 | Data Collection

Data were collected between March 2017 and August 2022, during routine outpatient visits or directly at the patient's home. The questionnaires were filled out by the participants themselves, or with support from a research assistant if they had difficulty with vision or writing, either before or after the medical visit, depending on the participants' preference. Trained nurse research assistants identified potential participants, confirmed eligibility and exhaustively explained the purposes of the study before the consent were given. The data were collected before the pandemic, while others occurred after the most critical phases of COVID-19 had passed. The following three instruments were used to measure disease-specific self-care.

4.5 | Instruments With Validity and Reliability

The Self-Care of HF Index v. 6.2 (SCHFI) (Vellone et al. 2013) measures specific self-care behaviours of patients with HF. This 16-item instrument consists of two scales: self-care maintenance (10 items) (e.g., engage in 30-min daily exercise sessions) and self-care management (6 items) (e.g., reduce fluid intake). In this version of the SCHFI, the pair of items measuring self-care monitoring

behaviours (i.e., monitoring weight daily and checking ankle for swelling) are incorporated within the self-care maintenance scale (Vellone et al. 2013). In the SCHFI version 7.2, these two items were relocated into the self-care monitoring scale. Therefore, in this study, these two items were separately scored to maintain a consistent self-care monitoring metric in line with the other self-care measures employed. The Self-Care Confidence scale, which is part of SCHFI v.6.2, was not utilised in this study. Psychometric properties of the SCHFI v.6.2 were evaluated among Italian HF patients (Vellone et al. 2013). SCHFI showed good validity in confirmatory factor analysis (CFA) (Comparative Fit Indices, CFIs, ranging from 0.92 to 0.99 across the three scales) and good reliability (reliability coefficients ranging from 0.74 to 0.90 across the three scales) (Vellone et al. 2013).

The Self-Care of Diabetes Inventory (SCODI) (Ausili et al. 2017; De Maria et al. 2022) was used to measure specific self-care behaviours of patients with DM. This instrument is composed of 29 items grouped in the three scales: self-care maintenance (12 items) (e.g., eat a balance diet of carbohydrates), self-care monitoring (8 items) (e.g., keep a record of blood sugar in a diary or notebook) and self-care management (9 items) (e.g., check blood sugar when experience symptoms). Patients taking insulin answer an additional question regarding adjusting insulin dosage in case of hyperglycaemia or hypoglycaemia ('If you discover that your blood sugar is too high or too low, do you adjust your insulin dosage as instructed by your healthcare provider?'). The SCODI showed good validity and reliability properties on Italian DM patients. Specifically, it demonstrated a good construct validity in CFA, with CFIs ranging from 0.94 to 0.99, and supportive reliability (reliability coefficients ranged from 0.83 to 1.00) (De Maria et al. 2022).

The Self-Care of Chronic Obstructive Pulmonary Disease Inventory (SC-COPDI) (Matarese et al. 2020) v. 2.0 was used to measure specific self-care behaviours related to COPD. It comprises 32 items organised into three scales: self-care maintenance (13 items) (e.g., maintaining lung clearance through coughing or deep breathing when necessary), self-care monitoring (8 items) (e.g., monitoring for increased coughing) and self-care management (10 items) (e.g., consulting a healthcare provider if experiencing breathlessness). Among Italian COPD patients, the instrument demonstrated robust construct validity in CFA, with CFIs ranging from 0.95 to 0.99 across the three scales, and good reliability (global reliability indices for multidimensional scales) ranging from 0.78 to 0.92 across the three scales (Matarese et al. 2020).

All three self-care instruments use a 5-point Likert scale ranging from 1 (never) to 5 (always) for self-care maintenance and monitoring scale, and from 1 (not likely) to 5 (very likely) for the self-care management scale.

Patients without symptoms did not complete the self-care management scales, except for the SCODI, because the inventory allowed it. Across all these instruments, the scale scores were standardised on a scale of 0–100, where higher scores indicate better self-care. A score ≥ 70 is deemed satisfactory self-care in all assessments (Riegel et al. 2009).

Socio-demographic data were collected using an *ad hoc* questionnaire including sex, age, education (in years: 0–8, 9–13 and > 13), marital status (married or single), employment status

(unemployed or employed), perceived income (less than needed, enough for living or more than needed), number of chronic conditions, years from diagnosis and measure of disease's severity (i.e., New York Heart Association Class-NYHA for HF, glycated haemoglobin for DM, Modified British Medical Research Council Questionnaire-mMRC and Global Initiative for Chronic Obstructive Lung Disease-GOLD for COPD).

4.6 | Data Analysis

First, to describe socio-demographic and clinical data of the sample, descriptive statistics (frequencies, percentages, means, standard deviations [SD] and medians as appropriated) were used. We checked the data for univariate and multivariate outliers, normality, multicollinearity between the outcome variables, homogeneity of regression slopes and variance/covariance matrices.

Second, to describe disease-specific self-care measures in HF, DM and COPD means and SDs were computed.

Third, we compared the SCHFI, SCODI and SC-COPDI scores within the groups of patients with HF+DM, HF+COPD, DM+COPD and HF+DM+COPD using the Student's *t*-test and the repeated measures ANOVA test with post hoc Tukey. All assumptions for both paired sample *t*-test and repeated measures ANOVA were satisfied.

Fourth, to compare HF self-care, DM self-care and COPD self-care measures among the groups of patients with HF+DM, HF+COPD, DM+COPD and HF+DM+COPD (i.e., DM+HF vs. DM+COPD and DM+HF+COPD), the multivariate analysis of variance (MANOVA) was tested. Specifically, three MANOVAs were tested one for each chronic condition (HF, DM and COPD). The choice of MANOVA stemmed from its capability to enhance the probability of identifying group disparities by accounting for the interconnections among outcome variables while simultaneously managing type I error (Warne 2014). Furthermore, a robust theoretical foundation for encompassing all outcome variables in the analysis exist, as they collectively gauge self-care behaviours (Riegel, Jaarsma, and Strömberg 2012).

The data were analysed with SPSS Version 27.0 (IBM Corp.); a $p < 0.05$ was considered to indicate statistical significance.

4.7 | Ethical Consideration

Approval from the Research Ethical Committee was received for the main study (Protocol number: ComET ASReM 2017/138), and written informed consent was obtained from all participants.

5 | Results

5.1 | Sample Characteristics

Socio-demographic and clinical characteristics of participants are shown in Table 1. The initial total sample consisted of 1079 patients diagnosed with at least one chronic condition

TABLE 1 | Socio-demographical and clinical characteristics of participants ($n = 1079$ patients with MCCs).

	M (\pm SD) range
Age (years)	77.29 (7.52) 65–101
	N (%)
Sex	
Female	576 (53.38)
Male	503 (46.63)
Education level (years)	
0–8	858 (72.52)
9–13	214 (19.83)
> 13	34 (3.15)
Marital status	
Married	652 (60.43)
Single	427 (39.57)
Employment status	
Unemployed	1060 (98.24)
Employed	19 (1.76)
Perceived income	
Less than needed	43 (3.99)
Enough for living	862 (79.89)
More than needed	174 (16.13)
Chronic conditions	
HF + DM + other	123 (11.40)
HF + COPD + other	50 (4.63)
DM + COPD + other	27 (2.50)
DM + COPD + HF + other	23 (2.13)
DM severity	
Without complications	540 (75.00)
With complications	180 (25.00)
Minor complications	152 (84.45)
Major complications	28 (15.55)
HF severity (Class NYHA)	
1	85 (19.54)
2	218 (50.22)
3	113 (25.98)
4	18 (4.25)
COPD severity (mMRC)	
0	20 (11.76)
1	48 (28.24)

(Continues)

TABLE 1 | (Continued)

2	42 (23.71)
3	37 (20.76)
4	23 (12.53)
COPD severity (GOLD)	
1	72 (44.17)
2	67 (41.10)
3	18 (11.05)
4	6 (3.68)
	M (\pm SD) median; range
Number of chronic conditions	3.19 (1.30) 3.00; 2–9

Abbreviations: COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; GOLD, global initiative for chronic obstructive lung disease; HF, heart failure; M, mean; mMRC, modified british medical research council; N, sample number; NYHA, New York Heart Association; SD, standard deviation.

between HF, DM or COPD, along with at least one other comorbidity. However, for this study, we focused on a more specific subset of 223 patients who had a combination of at least two of the three chronic conditions mentioned between HF, DM and COPD (Figure S1). In brief, participant whole group mean age was 77.3 (SD 7.5) and most of them were females (53.4%), with low education level (72.5%), and perceived their income to be adequate (79.9%). Patients were affected on average by 3.2 (SD 1.30) chronic conditions where the majority of patients was affected simultaneously by HF and DM (11.4%), followed by HF and COPD (4.6%). Among patients with HF, 50% reported NYHA class II, while 25% reported class III. Additionally, 75% of patients with DM did not report DM-related complications.

5.2 | Disease-Specific Self-Care in Patients Affected by MCCs

Disease-specific self-care of patients affected by MCCs is described in Table 2. Results showed that HF self-care maintenance, monitoring and management were on average inadequate (score < 70) in all groups of patients [respectively, HF + DM: 57.7 (SD 16.9), 58.1 (SD 24.9), 61.1 (SD 18.3); HF + COPD: 54.9 (SD 18.7), 50.3 (SD 25.5), 52.5 (SD 22.8); HF + DM + COPD: 49.7 (SD 21.4), 49.3 (SD 16.3) and 30.3 (SD 19.8)] (Figure S2).

Regarding DM, self-care maintenance was inadequate in patients with DM + COPD [69.1 (SD 13.6)] and DM + HF + COPD [63.6 (SD 20.6)]. DM self-care monitoring was inadequate in all groups [HF + DM: 66.9 (SD 18.4); DM + COPD: 62.1 (SD 18.8); HF + DM + COPD: 59.6 (SD 20.6)]. For those in insulin treatment, DM self-care management was inadequate in patients with DM + HF (65.6, SD 15.5), DM + HF + COPD (65.4, SD 23.6) and adequate in patients with DM + COPD. For those not in insulin treatment, DM self-care management was inadequate in all groups [DM + HF: 65.2 (SD 19.7), DM + COPD: 57.0 (SD 21.3), DM + HF + COPD: 55.2 (SD 27.2)] (Figure S3).

TABLE 2 | Disease-specific self-care behaviours in patients affected by MCCs.

	HF + DM <i>N</i> = 123 (11.40%)	HF + COPD <i>N</i> = 50 (4.63%)	HF + DM + COPD <i>N</i> = 23 (2.13%)
	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>
HF self-care maintenance	57.74 (16.91)	54.93 (18.73)	49.67 (21.42)
HF self-care monitoring	58.17 (24.91)	50.31 (25.52)	49.26 (16.26)
HF self-care management	61.08 (18.34) <i>n</i> = 60	52.50 (22.84) <i>n</i> = 24	30.33 (19.77) <i>n</i> = 15
	HF + DM <i>N</i> = 123 (11.40%)	DM + COPD <i>N</i> = 27 (2.50%)	HF + DM + COPD <i>N</i> = 23 (2.13%)
	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>
DM self-care maintenance	74.89 (12.27)	69.12 (13.55)	63.55 (20.59)
DM self-care monitoring	66.85 (18.42)	62.11 (18.84)	59.61 (20.58)
DM self-care management			
Insulin	65.55 (15.51) <i>n</i> = 62	73.42 (9.47) <i>n</i> = 7	65.41 (23.62) <i>n</i> = 11
No insulin	65.22 (19.76) <i>n</i> = 61	57.03 (21.38) <i>n</i> = 20	55.21 (27.19) <i>n</i> = 12
	HF + COPD <i>N</i> = 50 (4.63%)	DM + COPD <i>N</i> = 27 (2.50%)	HF + DM + COPD <i>N</i> = 23 (2.13%)
	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>	Mean (\pm SD) <i>n</i>
COPD self-care maintenance	60.85 (15.32)	58.48 (13.99)	55.02 (20.60)
COPD self-care monitoring	60.35 (27.67)	61.96 (68.75)	57.95 (27.29)
COPD self-care management	40.88 (21.58) <i>n</i> = 43	49.16 (24.00) <i>n</i> = 17	46.00 (24.15) <i>n</i> = 21

Note: HF self-care behaviours were measured by Self-Care of Heart Failure Index v.6.2; DM self-care behaviours were measured by Self-Care of Diabetes Inventory; COPD self-care behaviours were measured by Self-Care of Chronic Obstructive Pulmonary Disease.

Abbreviations: COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HF, heart failure; SC-COPDI, self-care of chronic obstructive pulmonary disease Inventory; SCHFI, self-care of heart failure index; SCODI, self-care of diabetes inventory; SD, standard deviation; *N*, sample size; *n*, number of patients with symptoms.

Finally, COPD self-care maintenance, monitoring and management were inadequate in all groups of patients [respectively, HF + COPD: 60.9 (SD 15.3), 60.4 (SD 27.7), 40.9 (SD 21.6); DM + COPD: 58.5 (SD 14.0), 62.0 (SD 68.8), 49.1 (SD 24.0); and HF + DM + COPD: 55.0 (SD 20.6), 58.0 (SD 27.3) and 46.0 (SD 24.1)] (Figure S4).

5.3 | Disease-Specific Self-Care Within Patients Affected by MCCs

Disease-specific self-care within patient groups are presented in Table 3. Patients affected by HF + DM treated with insulin scored lower in the SCHFI self-care maintenance, monitoring and management scales compared to the SCODI's ones [respectively, 57.7 (SD 16.9), 57.9 (SD 24.9) and 57.2 (SD 20.0); $p < 0.05$]. No significant differences between HF self-care and DM self-care were found in self-care management scores of patients not treated with insulin.

Patients affected by HF + COPD reported lower SCHFI' scores compared to the SC-COPDI's ones in self-care maintenance [respectively, 54.9 (SD 18.7), 60.9 (SD 15.3); $p = 0.008$]. No significant differences were found in self-care monitoring scores. Lower COPD self-care management scores were reported compared to HF [respectively, 42.9 (SD 23.5), 55.7 (SD 20.9); $p = 0.013$].

Patients affected by DM + COPD reported lower SC-COPDI' scores compared to the SCODI's ones in self-care maintenance, and lower COPD self-care management only in patients not treated with insulin [respectively, 59.5 (SD 14.0), 42.2 (SD 20.0); $p < 0.05$].

Patients affected by HF + DM + COPD scored lower in SCHFI and SC-COPDI self-care maintenance scales compared to the SCODI's one [respectively, 49.6 (SD 4.4), 55.0 (SD 4.3); $p < 0.001$]. No significant differences were found in self-care monitoring and self-care management scales.

5.4 | Disease-Specific Self-Care Among the Different Groups of Patients With MCCs

Disease-specific self-care among the different groups of patients with MCCs is reported in Table 4. MANOVA's results showed that the group of patients with HF + DM reported higher HF self-care maintenance scores than those with HF + COPD ($F = 4.009$, $p = 0.048$, $\eta^2 = 0.040$). No significant differences were found between HF self-care monitoring and HF self-care management scales.

The group with DM (in insulin treatment) + COPD reported higher scores of DM self-care monitoring scale than the group with HF + DM + COPD ($F = 5.537$, $p = 0.021$, $\eta^2 = 0.067$). No

TABLE 3 | Comparison of specific self-care behaviours within each group of patients affected by multiple chronic conditions.

HF + DM N=123 (11.40%)		SCHF	SCODI	Δ self-care	p	
		Mean (± SD)	Mean (± SD)			
Self-care maintenance		57.74 (16.91)	74.88 (12.26)	-17.14	-15.86	<0.001
Self-care monitoring		57.97 (24.91)	66.85 (18.42)	-8.87	-4.19	<0.001
Self-care management						
With insulin treatment		57.23 (20.04) n = 33	64.73 (15.28) n = 62	-7.46	-2.22	0.033
Not insulin treatment		65.74 (15.10) n = 27	71.18 (16.79) n = 61	-5.44	-1.42	0.166
HF + COPD N= 50 (4.63%)		SCHF	SC-COPDI	Δ self-care	p	
		Mean (± SD)	Mean (± SD)			
Self-care maintenance		54.93 (18.73)	60.85 (15.32)	-5.91	-2.72	0.008
Self-care monitoring		52.20 (26.01)	60.35 (27.67)	-8.14	-1.81	0.075
Self-care management		55.68 (20.94) n = 24	42.85 (23.48) n = 43	12.82	2.69	0.013
DM + COPD N= 27 (2.50%)		SCODI	SC-COPDI	Δ self-care	p	
		Mean (± SD)	Mean (± SD)			
Self-care maintenance		69.12 (13.55)	58.48 (13.99)	10.63	3.94	<0.0001
Self-care monitoring		62.29 (17.86)	61.96 (24.99)	0.93	0.07	0.937
Self-care management						
With insulin treatment		76.39 (10.75) n = 7	71.92 (23.84) n = 4	4.47	0.58	0.600
Not insulin treatment		59.37 (15.93) n = 20	42.16 (20.00) n = 13	17.21	2.28	0.041
HF + DM + COPD N= 23 (2.13%)	SCHF⁽¹⁾	SCODI⁽²⁾	SC-COPDI⁽³⁾	F	p	p Post-hoc
	Mean (± SE)	Mean (± SE)	Mean (± SE)			
Self-care maintenance	49.67 (4.46) ⁽¹⁼²⁾	63.54 (4.29) ^{(2=1) (2=3)}	55.01 (4.29) ⁽³⁼²⁾	9.54	<0.001	<0.0001^{(1=2) (2=3)}
Self-care monitoring	49.98 (3.46)	61.11 (4.20)	57.95 (5.81)	2.35	0.10	
Self-care management						
With insulin	54.28 (7.27) n = 7	65.87 (9.22) n = 11	44.40 (11.82) n = 11	2.51	0.11	
No insulin	51.42 (10.53) n = 8	54.46 (10.53) n = 12	47.10 (10.53) n = 10	0.16	0.85	

Note: HF self-care behaviours were measured by Self-Care of Heart Failure Index v. 6.2; DM self-care behaviours were measured by Self-Care of Diabetes Inventory; COPD self-care behaviours were measured by Self-Care of Chronic Obstructive Pulmonary Disease. A statistical analysis to evaluate the differences in means of two specific self-care behaviour scores within each group was used. The Student's *t*-test were performed. We tested the normality of the differences between paired observations, as assessed by the Shapiro-Wilk test and the absence of significant outliers. Additionally, the observations were independent, fulfilling the criteria for a valid *t*-test. Delta (Δ) self-care represents the difference between specific self-care scores (SCHFI and SCODI, SCHFI and SC-COPDI, and SCODI and SC-COPDI). A statistical analysis to evaluate the differences in means among three specific behaviours within group was tested. The repeated measures ANOVA test and post hoc Tukey were used. We tested the sphericity test. If Mauchly's *W* test is more than or equal to 0.05, we accepted H0 for which the variances are equal; if Mauchly's *W* test was under 0.05, the assumption of sphericity was not verified, we then set the Greenhouse-Geisser correction in interpreting the within-subjects effects. Statistically significant values are highlighted in bold style. Abbreviations: COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; F, F statistic; HF, heart failure; SC-COPDI, self-care of chronic obstructive pulmonary disease inventory; SCHFI, self-care of heart failure index; SCODI, self-care of diabetes inventory; SD, standard deviation; N, sample size; n, number of patients with symptoms; p, p-value; t, t di student.

TABLE 4 | Comparison of disease-specific self-care behaviours among diseases-groups of patients with MCCs.

	Wilks's Lambda	F	df	p	η_p^2	Observed power
SCODI self-care maintenance						
Omnibus test	0.927	2.991	2	0.055	0.059	0.568
HF + DM (<i>n</i> = 123) vs HF + COPD (<i>n</i> = 50)	0.952	4.009	1	0.048	0.040	0.509
HF + DM (<i>n</i> = 123) vs HF + DM + COPD (<i>n</i> = 23)	0.955	3.414	1	0.068	0.035	0.448
HF + COPD (<i>n</i> = 50) vs HF + DM + COPD (<i>n</i> = 23)	0.999	0.023	1	0.881	<0.001	0.053
SCODI self-care maintenance						
Omnibus test (with insulin treatment)	0.889	2.110	2	0.128	0.052	0.421
HF + DM (<i>n</i> = 123) vs DM + COPD (<i>n</i> = 27)	0.965	0.350	1	0.556	0.005	0.090
HF + DM (<i>n</i> = 123) vs HF + DM + COPD (<i>n</i> = 23)	0.926	3.532	1	0.064	0.044	0.459
DM + COPD (<i>n</i> = 27) vs HF + DM + COPD (<i>n</i> = 23)	0.924	3.095	1	0.082	0.039	0.412
SCODI self-care maintenance						
Omnibus test (not insulin treatment)	0.840	7.417	2	0.001	0.141	0.934
HF + DM (<i>n</i> = 123) vs DM + COPD (<i>n</i> = 27)	0.917	7.404	1	0.008	0.076	0.768
HF + DM (<i>n</i> = 123) vs HF + DM + COPD (<i>n</i> = 23)	0.889	10.356	1	0.002	0.103	0.889
DM + COPD (<i>n</i> = 27) vs HF + DM + COPD (<i>n</i> = 23)	0.971	0.745	1	0.390	0.008	0.137
SC-COPDI self-care maintenance						
Omnibus test	0.950	0.708	2	0.496	0.018	0.166

Note: HF self-care behaviours were measured by Self-Care of Heart Failure Index; DM self-care behaviours were measured by Self-Care of Diabetes Inventory; COPD self-care behaviours were measured by Self-Care of Chronic Obstructive Pulmonary Disease. Statistical analysis to evaluate the differences in the specific self-care scores among diseases-groups was tested. The multivariate group contrast was used. We tested the homogeneity of variances with Levene's test. Statistically significant values are highlighted in bold style.

Abbreviations: COPD, chronic obstructive pulmonary disease; DF, degrees of freedom; F, Snedecor Fisher test; HF, heart failure; DM, diabetes mellitus; *p*, *p*-value; η_p^2 , partial eta squared; SC-COPDI, self-care of chronic obstructive pulmonary disease inventory; SCHFI, self-care of heart failure index v.6.2; SCODI, self-care of diabetes inventory; *N*, sample size.

significant differences were found between self-care maintenance and self-care management scales.

The group of patients with HF + DM (not treated with insulin) reported higher scores in DM self-care maintenance and monitoring scales than the group with DM + COPD (respectively, $F = 7.404$, $p = 0.008$, $\eta_p^2 = 0.076$; $F = 4.287$, $p = 0.041$, $\eta_p^2 = 0.045$). The group of patients with HF + DM (not treated with insulin) reported higher scores in DM self-care maintenance scale than the group with HF + DM + COPD ($F = 10.356$, $p = 0.002$, $\eta_p^2 = 0.103$). No significant differences were found for self-care management scales.

No significant differences were found between the groups when the SC-COPDI' score were considered.

6 | Discussion

The aim of this study was to describe and to compare HF self-care, DM self-care and COPD self-care within and among groups of patients affected at least by two of these conditions. To the best of our knowledge, this study is the first that considered self-care behaviours in patients that suffered simultaneously from HF and COPD or DM and COPD or the three conditions together. We found that HF and COPD self-care maintenance, monitoring and management were inadequate in all groups of patients (HF + DM, HF + COPD, DM + COPD HF + DM + COPD). Only DM self-care maintenance and management were adequate in the groups of patients with HF + DM and DM + COPD treated with insulin, respectively. This is relevant because we showed how performing simultaneously specific self-care behaviours

<i>F</i>	<i>df</i>	<i>p</i>	η_p^2	Observed power	<i>F</i>	<i>df</i>	<i>p</i>	η_p^2	Observed power
SCODI self-care monitoring					SCODI self-care management				
0.685	2	0.507	0.014	0.162	2.715	2	0.071	0.054	0.525
0.795	1	0.375	0.008	0.143	3.213	1	0.076	0.033	0.426
0.905	1	0.344	0.009	0.156	3.530	1	0.063	0.036	0.460
0.032	1	0.857	<0.001	0.054	0.110	1	0.741	0.001	0.062
SCODI self-care monitoring					SCODI self-care management				
2.802	2	0.067	0.068	0.536	0.737	2	0.482	0.019	0.171
2.465	1	0.121	0.034	0.341	1.442	1	0.233	0.018	0.220
2.446	1	0.122	0.031	0.339	0.001	1	0.979	0.000	0.050
5.537	1	0.021	0.067	0.642	1.017	1	0.316	0.013	0.169
SCODI self-care monitoring					SCODI self-care management				
2.250	2	0.111	0.048	0.447	1.873	2	0.160	0.040	0.381
4.287	1	0.041	0.045	0.535	2.256	1	0.137	0.024	0.318
0.754	1	0.387	0.008	0.138	2.245	1	0.138	0.024	0.317
0.504	1	0.480	0.006	0.108	0.056	1	0.814	0.001	0.056
SC-COPDI self-care monitoring					SC-COPDI self-care management				
0.106	2	0.900	0.003	0.066	0.806	2	0.450	0.021	0.183

directed to HF, DM and COPD is complex for patients and often leads to inadequate self-care (Smith et al. 2012; Boyd et al. 2014). Our results show that patients give priority to one disease self-care over another when two or more chronic conditions are present together (De Maria et al. 2024). Our results are consistent with those of other studies. For instance, Piette and Kerr (2006) found that patients with a diagnosis of DM prioritised the management of this condition compared to other coexisting conditions (Piette and Kerr 2006), possibility also confirmed by recent studies (De Maria et al. 2024). Furthermore, based on our results, it seems that performing a disease-specific self-care behaviour could be less or more challenging based on the other present comorbidities (Smith et al. 2012; Boyd et al. 2014). Smith et al. (2012) support the ideas that multimorbidity represents a clinical and organisational challenge for patients or healthcare

system due to the current single disease approach to the management of chronic conditions (Smith et al. 2012). Moreover, Boyd et colleagues (2014) found that multimorbidity in older adults is strongly associated with greater disease burden (Boyd et al. 2014). All together, these results add valuable information to understand self-care in MCCs providing some theoretical, practical and research implications.

Regarding self-care maintenance, comparisons within a single group of patients revealed differences in self-care maintenance performance between conditions. Patients with HF+DM reported lower scores in HF self-care maintenance compared to DM, and patients with DM+COPD reported lower scores in COPD self-care maintenance compared to DM, indicating a preference in performing self-care maintenance behaviours directed

to DM over HF and COPD (De Maria et al. 2024; Piette and Kerr 2006). Patients affected by HF + COPD reported lower scores in COPD self-care maintenance compared to HF, but better scores when coexisting also DM, suggesting that when the number of chronic conditions increase, the priorities can change (De Maria et al. 2024; Piette and Kerr 2006). Comparison among groups, interestingly, showed that groups with DM and one other chronic conditions demonstrated satisfactory DM self-care maintenance (scores ≥ 70), again, suggesting that patients tend to prioritise the self-care maintenance behaviours directed to diabetes when HF and COPD are present simultaneously (Smith et al. 2012; De Maria et al. 2024; Piette and Kerr 2006). Furthermore, the combination of HF + DM + COPD posed significant challenges in performing self-care maintenance behaviours, with scores falling below satisfactory levels (Boyd et al. 2014). All these results suggest that having multiple chronic conditions may overwhelm patients, leading to neglect certain self-care behaviours (Smith et al. 2012). The inadequacy of self-care maintenance behaviours suggests a shared struggle among patients to engage in activities that promote their overall well-being. Moreover, the substantial variations among chronic conditions regarding self-care maintenance highlight the pervasive nature of the hurdles encountered by individuals coping with multiple chronic conditions. This suggests that the difficulties in adhering to self-care maintenance routines could be dictated by the specific conditions involved and represent a challenge inherent to the management of MCCs.

Regarding self-care monitoring, our results showed one significant variation in self-care monitoring scores across different chronic conditions within the same group of patients. Patients with HF + DM reported inadequate self-care monitoring behaviours, with lowest scores in HF self-care monitoring, indicating a potential challenge in recognising and responding to signs and symptoms related to both conditions and, as for self-care maintenance, indicating a possible emphasis on DM monitoring (De Maria et al. 2024). Furthermore, comparison within groups revealed prioritisation of self-care monitoring behaviours based on the presence of specific chronic conditions. Also, among different groups of MCCs, our findings highlighted variations in self-care monitoring based on the combination of chronic conditions. These hypotheses are also supported by the fact that significant differences in monitoring activities are found on two occasions where at least one of the two or three pathologies is COPD, the presence of which worsens and decreases the levels of global self-care monitoring. The findings indicate a consistent pattern of inadequate self-care monitoring across all groups, regardless of the combination of chronic conditions. This suggests that patients with MCCs face great challenges in monitoring their health status, irrespective of the specific conditions involved (Smith et al. 2012; Boyd et al. 2014).

Regarding self-care management, within the same groups, patients with HF + DM prioritised DM self-care management over HF self-care management, indicating a potential emphasis on managing DM symptoms over those of HF (De Maria et al. 2024; Piette and Kerr 2006). Patients with HF + COPD prioritised COPD self-care maintenance and monitoring over HF self-care maintenance and monitoring. However, the results showed better scores for HF self-care management, suggesting difficulty in addressing COPD-related symptoms. Finally, patients with DM + COPD not treated with insulin prioritised DM self-care management

behaviours, but with a general lowering of self-care scores, indicating that the co-presence of COPD affects negatively also DM management, probably due to difficulties in monitoring symptoms and preventing exacerbations. Comparisons among different comorbidity groups did not reveal significant differences in disease-specific self-care behaviours but showed a uniform trend of insufficient self-care management oversight among all groups, irrespective of the assortment of chronic conditions. These findings once again underscore the challenges patients face in managing MCCs, which may further exacerbate if specific diseases are present or if the co-occurrence of multiple conditions intensifies. (Smith et al. 2012; Boyd et al. 2014).

Understanding the differences in self-care among patients with MCCs is crucial for educating healthcare professionals on the importance of using disease-specific instruments for self-care assessment. In the context of MCCs, healthcare initiatives should primarily focus on patient education, by devising integrated, patient-centred, and personalised interventions tailored to address the distinct needs of patients managing multiple chronic conditions, given that these conditions are primarily managed at home. Moreover, the utilisation of disease-specific tools, where available, for measuring self-care not only enables the identification of patients at risk of inadequate self-care and potential adverse outcomes but also facilitates a nuanced understanding of the specific behaviours contributing to inadequacy. This study, specifically, provides a preliminary overview of specific self-care behaviours, generating hypotheses for future research by suggesting new questions and identifying relevant variables. It also guides the design of more complex studies, such as longitudinal or experimental ones, and offers valuable clinical insights into the self-care behaviours of specific subgroups of patients with MCCs. This deeper insight can inform the development of targeted psychoeducational interventions aimed at enhancing specific self-care behaviours. By integrating comprehensive assessments of self-care behaviours with tailored educational interventions, healthcare professionals can effectively empower patients and caregivers to better manage the complexities of multiple chronic conditions, ultimately improving health outcomes and quality of life (Dunbar et al. 2014, 2015).

6.1 | Limitation and Strengths

This study does not come without limitations. First, we considered a sample recruited in only one European country; we balanced this limitation with a multicentre enrolment; therefore, the results may be generalisable to other MCCs populations with caution. Future researches would benefit from replicating the study in populations with MCCs from other countries. Second, we did not adjust for socio-demographic variables in our comparisons, which could influence the results. Addressing this in future studies would provide a more comprehensive understanding of the impact of these variables. Third, we excluded patients with cancer and dementia. Thus, the generalisability of results in patients with cancer and dementia cannot be assumed.

Strengths of this study include the large sample and the multicentric nature of the enrolments. Another strength is in the use of robust instruments with strong validity and reliability for measuring self-care. Moreover, the research was underpinned

by a strong theoretical scaffolding, providing a comprehensive framework for understanding and interpreting the results. Finally, rigorous statistical methods were employed, adhering to best practices in data analysis, thus strengthening the credibility and robustness of the study's conclusions.

7 | Conclusion

Overall, our study contributes valuable insights into the multifaceted nature of self-care in the context of MCCs, in particular detailing the understanding of self-care in specific combination of groups of patients with HF, DM and COPD, offering guidance for improving health outcomes and quality of life for affected individuals.

Knowing the variability of self-care in patients with MCCs is fundamental to raise awareness in healthcare professionals of self-care detection through specific instruments. Healthcare activities must mainly address patient education, by developing of integrated, patient-centred and personalised interventions tailored to address the unique needs of patients managing multiple chronic conditions, since these are chronic conditions managed mainly at home (Dunbar et al. 2014, 2015).

The results suggest that both the number and type of chronic conditions influence self-care behaviours. However, our analysis indicates that number has a more pronounced effect, particularly when specific combinations or patterns are present. These findings might be helpful for future research since they are part of the first attempts to investigate how self-care works in MCCs, specifically, when two or more specific pathologies coexist, such as HF, DM and COPD. The results represent a starting point to orient towards even more specific themes in the investigation of self-care in MCCs.

Authors Contribution

Giulia Andrea Baldan: formal analysis, data curation and writing — original draft. Maddalena de Maria: conceptualization, methodology, formal analysis, data curation, writing — review and editing and supervision, project administration. Michela Luciani: writing — review and editing. Maria Matarese: conceptualization, methodology, writing — review and editing and supervision. Ercole Vellone: conceptualization, methodology, writing — review and editing and supervision. Davide Ausili: conceptualization, methodology, writing — review and editing, supervision and project administration.

Conflicts of Interest

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

Data Availability Statement

Research data are not shared.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.